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Discovering Deep Sky Objects

Over 600 Galaxies, Clusters, Nebulae, Variables and Carbon Stars

Discovering Deep Sky Objects

Over 600 Galaxies, Clusters, Nebulae, Variables and Carbon Stars (Version 2022-1)

Agnes Clarke

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Using This Book

This book collects some of the most well-known and interesting deep sky objects. The Messier and Caldwell catalogs are included, in addition to many other interesting objects, covering nebulae, star clusters, galaxies and variable and carbon stars.

The 110 objects of the Messier Catalog were logged by Charles Messier in the late 18th century, as an aid to comet hunters by highlighting fuzzy objects that might be mistaken for comets. At some point Messier must have been simply trying to pad out his list, as bright, well-known objects like Messier 45 (the Pleiades) could not reasonably be mistaken for a comet. A drawback of the Messier Catalog is that is biased to the northern hemisphere, but the objects it covers are generally bright and quite accessible to most amateur equipment.

The Caldwell Catalog is much more recent, published by Patrick Moore in 1995. It covers the full sky pole-to-pole, including 109 clusters, galaxies and nebulae. Some of the Caldwell objects, while intriguing, are very difficult to observe. For example, the North America Nebula (Caldwell 20) typically can only be observed under the darkest of skies.

These two catalogs form the the backbone of this book, but a further 169 objects have been included, covering some notable carbon and variable stars and brighter clusters and galaxies. Carbon stars are typically variable in brightness, and are a deep red because of the preponderance of carbon dust in their outer layers. Most are giants at the end of their lives.

While many different types of variable star exist, the majority of those in this book are long period variables that are moderately bright at their maxima, and fade out of the reach of medium-sized telescopes at their dimmest. Where possible I point out nearby stars that can be used to estimate the current magnitude.

I locate targets using a 50mm finderscope and a red dot finder (RDF). The RDF helps me to point the telescope within a few degrees of the target by simply moving the projected red dot in the sight to the right place in the sky, and then the finderscope takes over as it shows about 5-7 degrees of sky with about 8-10 times magnification (it varies because my finderscope accepts different eyepieces).

This book has two types of diagrams to help with these two phases. Firstly, large diagrams show brighter stars visible from an urban location with the positions of the deep sky objects indicated by a small color-coded circle - blue targets are easiest, followed by orange and then red targets. This diagram helps with the rough pointing of the telescope via the red dot finder. Stars down to magnitude 5 are included in these overview charts, which is somewhat fainter than I can normally see from a light polluted location, unless it is a good clear night and it's past midnight!

To get the "right place in the sky" for the RDF, I rely on geometrical patterns and projections, and I have include some of these in the finding instructions for many of the objects. However, for some objects, there are no good signposts and one must simply squint at increasingly fainter nearby stars.

The second type of chart shows the faint stars visible in a finderscope (a 5° finder circle is shown on each chart), so that I can finally locate the object by matching the pattern to the book. I normally have the finderscope and telescope precisely aligned, so that I can keep a medium magnification eyepiece in the telescope and not have to keep switching between lower and higher magnification in the telescope to center the object in the telescope view. The finder chart covers 10° or the sky, a width spanning 20 full Moons, so even quite rough pointing with the RDF should put you somewhere on the chart.

The finder charts also list up to five other nearby objects. The number is capped to avoid cluttering the view of the star patterns, which is of course the main purpose of the charts.

Astronomical Abbreviations

Constellations are often referred to in this work by three-letter abbreviations. When the constellation name is used in a star name, the constellation's genitive form is used. For example, Aquarius is abbreviated as Aqr, and one of its stars would be 5 Aquarii.

The following list gives the abbreviation and the full and genitive names.

And - Andromeda (Andromedae)

Ant - Antlia (Antliae)

Aps - Apus (Apodis)

Aqr - Aquarius (Aquarii)

Aql - Aquila (Aquilae)

Ara - Ara (Arae)

Ari - Aries (Arietis)

Aur - Auriga (Aurigae)

Boo - Bootes (Bootis)

Cae - Caelum (Caeli)

Cam - Camelopardalis (Camelopardalis)

Cnc - Cancer (Cancri)

CVn - Canes Venatici (Canum Venaticorum)

CMa - Canis Major (Canis Majoris)

CMi - Canis Minor (Canis Minoris)

Cap - Capricornus (Capricorni)

Car - Carina (Carinae)

Cas - Cassiopeia (Cassiopeiae)

Cen - Centaurus (Centauri)

Cep - Cepheus (Cephei)

Cet - Cetus (Ceti)

Cha - Chamaeleon (Chamaeleontis)

Cir - Circinus (Circini)

Col - Columba (Columbae)

Com - Coma Berenices (Comae Berenices)

CrA - Corona Australis (Coronae Australis)

CrB - Corona Borealis (Coronae Borealis)

Crv - Corvus (Corvi)

Crt - Crater (Crateris)

Cru - Crux (Crucis)

Cyg - Cygnus (Cygni)

Del - Delphinus (Delphini)

Dor - Dorado (Doradus)

Dra - Draco (Draconis)

Equ - Equuleus (Equulei)

Eri - Eridanus (Eridani)

For - Fornax (Fornacis)

Gem - Gemini (Geminorum)

Gru - Grus (Gruis)

Her - Hercules (Herculis)

Hor - Horologium (Horologii)

Hya - Hydra (Hydrae)

Hyi - Hydrus (Hydri)

Ind - Indus (Indi)

Lac - Lacerta (Lacertae)

Leo - Leo (Leonis)

LMi - Leo Minor (Leonis Minoris)

Lep - Lepus (Leporis)

Lib - Libra (Librae)

Lup - Lupus (Lupi)

Lyn - Lynx (Lyncis)

Lyr - Lyra (Lyrae)

Men - Mensa Mensae)

Mic - Microscopium (Microscopii)

Mon - Monoceros (Monocerotis)

Mus - Musca (Muscae)

Nor - Norma (Normae)

Oct - Octans (Octantis)

Oph - Ophiuchus (Ophiuchi)

Ori - Orion (Orionis)

Pav - Pavo (Pavonis)

Peg - Pegasus (Pegasi)

Per - Perseus (Persei)

Phe - Phoenix (Phoenicis)

Pic - Pictor (Pictoris)

Psc - Pisces (Piscium)

PsA - Piscis Austrinus (Piscis Austrini)

Pup - Puppis (Puppis)

Pyx - Pyxis (Pyxidis)

Ret - Reticulum (Reticuli)

Sge - Sagitta (Sagittae)

Sgr - Sagittarius (Sagittarii)

Sco - Scorpius (Scorpii)

Scl - Sculptor (Sculptoris)

Sct - Scutum (Scuti)

Ser - Serpens (Serpentis)

Sex - Sextans (Sextantis)

Tau - Taurus (Tauri)

Tel - Telescopium (Telescopii)

Tri - Triangulum (Trianguli)

TrA - Triangulum Australe (Trianguli Australis)

Tuc - Tucana (Tucanae)

UMa - Ursa Major (Ursae Majoris)

UMi - Ursa Minor (Ursae Minoris)

Vel - Vela (Velorum)

Vir - Virgo (Virginis)

Vol - Volans (Volantis)

Vul - Vulpecula (Vulpeculae)

Greek letters are used in Bayer designations of stars, such as Alpha Canis Majoris (Sirius). Greek letters also have standardised three-letter abbreviations as follows:

α - alf - alpha

β - bet - beta

γ - gam - gamma

δ - del - delta

ε - eps - epsilon

ζ - zet - zeta

η - eta - eta

θ - tet - theta

ι - iot - iota

κ - kap - kappa

λ - lam -lamda, lambda

μ - mu. - mu

ν - nu. - nu

ξ - ksi - xi

ο - omi - omicron

π - pi. - pi

ρ - rho - rho

σ - sig - sigma

τ - tau - tau

υ - ups - upsilon

φ - phi - phi

χ - khi - chi

ψ - psi - psi

ω - ome - omega

Deep Sky Objects by Constellation

Andromeda

M110 (NGC 205) is a magnitude 8.5 elliptical galaxy. Angular size is 17x10'. (page 65)

Observed:

M32 (NGC 221) is a magnitude 8.1 elliptical galaxy. Angular size is 8x6'. (page 66)

Observed:

C28 (NGC 752) is a magnitude 5.7 open cluster. Angular size is 50'. (page 87)

Observed:

NGC 7686 is a magnitude 5.6 open cluster. Angular size is 15'. (page 64)

Observed:

C22 (Blue Snowball, NGC 7662) is a magnitude 9.2 planetary nebula. Angular size is 0.6'. (page 61)

Observed:

C23 (NGC 891) is a magnitude 9.9 barred spiral galaxy. Angular size is 14x3'. (page 87)

Observed:

M31 (Andromeda Galaxy, NGC 224) is a magnitude 3.4 spiral galaxy. Angular size is 178x63'. (page 62)

Observed:

R And (HD 1967) is a magnitude 5.8 variable star. Magnitude ranges from 14.9 to 5.8 (Δ mag. 9.1) with a period of 409d. (page 62)

Observed:

Antlia

U Ant (HD 91793) is a magnitude 5.7 carbon star. Magnitude ranges from 8.6 to 5.7 (Δ mag. 2.9) with a period of 170d. (page 199)

Observed:

Apus

C107 (NGC 6101) is a magnitude 9.3 globular cluster. Angular size is 11'. (page 308)

Observed:

Aquarius

M73 (NGC 6994) is a magnitude 9.0 asterism. Angular size is 3'. (page 296)

Observed:

M2 (NGC 7089) is a magnitude 6.5 globular cluster. Angular size is 12.9'. (page 293)

Observed:

M72 (NGC 6981) is a magnitude 9.3 globular cluster. Angular size is 6'. (page 293)

Observed:

C55 (Saturn Nebula, NGC 7009) is a magnitude 8.3 planetary nebula. Angular size is 0.7'. (page 295)

Observed:

C63 (Helix Nebula, NGC 7293) is a magnitude 6.5 planetary nebula. Angular size is 13'. (page 297)

Observed:

R Aqr (HD 222800) is a magnitude 5.8 variable star. Magnitude ranges from 12.4 to 5.8 (Δ mag. 6.6) with a period of 387d. (page 73)

Observed:

Aquila

NGC 6709 is a magnitude 6.7 open cluster. Angular size is 13'. (page 241)

Observed:

R Aql (HD 177940) is a magnitude 5.5 variable star. Magnitude ranges from 12.0 to 5.5 (Δ mag. 6.5) with a period of 284d. (page 242)

Observed:

Ara

C81 (NGC 6352) is a magnitude 8.1 globular cluster. Angular size is 7'. (page 269)

Observed:

C86 (NGC 6397) is a magnitude 5.6 globular cluster. Angular size is 26'. (page 270)

Observed:

C82 (NGC 6193) is a magnitude 5.2 open cluster. Angular size is 15'. (page 265)

Observed:

NGC 6250 is a magnitude 5.9 open cluster. Angular size is 8'. (page 264)

Observed:

Aries

V Ari (HD 13826) is a magnitude 8.0 carbon star. Magnitude ranges from 8.6 to 8.0 (Δ mag. 0.6) with a period of 75d. (page 92)

Observed:

R Ari (HD 13913) is a magnitude 7.4 variable star. Magnitude ranges from 13.7 to 7.4 (Δ mag. 6.3) with a period of 187d. (page 90)

Observed:

U Ari (HD 19737) is a magnitude 7.2 variable star. Magnitude ranges from 15.2 to 7.2 (Δ mag. 8.0) with a period of 371d. (page 92)

Observed:

Auriga

C31 (Flaming Star Nebula, IC 405) is a magnitude 6.0 bright nebula. Angular size is 30x19'. (page 109)

Observed:

UU Aur (HD 46687) is a magnitude 5.1 carbon star. Magnitude ranges from 7.0 to 5.1 (Δ mag. 1.9) with a period of 235d. (page 107)

Observed:

M36 (NGC 1960) is a magnitude 6.3 open cluster. Angular size is 12'. (page 109)

Observed:

M37 (NGC 2099) is a magnitude 6.2 open cluster. Angular size is 24'. (page 110)

Observed:

M38 (NGC 1912) is a magnitude 7.4 open cluster. Angular size is 21'. (page 108)

Observed:

NGC 2281 is a magnitude 5.4 open cluster. Angular size is 15'. (page 107)

Observed:

AE Aur (HD 4078) is a magnitude 5.78 variable star. Magnitude ranges from 6.08 to 5.78 (Δ mag. 0.3). (page 108)

Observed:

R Aur (HD 34019) is a magnitude 6.7 variable star. Magnitude ranges from 13.9 to 6.7 (Δ mag. 7.2) with a period of 458d. (page 106)

Observed:

Boötes

C45 (NGC 5248) is a magnitude 10.2 spiral galaxy. Angular size is 6x4'. (page 217)

Observed:

R Boo (HD 128609) is a magnitude 6.2 variable star. Magnitude ranges from 13.1 to 6.2 (Δ mag. 6.9) with a period of 223d. (page 215)

Observed:

Camelopardalis

NGC 1502 is a magnitude 5.7 open cluster. Angular size is 8'. (page 81)

Observed:

C5 (Maffei 1 Group, IC342) is a magnitude 9.2 spiral galaxy. Angular size is 21x21'. (page 54)

Observed:

C7 (NGC 2403) is a magnitude 8.9 spiral galaxy. Angular size is 22x12'. (page 136)

Observed:

Cancer

M44 (Beehive Cluster, NGC 2632) is a magnitude 3.7 open cluster. Angular size is 95'. (page 140)

Observed:

M67 (NGC 2682) is a magnitude 6.1 open cluster. Angular size is 30'. (page 141)

Observed:

C48 (NGC 2775) is a magnitude 10.3 spiral galaxy. Angular size is 4.5x3'. (page 143)

Observed:

R Cnc (HD 69243) is a magnitude 6.07 variable star. Magnitude ranges from 11.8 to 6.07 (Δ mag. 5.7) with a period of 362d. (page 141)

Observed:

X Cnc (HD 76221) is a magnitude 5.6 variable star. Magnitude ranges from 7.5 to 5.6 (Δ mag. 1.9) with a period of 195d. (page 140)

Observed:

Canes Venatici

Y Cvn (La Superba, HD 110914) is a magnitude 5.0 carbon star. Magnitude ranges from 6.4 to 5.0 (Δ mag. 1.4) with a period of 158d. (page 169)

Observed:

M3 (NGC 5272) is a magnitude 6.2 globular cluster. Angular size is 16.2'. (page 214)

Observed:

C21 (NCG 4449, NGC 4449) is a magnitude 9.4 irregular galaxy. Angular size is 6x4'. (page 173)

Observed:

C29 (NGC 5005) is a magnitude 9.8 barred spiral galaxy. Angular size is 5x2'. (page 170)

Observed:

C26 (NGC 4244) is a magnitude 10.6 spiral galaxy. Angular size is 17x2'. (page 174)

Observed:

C32 (Whale Galaxy, NGC 4631) is a magnitude 9.3 spiral galaxy. Angular size is 15x3'. (page 170)

Observed:

M106 (NGC 4258) is a magnitude 8.4 spiral galaxy. Angular size is 19x8'. (page 172)

Observed:

M51 (Whirlpool Galaxy, NGC 5194) is a magnitude 8.4 spiral galaxy. Angular size is 11x7'. (page 168)

Observed:

M63 (Sunflower Galaxy, NGC 5055) is a magnitude 8.6 spiral galaxy. Angular size is 10x6'. (page 169)

Observed:

M94 (NGC 4736) is a magnitude 8.2 spiral galaxy. Angular size is 7x3'. (page 173)

Observed:

Canis Major

C58 (Caroline's Cluster, NGC 2360) is a magnitude 7.2 open cluster. Angular size is 13'. (page 129)

Observed:

C64 (Pirate's Jewels Cluster, NGC 2362) is a magnitude 4.1 open cluster. Angular size is 8'. (page 130)

Observed:

M41 (NGC 2287) is a magnitude 4.6 open cluster. Angular size is 38'. (page 129)

Observed:

NGC 2354 is a magnitude 6.5 open cluster. Angular size is 20'. (page 126)

Observed:

R CMa (HD 57167) is a magnitude 5.7 variable star. Magnitude ranges from 6.34 to 5.7 (Δ mag. 0.6) with a period of 1.13594d. (page 125)

Observed:

VY CMa (HD 58061) is a magnitude 6.5 variable star. Magnitude ranges from 9.6 to 6.5 (Δ mag. 3.1). (page 130)

Observed:

Canis Minor

S CMi (HD 59950) is a magnitude 6.6 variable star. Magnitude ranges from 13.2 to 6.6 (Δ mag. 6.6) with a period of 333d. (page 142)

Observed:

Capricornus

RT Cap (HD 192737) is a magnitude 6.5 carbon star. Magnitude ranges from 8.1 to 6.5 (Δ mag. 1.6) with a period of 395d. (page 294)

Observed:

M30 (NGC 7099) is a magnitude 7.2 globular cluster. Angular size is 11'. (page 297)

Observed:

Carina

C92 (Eta Carinae Nebula, NGC 3372) is a magnitude 6.2 bright nebula. Angular size is 120x120'. (page 200)

Observed:

NGC 2808 (NGC) is a magnitude 6.2 globular cluster. Angular size is 14'. (page 159)

Observed:

C102 (Theta Car Cluster, IC 2602) is a magnitude 1.9 open cluster. Angular size is 50'. (page 202)

Observed:

C91 (Wishing Well Cluster, NGC 3532) is a magnitude 3.0 open cluster. Angular size is 55'. (page 200)

Observed:

C96 (Southern Beehive, NGC 2516) is a magnitude 3.8 open cluster. Angular size is 30'. (page 158)

Observed:

IC 2581 is a magnitude 4.3 open cluster. Angular size is 8'. (page 157)

Observed:

NGC 3114 is a magnitude 4.2 open cluster. Angular size is 35'. (page 162)

Observed:

C90 (NGC 2867) is a magnitude 9.7 planetary nebula. Angular size is 0.2'. (page 161)

Observed:

R Car (HD 82901) is a magnitude 3.9 variable star. Magnitude ranges from 10.5 to 3.9 (Δ mag. 6.6) with a period of 309d. (page 163)

Observed:

S Car (HD 88366) is a magnitude 4.5 variable star. Magnitude ranges from 9.9 to 4.5 (Δ mag. 5.4) with a period of 149d. (page 162)

Observed:

l Car (HD 84810) is a magnitude 3.28 variable star. Magnitude ranges from 4.18 to 3.28 (Δ mag. 0.9) with a period of 35.53584d. (page 158)

Observed:

Cassiopeia

C11 (Bubble Nebula, NGC 7635) is a magnitude 7.0 bright nebula. Angular size is 15x8'. (page 63)

Observed:

C17 (NGC 147) is a magnitude 9.3 elliptical galaxy. Angular size is 13x8'. (page 61)

Observed:

C18 (NGC 185) is a magnitude 9.2 elliptical galaxy. Angular size is 12x9'. (page 65)

Observed:

C10 (NGC 663) is a magnitude 7.1 open cluster. Angular size is 16'. (page 81)

Observed:

C13 (Owl Cluster, NGC 457) is a magnitude 6.4 open cluster. Angular size is 13'. (page 64)

Observed:

C8 (NGC 559) is a magnitude 9.5 open cluster. Angular size is 7'. (page 59)

Observed:

M103 (NGC 581) is a magnitude 7.4 open cluster. Angular size is 6'. (page 85)

Observed:

M52 (NGC 7654) is a magnitude 7.3 open cluster. Angular size is 13'. (page 59)

Observed:

NGC 129 is a magnitude 6.5 open cluster. Angular size is 21'. (page 60)

Observed:

NGC 654 is a magnitude 6.5 open cluster. Angular size is 5'. (page 85)

Observed:

R Cas (HD 224490) is a magnitude 4.7 variable star. Magnitude ranges from 13.5 to 4.7 (Δ mag. 8.8) with a period of 430d. (page 60)

Observed:

Centaurus

C80 (Omega Centauri, NGC 5139) is a magnitude 3.6 globular cluster. Angular size is 36'. (page 199)

Observed:

C84 (NGC 5286) is a magnitude 7.6 globular cluster. Angular size is 9'. (page 230)

Observed:

C100 (Lambda Centauri Nebula, IC 2944) is a magnitude 4.5 open cluster. Angular size is 15'. (page 204)

Observed:

C97 (Pearl Cluster, NGC 3766) is a magnitude 5.3 open cluster. Angular size is 12'. (page 204)

Observed:

NGC 5281 is a magnitude 5.9 open cluster. Angular size is 5'. (page 232)

Observed:

NGC 5316 is a magnitude 6.0 open cluster. Angular size is 14'. (page 228)

Observed:

NGC 5460 is a magnitude 5.6 open cluster. Angular size is 25'. (page 229)

Observed:

NGC 5617 is a magnitude 6.3 open cluster. Angular size is 10'. (page 228)

Observed:

NGC 5662 is a magnitude 5.5 open cluster. Angular size is 12'. (page 231)

Observed:

C77 (Centaurus A, NGC 5128) is a magnitude 7.0 peculiar galaxy. Angular size is 18x14'. (page 202)

Observed:

C83 (NGC 4945) is a magnitude 9.5 spiral galaxy. Angular size is 20x4'. (page 203)

Observed:

R Cen (HD 124601) is a magnitude 5.3 variable star. Magnitude ranges from 11.8 to 5.3 (Δ mag. 6.5) with a period of 546d. (page 231)

Observed:

T Cen (HD 119090) is a magnitude 5.5 variable star. Magnitude ranges from 9.0 to 5.5 (Δ mag. 3.5) with a period of 90.44d. (page 229)

Observed:

Cepheus

C4 (Iris Nebula, NGC 7023) is a magnitude 6.8 bright nebula. Angular size is 18x18'. (page 51)

Observed:

C9 (Cave Nebula, Sh2-155) is a magnitude 7.7 bright nebula. Angular size is 50x30'. (page 63)

Observed:

mu Cep (Garnet Star, NGC 206936) is a magnitude 3.7 carbon star. Magnitude ranges from 5.0 to 3.7 (Δ mag. 1.3). (page 273)

Observed:

C1 (Polarissima Cluster, NGC 188) is a magnitude 8.1 open cluster. Angular size is 15'. (page 53)

Observed:

NGC 7160 is a magnitude 6.1 open cluster. Angular size is 7'. (page 273)

Observed:

C2 (Bow Tie Nebula, NGC 40) is a magnitude 11.6 planetary nebula. Angular size is 0.6'. (page 52)

Observed:

C12 (NGC 6946) is a magnitude 9.7 spiral galaxy. Angular size is 12x10'. (page 277)

Observed:

AR Cep (HD 217158) is a magnitude 7.0 variable star. Magnitude ranges from 7.9 to 7.0 (Δ mag. 0.9). (page 54)

Observed:

T Cep (HD 202012) is a magnitude 5.2 variable star. Magnitude ranges from 11.3 to 5.2 (Δ mag. 6.1) with a period of 388d. (page 55)

Observed:

U Cep (HD 5679) is a magnitude 6.75 variable star. Magnitude ranges from 9.24 to 6.75 (Δ mag. 2.5) with a period of 2.49305d. (page 51)

Observed:

Cetus

C51 (IC 1613) is a magnitude 9.0 irregular galaxy. Angular size is 12x11'. (page 70)

Observed:

C56 (Skull Nebula, NGC 246) is a magnitude 8.0 planetary nebula. Angular size is 3.8'. (page 72)

Observed:

C62 (Needle's Eye Galaxy, NGC 247) is a magnitude 8.9 spiral galaxy. Angular size is 20x7'. (page 74)

Observed:

M77 (NGC 1068) is a magnitude 8.9 spiral galaxy. Angular size is 7x6'. (page 94)

Observed:

T Cet (HD 1760) is a magnitude 5.0 variable star. Magnitude ranges from 6.9 to 5.0 (Δ mag. 1.9) with a period of 159d. (page 73)

Observed:

U Cet (HD 15971) is a magnitude 6.8 variable star. Magnitude ranges from 13.4 to 6.8 (Δ mag. 6.6) with a period of 235d. (page 96)

Observed:

W Cet (HD 224960) is a magnitude 7.1 variable star. Magnitude ranges from 14.8 to 7.1 (Δ mag. 7.7) with a period of 351d. (page 72)

Observed:

o Cet (Mira, HD 14386) is a magnitude 2.0 variable star. Magnitude ranges from 10.1 to 2.0 (Δ mag. 8.1) with a period of 332d. (page 96)

Observed:

Chamaeleon

C109 (NGC 3195) is a magnitude 11.6 planetary nebula. Angular size is 1.3'. (page 311)

Observed:

Circinus

C88 (NGC 5823) is a magnitude 7.9 open cluster. Angular size is 10'. (page 227)

Observed:

Columba

C73 (NGC 1851) is a magnitude 7.3 globular cluster. Angular size is 11'. (page 133)

Observed:

T Col (HD 34897) is a magnitude 6.6 variable star. Magnitude ranges from 12.7 to 6.6 (Δ mag. 6.1) with a period of 226d. (page 132)

Observed:

Coma Berenices

M91 (NGC 4548) is a magnitude 10.2 barred spiral galaxy. Angular size is 5'. (page 186)

Observed:

C35 (NGC 4889) is a magnitude 11.4 elliptical galaxy. Angular size is 3x2'. (page 177)

Observed:

M53 (NGC 5024) is a magnitude 7.6 globular cluster. Angular size is 13'. (page 178)

Observed:

M85 (NGC 4382) is a magnitude 9.1 lenticular galaxy. Angular size is 7x5'. (page 185)

Observed:

C38 (Needle Galaxy, NGC 4565) is a magnitude 9.6 barred spiral galaxy. Angular size is 16x3'. (page 177)

Observed:

C36 (Koi Fish Galaxy, NGC 4559) is a magnitude 9.8 spiral galaxy. Angular size is 10x4'. (page 184)

Observed:

M100 (NGC 4321) is a magnitude 9.3 spiral galaxy. Angular size is 7x6'. (page 185)

Observed:

M64 (Black Eye Galaxy, NGC 4826) is a magnitude 8.5 spiral galaxy. Angular size is 9x5'. (page 184)

Observed:

M88 (NGC 4501) is a magnitude 9.6 spiral galaxy. Angular size is 7x4'. (page 179)

Observed:

M98 (NGC 4192) is a magnitude 10.1 spiral galaxy. Angular size is 10x3'. (page 179)

Observed:

M99 (NGC 4254) is a magnitude 9.9 spiral galaxy. Angular size is 5'. (page 186)

Observed:

Corona Australis

C68 (NGC 6729) is a magnitude 9.7 bright nebula. Angular size is 1.0'. (page 263)

Observed:

C78 (Cacciatore Cluster, NGC 6541) is a magnitude 6.6 globular cluster. Angular size is 13'. (page 269)

Observed:

Corona Borealis

R CrB (HD 141527) is a magnitude 5.71 variable star. Magnitude ranges from 14.8 to 5.71 (Δ mag. 9.1). (page 214)

Observed:

S CrB (HD 136753) is a magnitude 5.8 variable star. Magnitude ranges from 14.1 to 5.8 (Δ mag. 8.3) with a period of 360d. (page 211)

Observed:

T CrB (HD 143454) is a magnitude 2.0 variable star. Magnitude ranges from 10.8 to 2.0 (Δ mag. 8.8) with a period of 80y. (page 215)

Observed:

U CrB (HD 136175) is a magnitude 7.66 variable star. Magnitude ranges from 8.79 to 7.66 (Δ mag. 1.1) with a period of 3.45220d. (page 211)

Observed:

V CrB (HD 141826) is a magnitude 6.9 variable star. Magnitude ranges from 12.6 to 6.9 (Δ mag. 5.7) with a period of 358d. (page 210)

Observed:

W CrB (HD 146560) is a magnitude 7.8 variable star. Magnitude ranges from 14.3 to 7.8 (Δ mag. 6.5) with a period of 238d. (page 210)

Observed:

Corvus

C60 (Antennae Galaxies, NGC 4038) is a magnitude 11.3 spiral galaxy. Angular size is 2.6x1.8'. (page 193)

Observed:

C61 (Antennae Galaxies, NGC 4039) is a magnitude 13.0 spiral galaxy. Angular size is 3.2x2.2'. (page 194)

Observed:

R Crv (HD 107199) is a magnitude 6.7 variable star. Magnitude ranges from 14.4 to 6.7 (Δ mag. 7.7) with a period of 317d. (page 194)

Observed:

Crux

C99 (Coalsack Nebula, TGU H1867) is a magnitude 20.0 dark nebula. Angular size is 400x300'. (page 205)

Observed:

C94 (Jewel Box, NGC 4755) is a magnitude 4.2 open cluster. Angular size is 10'. (page 203)

Observed:

C98 (Coalsack Cluster, NGC 4609) is a magnitude 6.9 open cluster. Angular size is 5'. (page 201)

Observed:

R Cru (HD 107805) is a magnitude 6.4 variable star. Magnitude ranges from 7.23 to 6.4 (Δ mag. 0.8) with a period of 5.82575d. (page 201)

Observed:

Cygnus

C19 (Cocoon Nebula, IC 5146) is a magnitude 10.0 bright nebula. Angular size is 12'. (page 279)

Observed:

C20 (North America Nebula, NGC 7000) is a magnitude 6.0 bright nebula. Angular size is 120x100'. (page 275)

Observed:

C27 (Crescent Nebula, NGC 6888) is a magnitude 7.5 bright nebula. Angular size is 20x10'. (page 280)

Observed:

M29 (NGC 6913) is a magnitude 7.1 open cluster. Angular size is 7'. (page 276)

Observed:

M39 (NGC 7092) is a magnitude 4.6 open cluster. Angular size is 32'. (page 279)

Observed:

NGC 6871 is a magnitude 5.2 open cluster. Angular size is 20'. (page 280)

Observed:

C15 (Blinking Planetary, NGC 6826) is a magnitude 9.8 planetary nebula. Angular size is 0.5'. (page 274)

Observed:

C33 (East Veil Nebula, NGC 6992/5) is a magnitude 8.0 supernova remnant. Angular size is 60x8'. (page 277)

Observed:

C34 (West Veil Nebula, NGC 6960) is a magnitude 8.0 supernova remnant. Angular size is 70x6'. (page 281)

Observed:

CH Cyg (HD 182917) is a magnitude 5.6 variable star. Magnitude ranges from 8.49 to 5.6 (Δ mag. 2.9). (page 234)

Observed:

R Cyg (HD 185456) is a magnitude 6.1 variable star. Magnitude ranges from 14.4 to 6.1 (Δ mag. 8.3) with a period of 426d. (page 278)

Observed:

RT Cyg (HD 186686) is a magnitude 6.0 variable star. Magnitude ranges from 13.1 to 6.0 (Δ mag. 7.1) with a period of 190d. (page 274)

Observed:

U Cyg (HD 193680) is a magnitude 5.9 variable star. Magnitude ranges from 12.1 to 5.9 (Δ mag. 6.2) with a period of 463d. (page 275)

Observed:

X Cyg (HD 197572) is a magnitude 5.85 variable star. Magnitude ranges from 6.91 to 5.85 (Δ mag. 1.1) with a period of 16.38633d. (page 276)

Observed:

χ Cyg (HD 187796) is a magnitude 3.3 variable star. Magnitude ranges from 14.2 to 3.3 (Δ mag. 10.9) with a period of 408d. (page 281)

Observed:

Delphinus

C42 (NGC 7006) is a magnitude 10.6 globular cluster. Angular size is 2.8'. (page 289)

Observed:

C47 (NGC 6934) is a magnitude 8.9 globular cluster. Angular size is 5.9'. (page 289)

Observed:

EU Del (HD 196610) is a magnitude 5.79 variable star. Magnitude ranges from 6.9 to 5.79 (Δ mag. 1.1) with a period of 59.7d. (page 288)

Observed:

Dorado

C103 (Tarantula Nebula, NGC 2070) is a magnitude 4.0 bright nebula. Angular size is 40x25'. (page 308)

Observed:

LMC is a magnitude 0.91 Magellanic barred spiral galaxy. Angular size is 645'. (page 310)

Observed:

β Dor (HD 037350) is a magnitude 3.46 variable star. Magnitude ranges from 4.08 to 3.46 (Δ mag. 0.6) with a period of 9.8426d. (page 134)

Observed:

Draco

RY Dra (HD 112559) is a magnitude 6.0 carbon star. Magnitude ranges from 8.2 to 6.0 (Δ mag. 2.2) with a period of 170d. (page 167)

Observed:

UX Dra (HD 183556) is a magnitude 6.2 carbon star. Magnitude ranges from 7.0 to 6.2 (Δ mag. 0.8) with a period of 170d. (page 50)

Observed:

M102 (NGC 5866) is a magnitude 9.9 lenticular galaxy. Angular size is 5x2'. (page 208)

Observed:

C6 (Cat's Eye Nebula, NGC 6543) is a magnitude 8.8 planetary nebula. Angular size is 0.3'. (page 234)

Observed:

C3 (NGC 4236) is a magnitude 9.7 barred spiral galaxy. Angular size is 22x7'. (page 52)

Observed:

Eridanus

NGC 1291 is a magnitude 9.39 barred spiral galaxy. Angular size is 10'. (page 101)

Observed:

NGC 1535 (Cleopatra's Eye Nebula) is a magnitude 9.5 planetary nebula. Angular size is 18". The central star is magnitude 12.2. (page 97)

Observed:

T Eri (HD 024754) is a magnitude 7.2 variable star. Magnitude ranges from 13.2 to 7.2 (Δ mag. 6.0) with a period of 252d. (page 97)

Observed:

Fornax

Fornax Dwarf is a magnitude 9.3 irregular galaxy. Angular size is 17'. (page 100)

Observed:

NGC 1316 is a magnitude 9.42 lenticular galaxy. Angular size is 12'. (page 101)

Observed:

NGC 1360 (Robin's Egg Nebula) is a magnitude 9.5 planetary nebula. Angular size is 380". The central star is magnitude 11.4. (page 98)

Observed:

C67 (NGC 1097) is a magnitude 9.2 barred spiral galaxy. Angular size is 9x6'. (page 100)

Observed:

R For (HIP 011582) is a magnitude 7.5 variable star. Magnitude ranges from 13.0 to 7.5 (Δ mag. 5.5) with a period of 389d. (page 98)

Observed:

Gemini

M35 (NGC 2168) is a magnitude 5.3 open cluster. Angular size is 28'. (page 113)

Observed:

C39 (Eskimo Nebula, NGC 2392) is a magnitude 9.9 planetary nebula. Angular size is 0.8'. (page 117)

Observed:

R Gem (HD 053791) is a magnitude 6.0 variable star. Magnitude ranges from 14.0 to 6.0 (Δ mag. 8.0) with a period of 370d. (page 113)

Observed:

Grus

S Gru (HD 212539) is a magnitude 6.0 variable star. Magnitude ranges from 15.0 to 6.0 (Δ mag. 9.0) with a period of 402d. (page 302)

Observed:

Hercules

M13 (Great Hercules Globular, NGC 6205) is a magnitude 5.8 globular cluster. Angular size is 17'. (page 236)

Observed:

M92 (NGC 6341) is a magnitude 6.4 globular cluster. Angular size is 11'. (page 235)

Observed:

S Her (HD 152276) is a magnitude 6.4 variable star. Magnitude ranges from 13.8 to 6.4 (Δ mag. 7.4) with a period of 307d. (page 240)

Observed:

U Her (HD 148206) is a magnitude 6.4 variable star. Magnitude ranges from 13.4 to 6.4 (Δ mag. 7.0) with a period of 406d. (page 216)

Observed:

X Her (HD 144205) is a magnitude 6.0 variable star. Magnitude ranges from 7.0 to 6.0 (Δ mag. 1.0) with a period of 95.0d. (page 209)

Observed:

g Her (HD 148783) is a magnitude 4.3 variable star. Magnitude ranges from 6.3 to 4.3 (Δ mag. 2.0) with a period of 89.2d. (page 209)

Observed:

u Her (HD 156633) is a magnitude 4.69 variable star. Magnitude ranges from 5.37 to 4.69 (Δ mag. 0.7) with a period of 2.05103d. (page 237)

Observed:

Horologium

C87 (NGC 1261) is a magnitude 8.4 globular cluster. Angular size is 7'. (page 103)

Observed:

R Hor (HD 018242) is a magnitude 4.7 variable star. Magnitude ranges from 14.3 to 4.7 (Δ mag. 9.6) with a period of 408d. (page 102)

Observed:

U Hor (HD 024607) is a magnitude 7.8 variable star. Magnitude ranges from 15.1 to 7.8 (Δ mag. 7.3) with a period of 348d. (page 102)

Observed:

Hydra

U Hya (HD 92055) is a magnitude 4.7 carbon star. Magnitude ranges from 6.2 to 4.7 (Δ mag. 1.5). (page 193)

Observed:

V Hya (SAO 179278) is a magnitude 6.5 carbon star. Magnitude ranges from 12.0 to 6.5 (Δ mag. 5.5) with a period of 533d. (page 195)

Observed:

C66 (NGC 5694) is a magnitude 10.2 globular cluster. Angular size is 3.6'. (page 221)

Observed:

M68 (NGC 4590) is a magnitude 7.8 globular cluster. Angular size is 12'. (page 196)

Observed:

M48 (NGC 2548) is a magnitude 5.5 open cluster. Angular size is 54'. (page 147)

Observed:

C59 (Ghost of Jupiter, NGC 3242) is a magnitude 8.6 planetary nebula. Angular size is 0.4'. (page 149)

Observed:

M83 (Southern Pinwheel, NGC 5236) is a magnitude 7.6 spiral galaxy. Angular size is 11x10'. (page 225)

Observed:

R Hya (HD 117287) is a magnitude 3.5 variable star. Magnitude ranges from 10.9 to 3.5 (Δ mag. 7.4) with a period of 389d. (page 195)

Observed:

S Hya (HD 076011) is a magnitude 7.2 variable star. Magnitude ranges from 13.3 to 7.2 (Δ mag. 6.1) with a period of 257d. (page 143)

Observed:

Lacerta

C16 (NGC 7243) is a magnitude 6.4 open cluster. Angular size is 21'. (page 278)

Observed:

Leo

M95 (NGC 3351) is a magnitude 9.7 barred spiral galaxy. Angular size is 4x3'. (page 189)

Observed:

M105 (NGC 3379) is a magnitude 9.3 elliptical galaxy. Angular size is 2'. (page 180)

Observed:

C40 (NGC 3626) is a magnitude 10.9 barred spiral galaxy. Angular size is 3x2'. (page 178)

Observed:

M65 (NGC 3623) is a magnitude 9.3 spiral galaxy. Angular size is 8x1.5'. (page 187)

Observed:

M66 (NGC 3627) is a magnitude 8.9 spiral galaxy. Angular size is 8x2.5'. (page 187)

Observed:

M96 (NGC 3368) is a magnitude 9.2 spiral galaxy. Angular size is 6x4'. (page 182)

Observed:

R Leo (HD 084748) is a magnitude 4.4 variable star. Magnitude ranges from 11.3 to 4.4 (Δ mag. 6.9) with a period of 310d. (page 142)

Observed:

Leo Minor

R LMi (HD 084346) is a magnitude 6.3 variable star. Magnitude ranges from 13.2 to 6.3 (Δ mag. 6.9) with a period of 372d. (page 138)

Observed:

Lepus

M79 (NGC 1904) is a magnitude 7.7 globular cluster. Angular size is 9'. (page 126)

Observed:

R Lep (HD 031996) is a magnitude 5.5 variable star. Magnitude ranges from 11.7 to 5.5 (Δ mag. 6.2) with a period of 427d. (page 125)

Observed:

RX Lep (HD 033664) is a magnitude 5.0 variable star. Magnitude ranges from 7.4 to 5.0 (Δ mag. 2.4) with a period of 60d. (page 128)

Observed:

Lynx

Y Lyn (HD 58521) is a magnitude 6.9 carbon star. Magnitude ranges from 7.5 to 6.9 (Δ mag. 0.6) with a period of 110d. (page 106)

Observed:

C25 (Intergalactic Wanderer, NGC 2419) is a magnitude 10.4 globular cluster. Angular size is 6'. (page 137)

Observed:

Lyra

M56 (NGC 6779) is a magnitude 8.3 globular cluster. Angular size is 7'. (page 237)

Observed:

M57 (Ring Nebula, NGC 6720) is a magnitude 8.8 planetary nebula. Angular size is 1.4x1.0'. (page 236)

Observed:

R Lyr (HD 175865) is a magnitude 3.88 variable star. Magnitude ranges from 5.0 to 3.88 (Δ mag. 1.1) with a period of 46d. (page 235)

Observed:

Microscopium

U Mic (HD 194814) is a magnitude 7.0 variable star. Magnitude ranges from 14.4 to 7.0 (Δ mag. 7.4) with a period of 334d. (page 301)

Observed:

Monoceros

C46 (Hubble's Variable Nebula, NGC 2261) is a magnitude 10.0 bright nebula. Angular size is 2x1'. (page 119)

Observed:

C49 (NGC 2237-9) is a magnitude 9.0 bright nebula. Angular size is 80x60'. (page 119)

Observed:

C50 (Rosette Nebula, NGC 2244) is a magnitude 4.8 open cluster. Angular size is 24'. (page 116)

Observed:

C54 (NGC 2506) is a magnitude 7.6 open cluster. Angular size is 7'. (page 150)

Observed:

M50 (NGC 2323) is a magnitude 6.3 open cluster. Angular size is 16'. (page 124)

Observed:

NGC 2232 is a magnitude 3.9 open cluster. Angular size is 30'. (page 127)

Observed:

NGC 2301 is a magnitude 6.0 open cluster. Angular size is 12'. (page 116)

Observed:

U Mon (HD 059693) is a magnitude 6.1 variable star. Magnitude ranges from 8.8 to 6.1 (Δ mag. 2.7) with a period of 91.3d. (page 147)

Observed:

V Mon (HD 044639) is a magnitude 6.0 variable star. Magnitude ranges from 13.9 to 6.0 (Δ mag. 7.9) with a period of 341d. (page 127)

Observed:

Musca

C105 (The Southern Butterfly, NGC 4833) is a magnitude 7.3 globular cluster. Angular size is 14'. (page 311)

Observed:

C108 (NGC 4372) is a magnitude 7.8 globular cluster. Angular size is 19'. (page 309)

Observed:

Norma

C89 (S Norma Cluster, NGC 6087) is a magnitude 5.4 open cluster. Angular size is 12'. (page 227)

Observed:

NGC 6067 is a magnitude 5.6 open cluster. Angular size is 13'. (page 230)

Observed:

R Nor (HD 138743) is a magnitude 6.5 variable star. Magnitude ranges from 13.9 to 6.5 (Δ mag. 7.4) with a period of 508d. (page 226)

Observed:

T Nor (HD 140041) is a magnitude 6.2 variable star. Magnitude ranges from 13.6 to 6.2 (Δ mag. 7.4) with a period of 241d. (page 226)

Observed:

Octans

R Oct (HD 040857) is a magnitude 6.4 variable star. Magnitude ranges from 13.2 to 6.4 (Δ mag. 6.8) with a period of 405d. (page 310)

Observed:

Ophiuchus

M10 (NGC 6254) is a magnitude 6.6 globular cluster. Angular size is 15'. (page 247)

Observed:

M107 (NGC 6171) is a magnitude 7.9 globular cluster. Angular size is 10'. (page 249)

Observed:

M12 (NGC 6218) is a magnitude 6.7 globular cluster. Angular size is 15'. (page 247)

Observed:

M14 (NGC 6402) is a magnitude 7.6 globular cluster. Angular size is 12'. (page 252)

Observed:

M19 (NGC 6273) is a magnitude 6.8 globular cluster. Angular size is 14'. (page 257)

Observed:

M62 (NGC 6266) is a magnitude 6.5 globular cluster. Angular size is 14'. (page 261)

Observed:

M9 (NGC 6333) is a magnitude 7.7 globular cluster. Angular size is 9.3'. (page 255)

Observed:

IC 4665 is a magnitude 4.2 open cluster. Angular size is 41'. (page 243)

Observed:

NGC 6633 is a magnitude 4.6 open cluster. Angular size is 27'. (page 242)

Observed:

RS Oph (HD 162214) is a magnitude 4.3 variable star. Magnitude ranges from 12.5 to 4.3 (Δ mag. 8.2). (page 253)

Observed:

V Oph (HD 148182) is a magnitude 7.3 variable star. Magnitude ranges from 11.6 to 7.3 (Δ mag. 4.3) with a period of 297d. (page 220)

Observed:

X Oph (HD 172171) is a magnitude 5.9 variable star. Magnitude ranges from 9.2 to 5.9 (Δ mag. 3.3) with a period of 329d. (page 241)

Observed:

Orion

Betelgeuse (HD 39801) is a magnitude 0.4 carbon star. Magnitude ranges from 1.3 to 0.4 (Δ mag. 0.9). (page 115)

Observed:

W Ori (HD 32736) is a magnitude 6.5 carbon star. Magnitude ranges from 10.0 to 6.5 (Δ mag. 3.5) with a period of 210d. (page 120)

Observed:

M42 (Great Nebula in Orion, NGC 1976) is a magnitude 4.0 diffuse nebula. Angular size is 85x60'. (page 128)

Observed:

M43 (De Mairan's Nebula, NGC 1982) is a magnitude 9.0 diffuse nebula. Angular size is 20x15'. (page 124)

Observed:

M78 (NGC 2068) is a magnitude 8.3 diffuse nebula. Angular size is 8x6'. (page 120)

Observed:

NGC 1662 is a magnitude 6.4 open cluster. Angular size is 20'. (page 115)

Observed:

NGC 1981 is a magnitude 4.6 open cluster. Angular size is 25'. (page 123)

Observed:

NGC 2169 is a magnitude 5.9 open cluster. Angular size is 7'. (page 118)

Observed:

U Ori (HD 039816) is a magnitude 4.8 variable star. Magnitude ranges from 13.0 to 4.8 (Δ mag. 8.2) with a period of 368d. (page 118)

Observed:

VV Ori (HD 036695) is a magnitude 5.31 variable star. Magnitude ranges from 5.66 to 5.31 (Δ mag. 0.4) with a period of 1.48538d. (page 123)

Observed:

Pavo

C93 (Pavo Globular Cluster, NGC 6752) is a magnitude 5.4 globular cluster. Angular size is 20'. (page 265)

Observed:

C101 (NGC 6744) is a magnitude 9.0 barred spiral galaxy. Angular size is 16x10'. (page 270)

Observed:

S Pav (HD 187835) is a magnitude 6.6 variable star. Magnitude ranges from 10.4 to 6.6 (Δ mag. 3.8) with a period of 381d. (page 303)

Observed:

Pegasus

TW Peg (HD 209598) is a magnitude 7.0 carbon star. Magnitude ranges from 9.2 to 7.0 (Δ mag. 2.2) with a period of 956d. (page 285)

Observed:

M15 (Great Pegasus Globular, NGC 7078) is a magnitude 6.2 globular cluster. Angular size is 12'. (page 287)

Observed:

C30 (Deer Lick Group, NGC 7331) is a magnitude 9.5 barred spiral galaxy. Angular size is 11x4'. (page 66)

Observed:

C43 (Little Sombrero Galaxy, NGC 7814) is a magnitude 10.5 barred spiral galaxy. Angular size is 6x2'. (page 68)

Observed:

C44 (NGC 7479) is a magnitude 11.0 barred spiral galaxy. Angular size is 4x3'. (page 69)

Observed:

R Peg (HD 218292) is a magnitude 6.9 variable star. Magnitude ranges from 13.8 to 6.9 (Δ mag. 6.9) with a period of 378d. (page 69)

Observed:

Perseus

C14 (Double Cluster, NGC 869/884) is a magnitude 4.3 open cluster. Angular size is 60x30'. (page 82)

Observed:

M34 (NGC 1039) is a magnitude 5.5 open cluster. Angular size is 35'. (page 83)

Observed:

NGC 1528 is a magnitude 6.4 open cluster. Angular size is 24'. (page 82)

Observed:

NGC 1545 is a magnitude 6.2 open cluster. Angular size is 18'. (page 86)

Observed:

M76 (Little Dumbbell Nebula, NGC 650) is a magnitude 10.1 planetary nebula. Angular size is 3x2'. (page 86)

Observed:

C24 (Perseus A, NGC 1275) is a magnitude 11.6 seyfert galaxy. Angular size is 2'. (page 83)

Observed:

X Per (HD 024534) is a magnitude 6.03 variable star. Magnitude ranges from 7.0 to 6.03 (Δ mag. 1.0). (page 84)

Observed:

Pictor

R Pic (HD 030551) is a magnitude 6.35 variable star. Magnitude ranges from 10.1 to 6.35 (Δ mag. 3.8) with a period of 171d. (page 133)

Observed:

Pisces

Z Psc (HD 7561) is a magnitude 7.0 carbon star. Magnitude ranges from 7.9 to 7.0 (Δ mag. 0.9) with a period of 144d. (page 68)

Observed:

M74 (NGC 628) is a magnitude 9.4 spiral galaxy. Angular size is 10'. (page 91)

Observed:

R Psc (HD 009203) is a magnitude 7.0 variable star. Magnitude ranges from 14.8 to 7.0 (Δ mag. 7.8) with a period of 345d. (page 93)

Observed:

TX Psc (HD 223075) is a magnitude 4.79 variable star. Magnitude ranges from 5.2 to 4.79 (Δ mag. 0.4). (page 70)

Observed:

Puppis

NGC 2298 (NGC) is a magnitude 9.29 globular cluster. Angular size is 5'. (page 132)

Observed:

C71 (NGC 2477) is a magnitude 5.8 open cluster. Angular size is 27'. (page 155)

Observed:

M46 (NGC 2437) is a magnitude 6.0 open cluster. Angular size is 27'. (page 151)

Observed:

M47 (NGC 2422) is a magnitude 5.2 open cluster. Angular size is 30'. (page 148)

Observed:

M93 (NGC 2447) is a magnitude 6.0 open cluster. Angular size is 22'. (page 152)

Observed:

NGC 2423 is a magnitude 6.7 open cluster. Angular size is 19'. (page 151)

Observed:

NGC 2451 is a magnitude 2.8 open cluster. Angular size is 45'. (page 159)

Observed:

NGC 2527 is a magnitude 6.5 open cluster. Angular size is 22'. (page 149)

Observed:

NGC 2539 is a magnitude 6.5 open cluster. Angular size is 22'. (page 148)

Observed:

NGC 2546 is a magnitude 6.3 open cluster. Angular size is 41'. (page 155)

Observed:

Reticulum

NGC 1313 is a magnitude 9.2 barred spiral galaxy. Angular size is 9'. (page 103)

Observed:

Sagitta

M71 (NGC 6838) is a magnitude 8.2 globular cluster. Angular size is 7'. (page 286)

Observed:

U Sge (HD 181182) is a magnitude 6.45 variable star. Magnitude ranges from 9.28 to 6.45 (Δ mag. 2.8) with a period of 3.38062d. (page 240)

Observed:

WZ Sge (HV 03518) is a magnitude 7.0 variable star. Magnitude ranges from 15.53 to 7.0 (Δ mag. 8.5) with a period of 33y. (page 286)

Observed:

Sagittarius

AQ Sgr (HD 184283) is a magnitude 6.6 carbon star. Magnitude ranges from 7.7 to 6.6 (Δ mag. 1.1) with a period of 200d. (page 296)

Observed:

M17 (Omega Nebula, NGC 6618) is a magnitude 7.0 diffuse nebula. Angular size is 11'. (page 249)

Observed:

M20 (Trifid Nebula, NGC 6514) is a magnitude 9.0 diffuse nebula. Angular size is 28'. (page 256)

Observed:

M8 (Lagoon Nebula, NGC 6523) is a magnitude 6.0 diffuse nebula. Angular size is 90x40'. (page 257)

Observed:

M22 (Sagittarius Cluster, NGC 6656) is a magnitude 5.1 globular cluster. Angular size is 24'. (page 251)

Observed:

M28 (NGC 6626) is a magnitude 6.8 globular cluster. Angular size is 11'. (page 252)

Observed:

M54 (NGC 6715) is a magnitude 7.6 globular cluster. Angular size is 9'. (page 266)

Observed:

M55 (NGC 6809) is a magnitude 6.3 globular cluster. Angular size is 19'. (page 300)

Observed:

M69 (NGC 6637) is a magnitude 7.6 globular cluster. Angular size is 7'. (page 267)

Observed:

M70 (NGC 6681) is a magnitude 7.9 globular cluster. Angular size is 8'. (page 262)

Observed:

M75 (NGC 6864) is a magnitude 8.5 globular cluster. Angular size is 6'. (page 295)

Observed:

C57 (Barnard's Galaxy, NGC 6822) is a magnitude 9.3 irregular galaxy. Angular size is 10x9'. (page 294)

Observed:

M24 (Sagittarius Star Cloud, IC 4715) is a magnitude 4.6 star cloud. Angular size is 90'. (page 250)

Observed:

M18 (NGC 6613) is a magnitude 7.5 open cluster. Angular size is 9'. (page 255)

Observed:

M21 (NGC 6531) is a magnitude 6.5 open cluster. Angular size is 13'. (page 251)

Observed:

M23 (NGC 6494) is a magnitude 6.9 open cluster. Angular size is 27'. (page 250)

Observed:

M25 (IC 4725) is a magnitude 6.5 open cluster. Angular size is 40'. (page 256)

Observed:

RR Sgr (HD 188378) is a magnitude 5.4 variable star. Magnitude ranges from 14.0 to 5.4 (Δ mag. 8.6) with a period of 336d. (page 300)

Observed:

RT Sgr (HD 192702) is a magnitude 6.0 variable star. Magnitude ranges from 14.1 to 6.0 (Δ mag. 8.1) with a period of 306d. (page 301)

Observed:

RU Sgr (HD 188813) is a magnitude 6.0 variable star. Magnitude ranges from 13.8 to 6.0 (Δ mag. 7.8) with a period of 240d. (page 302)

Observed:

RY Sgr (HD 180093) is a magnitude 5.8 variable star. Magnitude ranges from 14.0 to 5.8 (Δ mag. 8.2) with a period of Period. (page 263)

Observed:

Sc

M11 (Wild Duck Cluster, NGC 6705) is a magnitude 6.3 open cluster. Angular size is 14'. (page 248)

Observed:

Scorpius

Antares (HD 148478) is a magnitude 0.9 carbon star. Magnitude ranges from 1.0 to 0.9 (Δ mag. 0.1). (page 222)

Observed:

M4 (NGC 6121) is a magnitude 5.6 globular cluster. Angular size is 26.3'. (page 222)

Observed:

M80 (NGC 6093) is a magnitude 7.3 globular cluster. Angular size is 10'. (page 221)

Observed:

C75 (NGC 6124) is a magnitude 5.8 open cluster. Angular size is 29'. (page 225)

Observed:

C76 (Northern Jewel Box, NGC 6231) is a magnitude 2.6 open cluster. Angular size is 15'. (page 268)

Observed:

M6 (Butterfly Cluster, NGC 6405) is a magnitude 4.2 open cluster. Angular size is 25'. (page 266)

Observed:

M7 (Ptolemy's Cluster, NGC 6475) is a magnitude 3.3 open cluster. Angular size is 80'. (page 267)

Observed:

NGC 6322 is a magnitude 6.0 open cluster. Angular size is 10'. (page 264)

Observed:

NGC 6416 is a magnitude 5.7 open cluster. Angular size is 18'. (page 262)

Observed:

C69 (Bug Nebula, NGC 6302) is a magnitude 12.8 planetary nebula. Angular size is 0.8'. (page 268)

Observed:

RR Sco (HD 152783) is a magnitude 5.0 variable star. Magnitude ranges from 12.4 to 5.0 (Δ mag. 7.4) with a period of 281d. (page 261)

Observed:

Sculptor

R Scl (HD 8879) is a magnitude 6.1 carbon star. Magnitude ranges from 8.8 to 6.1 (Δ mag. 2.7) with a period of 363d. (page 76)

Observed:

C72 (String of Pearls, NGC 55) is a magnitude 8.2 barred spiral galaxy. Angular size is 32x6'. (page 77)

Observed:

C65 (Sculptor Galaxy, NGC 253) is a magnitude 7.1 spiral galaxy. Angular size is 25x7'. (page 74)

Observed:

C70 (Southern Pinwheel Galaxy, NGC 300) is a magnitude 8.1 spiral galaxy. Angular size is 20x13'. (page 77)

Observed:

S Scl (HD 001115) is a magnitude 5.5 variable star. Magnitude ranges from 13.6 to 5.5 (Δ mag. 8.1) with a period of 363d. (page 76)

Observed:

Scutum

M26 (NGC 6694) is a magnitude 8.0 open cluster. Angular size is 15'. (page 248)

Observed:

R Sct (HD 173819) is a magnitude 4.2 variable star. Magnitude ranges from 8.6 to 4.2 (Δ mag. 4.4) with a period of 146.5d. (page 253)

Observed:

Serpens

M5 (NGC 5904) is a magnitude 5.6 globular cluster. Angular size is 17.4'. (page 218)

Observed:

IC 4756 is a magnitude 5.0 open cluster. Angular size is 52'. (page 243)

Observed:

M16 (Eagle Nebula, NGC 6611) is a magnitude 6.4 open cluster. Angular size is 7'. (page 254)

Observed:

NGC 6605 is a magnitude 6.0 open cluster. Angular size is 29'. (page 254)

Observed:

R Ser (HD 141850) is a magnitude 5.16 variable star. Magnitude ranges from 14.4 to 5.16 (Δ mag. 9.2) with a period of 356d. (page 216)

Observed:

S Ser (HD 136695) is a magnitude 7.0 variable star. Magnitude ranges from 14.1 to 7.0 (Δ mag. 7.1) with a period of 372d. (page 217)

Observed:

Sextans

C53 (Spindle Galaxy, NGC 3115) is a magnitude 9.1 elliptical galaxy. Angular size is 8x3'. (page 150)

Observed:

Taurus

C41 (Hyades, Mel 25) is a magnitude 1.0 open cluster. Angular size is 330'. (page 91)

Observed:

M45 (Pleiades, Mel 22) is a magnitude 1.6 open cluster. Angular size is 110'. (page 90)

Observed:

NGC 1647 is a magnitude 6.4 open cluster. Angular size is 45'. (page 114)

Observed:

NGC 1746 is a magnitude 6.0 open cluster. Angular size is 42'. (page 117)

Observed:

M1 (Crab Nebula, NGC 1952) is a magnitude 8.4 supernova remnant. Angular size is 6x4'. (page 114)

Observed:

R Tau (HD 028309) is a magnitude 7.6 variable star. Magnitude ranges from 15.8 to 7.6 (Δ mag. 8.2) with a period of 321d. (page 93)

Observed:

Triangulum

M33 (Triangulum Galaxy, NGC 598) is a magnitude 5.7 spiral galaxy. Angular size is 73x45'. (page 88)

Observed:

R Tri (HD 016210) is a magnitude 5.4 variable star. Magnitude ranges from 12.6 to 5.4 (Δ mag. 7.2) with a period of 267d. (page 84)

Observed:

Triangulum Australe

C95 (NGC 6025) is a magnitude 5.1 open cluster. Angular size is 12'. (page 232)

Observed:

Tucana

SMC is a magnitude 2.7 Magellanic barred spiral galaxy. Angular size is 315'. (page 307)

Observed:

C104 (NGC 362) is a magnitude 6.6 globular cluster. Angular size is 13'. (page 307)

Observed:

C106 (47 Tucanae, NGC 104) is a magnitude 4.0 globular cluster. Angular size is 31'. (page 309)

Observed:

Ursa Major

M109 (NGC 3992) is a magnitude 9.8 barred spiral galaxy. Angular size is 7x4'. (page 172)

Observed:

RT UMa (TYC 3431-229-1) is a magnitude 8.6 carbon star. Magnitude ranges from 9.6 to 8.6 (Δ mag. 1.0). (page 137)

Observed:

VY UMa (HD 92839) is a magnitude 6.0 carbon star. Magnitude ranges from 6.6 to 6.0 (Δ mag. 0.6). (page 49)

Observed:

M40 (Winnecke 4, Win 4) is a magnitude 8.4 double star. Angular size is 0.8'. (page 171)

Observed:

M82 (Cigar Galaxy, NGC 3034) is a magnitude 8.4 irregular galaxy. Angular size is 9x4'. (page 50)

Observed:

M97 (Owl Nebula, NGC 3587) is a magnitude 9.9 planetary nebula. Angular size is 3x3.3'. (page 168)

Observed:

M101 (Pinwheel Galaxy, NGC 5457) is a magnitude 7.9 spiral galaxy. Angular size is 22'. (page 208)

Observed:

M108 (NGC 3556) is a magnitude 10.0 spiral galaxy. Angular size is 8x1'. (page 171)

Observed:

M81 (Bode's Galaxy, NGC 3031) is a magnitude 6.9 spiral galaxy. Angular size is 21x10'. (page 53)

Observed:

R UMa (HD 092763) is a magnitude 6.5 variable star. Magnitude ranges from 13.7 to 6.5 (Δ mag. 7.2) with a period of 302d. (page 49)

Observed:

W UMa (HD 083950) is a magnitude 7.75 variable star. Magnitude ranges from 8.48 to 7.75 (Δ mag. 0.7) with a period of 0.3336d. (page 136)

Observed:

Z UMa (HD 103681) is a magnitude 6.2 variable star. Magnitude ranges from 9.4 to 6.2 (Δ mag. 3.2) with a period of 196d. (page 167)

Observed:

Vela

C79 (NGC 3201) is a magnitude 6.7 globular cluster. Angular size is 18'. (page 156)

Observed:

IC 2395 is a magnitude 4.6 open cluster. Angular size is 8'. (page 160)

Observed:

NGC 2547 is a magnitude 4.7 open cluster. Angular size is 20'. (page 156)

Observed:

NGC 2669 is a magnitude 6.1 open cluster. Angular size is 12'. (page 161)

Observed:

NGC 3228 is a magnitude 6.0 open cluster. Angular size is 18'. (page 157)

Observed:

C74 (Eight Burst Nebula, NGC 3132) is a magnitude 8.2 planetary nebula. Angular size is 0.8'. (page 160)

Observed:

Virgo

M58 (NGC 4579) is a magnitude 9.7 barred spiral galaxy. Angular size is 6x5'. (page 182)

Observed:

SS Vir (HD 108105) is a magnitude 6.0 carbon star. Magnitude ranges from 9.6 to 6.0 (Δ mag. 3.6) with a period of 355d. (page 190)

Observed:

C52 (NGC 4697) is a magnitude 9.3 elliptical galaxy. Angular size is 6x3'. (page 192)

Observed:

M49 (NGC 4472) is a magnitude 8.4 elliptical galaxy. Angular size is 9x7.5'. (page 190)

Observed:

M59 (NGC 4621) is a magnitude 9.6 elliptical galaxy. Angular size is 5x4'. (page 189)

Observed:

M60 (NGC 4649) is a magnitude 8.8 elliptical galaxy. Angular size is 7x6'. (page 183)

Observed:

M87 (NGC 4486) is a magnitude 8.6 elliptical galaxy. Angular size is 7'. (page 188)

Observed:

M89 (NGC 4552) is a magnitude 9.8 elliptical galaxy. Angular size is 4'. (page 181)

Observed:

M84 (NGC 4374) is a magnitude 9.1 lenticular galaxy. Angular size is 5'. (page 188)

Observed:

M86 (NGC 4406) is a magnitude 8.9 lenticular galaxy. Angular size is 8x6'. (page 181)

Observed:

M104 (Sombrero Galaxy, NGC 4594) is a magnitude 8.0 spiral galaxy. Angular size is 9x4'. (page 192)

Observed:

M61 (NGC 4303) is a magnitude 9.7 spiral galaxy. Angular size is 6'. (page 183)

Observed:

M90 (NGC 4569) is a magnitude 9.5 spiral galaxy. Angular size is 10x5'. (page 180)

Observed:

S Vir (HD 117833) is a magnitude 6.3 variable star. Magnitude ranges from 13.2 to 6.3 (Δ mag. 6.9) with a period of 375d. (page 220)

Observed:

Vulpecula

C37 (20 Vulpeculae Cluster, NGC 6885) is a magnitude 5.7 open cluster. Angular size is 7'. (page 285)

Observed:

NGC 6940 is a magnitude 6.3 open cluster. Angular size is 31'. (page 287)

Observed:

M27 (Dumbbell Nebula, NGC 6853) is a magnitude 7.4 planetary nebula. Angular size is 8x6'. (page 288)

Observed:

Bortle Light Pollution Scale

The Bortle Light Pollution Scale was developed by John E Bortle in 2001 to categorize local light pollution levels into nine categories, with "one" being truly dark, pristine skies and "nine" being highly polluted inner city skies.

To help you judge your local light pollution, the following pages show selected regions at Bortle levels nine, seven five and three. The northern and southern polar regions are included, as are the more equatorial constellations of Leo, Scorpius, Orion and Pegasus. I also include two bright and easily recognized circumpolar constellations, Crux and Cassiopeia. Although only some Bortle levels are illustrated, it should be fairly simple to interpolate the remaining levels - for example if the sky is slightly better than the Bortle 7 chart but not quite as good as Bortle 5, then it is reasonable to estimate a level of Bortle 6 even though it is not separately illustrated.

The targets in this book are color-coded into three categories: blue targets have a magnitude of at least 7 and are the brightest and red targets are the faintest, no brighter than magnitude 9, while orange targets fall between. This is only a rough guide, as an object might be relatively bright but very spread out (that is, having a low surface brightness) so it might be classified as a blue object but actually be somewhat more difficult.

In Bortle 9 skies, all targets are extremely difficult, with only a few of the brightest blue targets such as the Pleiades being easily visible. Finding the targets presents its own challenge as even the relatively bright signpost stars used in this book are at the edge of visibility. Very bright skies make galaxies in particular more difficult, while open clusters and globular clusters fare somewhat better. This is because higher magnification can be used to stretch out and dim the background, while stars, being point sources, are not significantly dimmed by higher magnifications. Likewise, colored stars like carbon stars can still be enjoyed regardless of light pollution.

Bortle 8 skies show a slight improvement, and most blue targets should be visible though a small telescope. Other targets may only show on the best nights. Red targets will mostly prove elusive.

In Bortle 7 skies, the blue targets should present themselves beautifully in the eyepiece, and almost all other targets should at least be visible.

In Bortle 6 skies, orange targets should show well in your telescope, and the milky way should be visible. While these skies are regarded as relatively badly light polluted, a Bortle 6 sky nevertheless retains some traces of its true majesty.

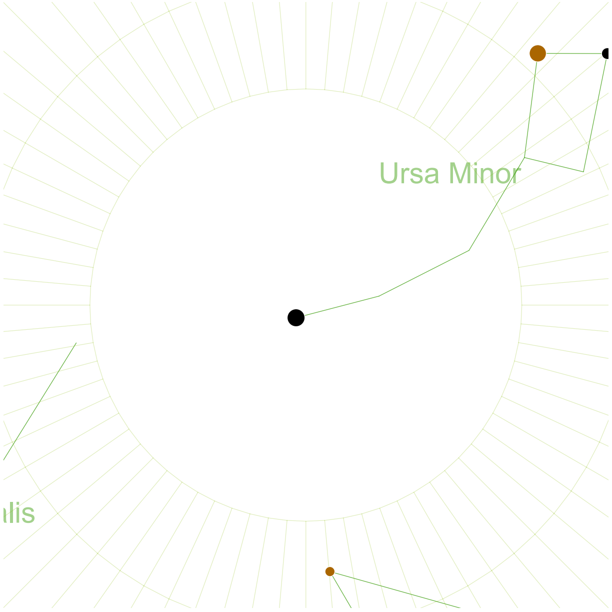
Light pollution is worse nearer to the horizon, and stars are partially extinguished by the atmosphere at lower elevations, so it is not unusual to for different parts of the sky to be a different Bortle.

Aside from being a nuisance to stargazers, light pollution has serious consequences for ecosystems and human health. Light pollution can affect the reproductive cycles of animals, the migration of birds, and contributes to the catastrophic decline in the numbers of insects. Light intrusion at night can affect humans too, not only disrupting sleep but also increasing the risk of conditions such as obesity, depression, diabetes and breast cancer. In addition, unnecessary and inefficient lighting wastes energy and contributes to climate change.

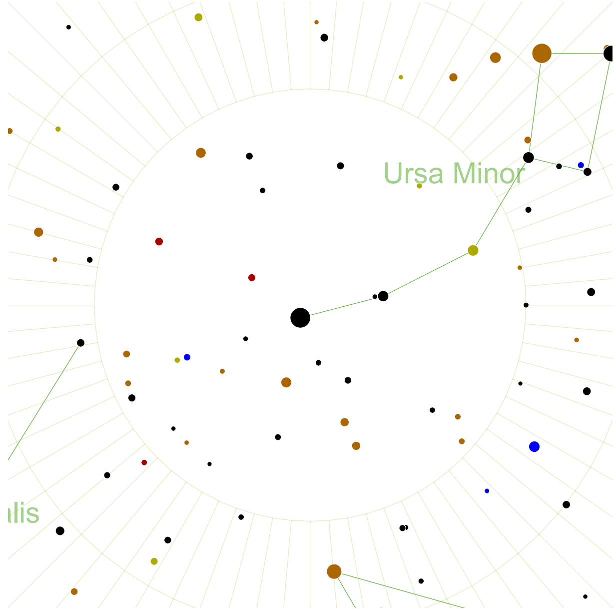
The International Dark-Sky Association campaigns against light pollution:

https://www.darksky.org/

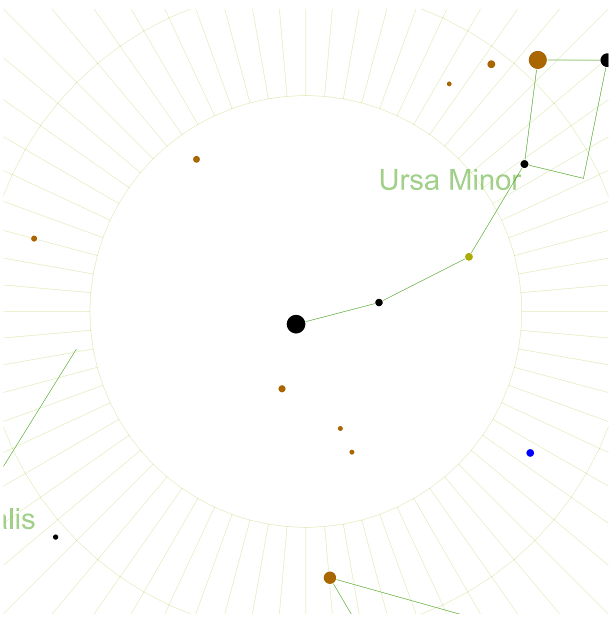
Bortle Scale (Ursa Minor)



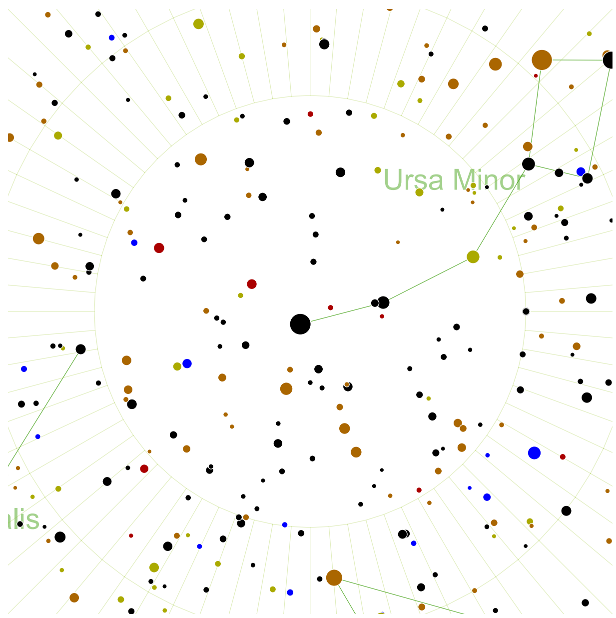
Bortle 9 (limiting magnitude 4.0)



Bortle 5 (limiting magnitude 6.0)

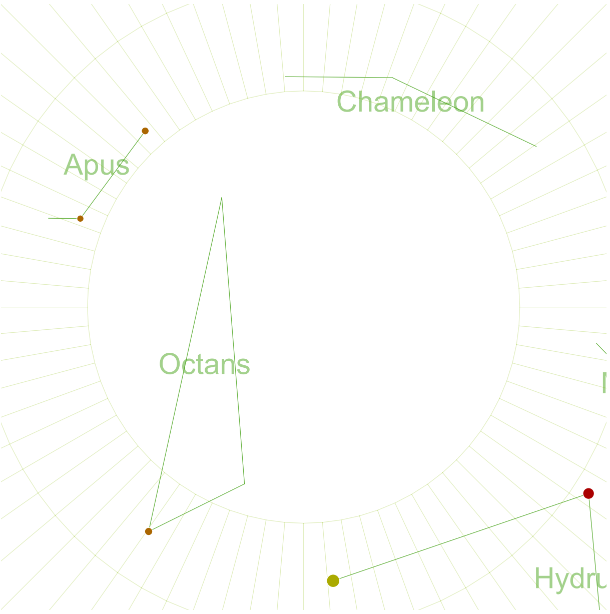


Bortle 7 (limiting magnitude 5.0)

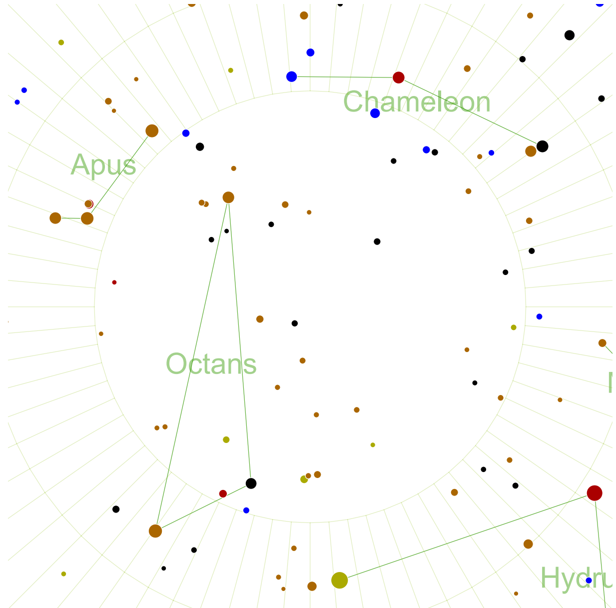


Bortle 3 (limiting magnitude 7.0)

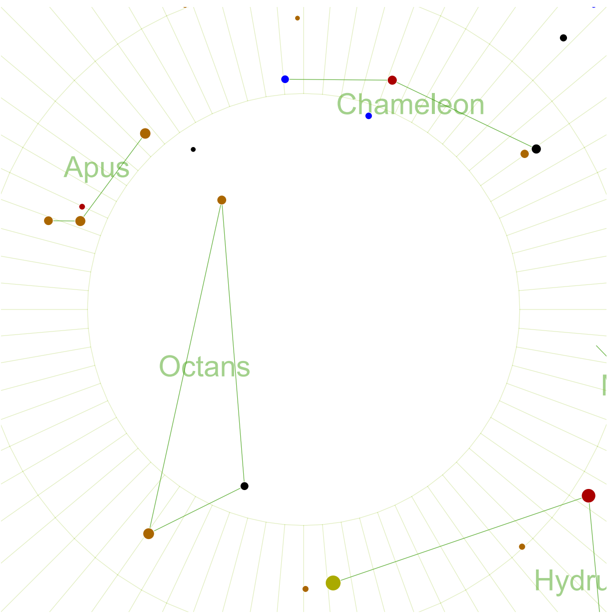
Bortle Scale (Octans)



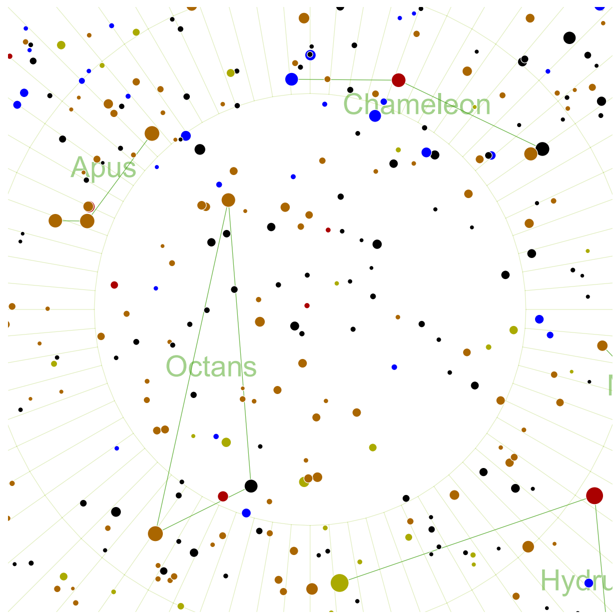
Bortle 9 (limiting magnitude 4.0)



Bortle 5 (limiting magnitude 6.0)

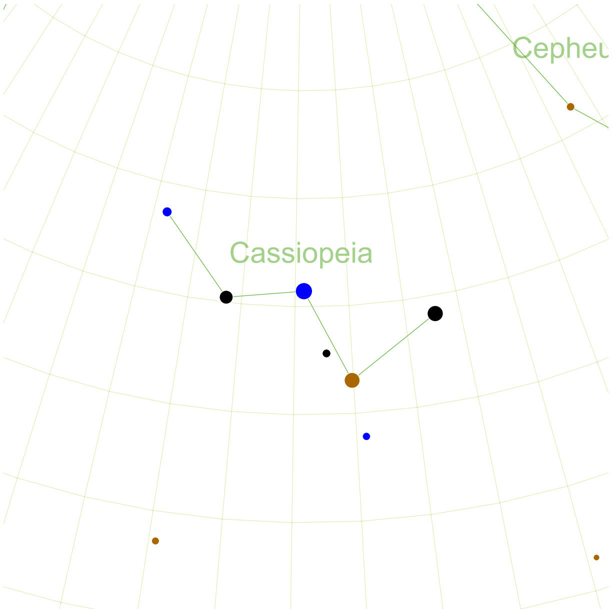


Bortle 7 (limiting magnitude 5.0)

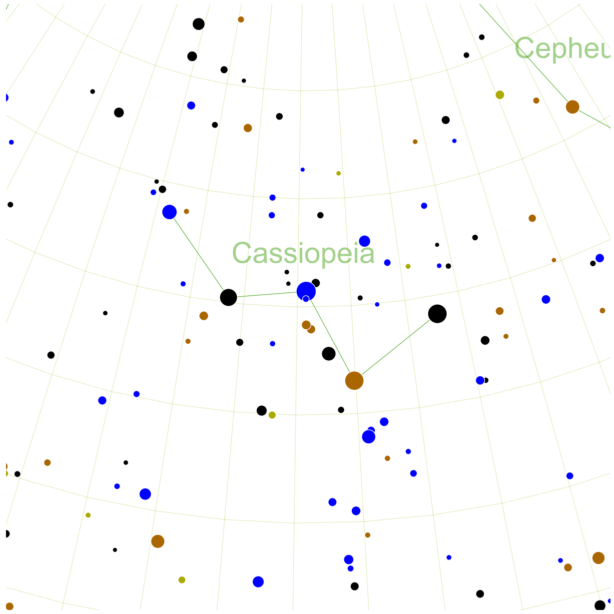


Bortle 3 (limiting magnitude 7.0)

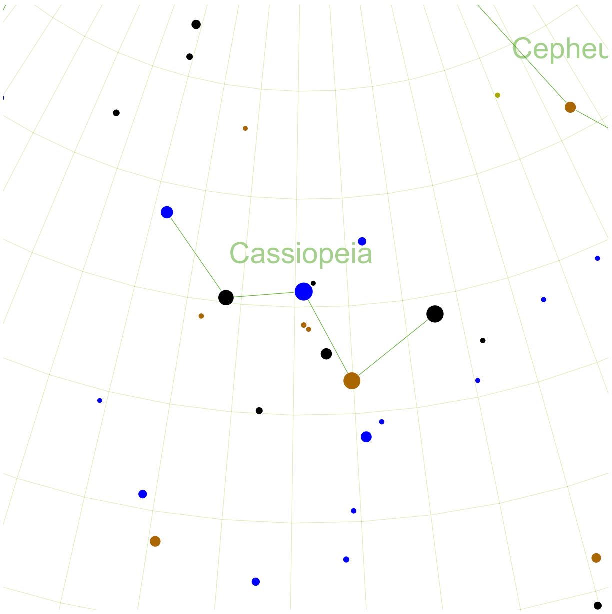
Bortle Scale (Cassiopeia)



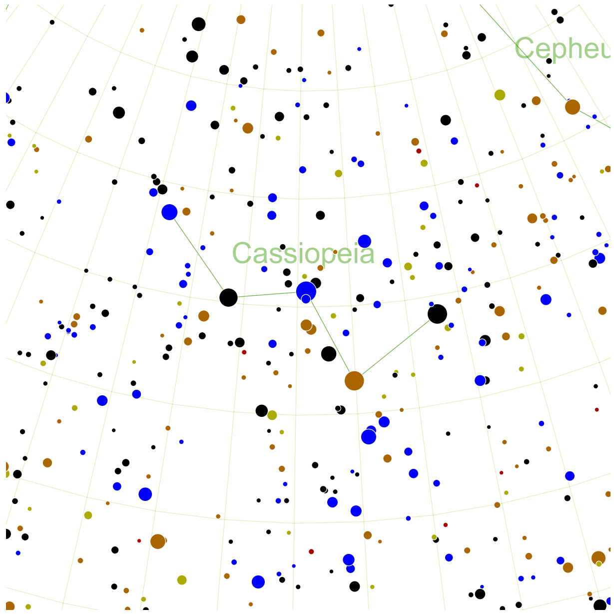
Bortle 9 (limiting magnitude 4.0)



Bortle 5 (limiting magnitude 6.0)

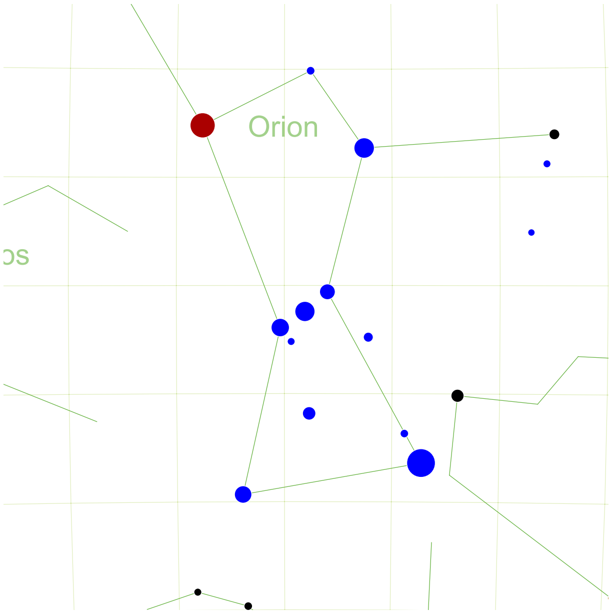


Bortle 7 (limiting magnitude 5.0)

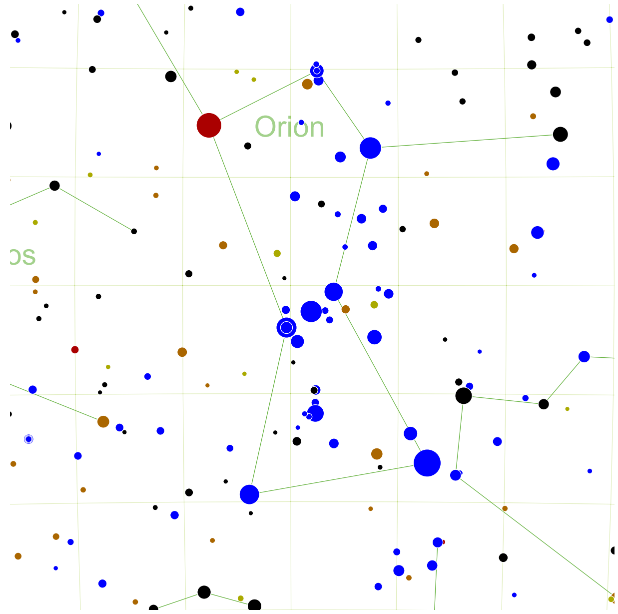


Bortle 3 (limiting magnitude 7.0)

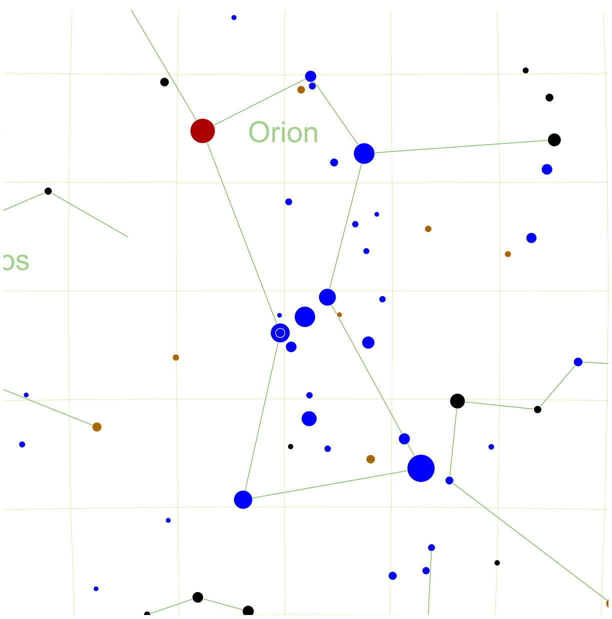
Bortle Scale (Orion)



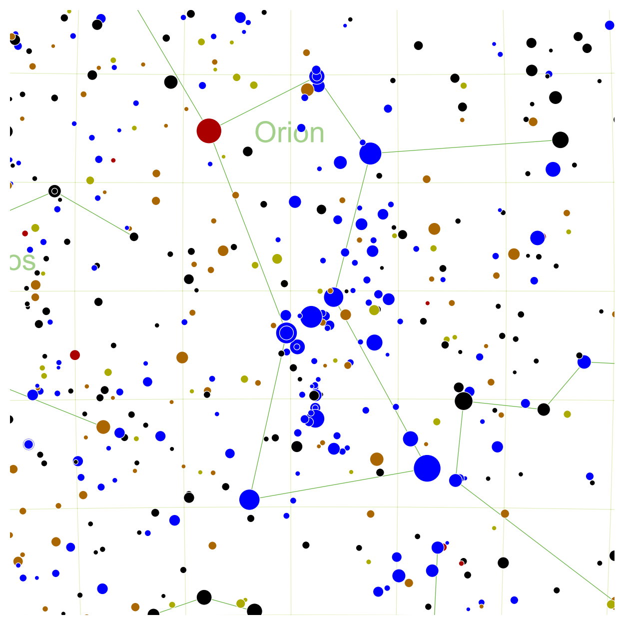
Bortle 9 (limiting magnitude 4.0)



Bortle 5 (limiting magnitude 6.0)

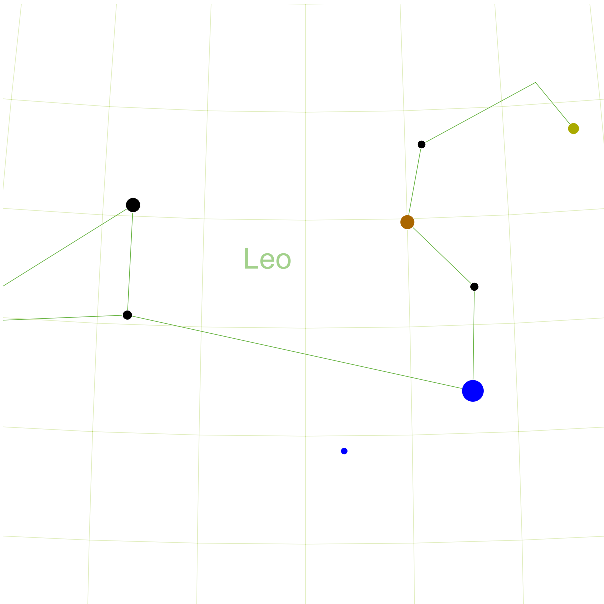


Bortle 7 (limiting magnitude 5.0)

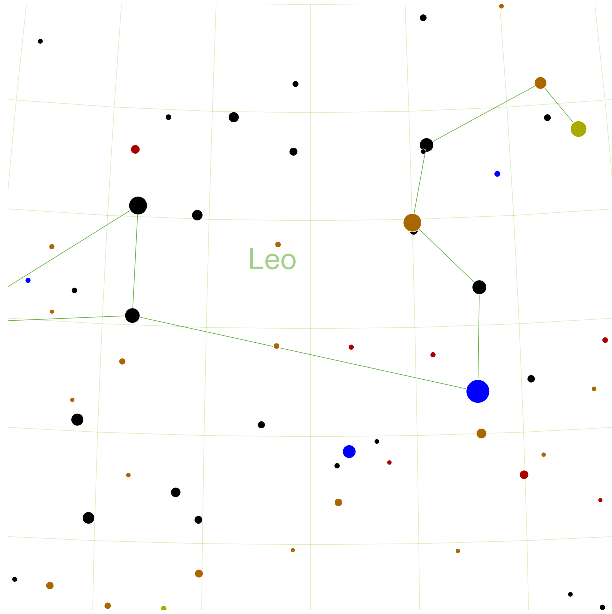


Bortle 3 (limiting magnitude 7.0)

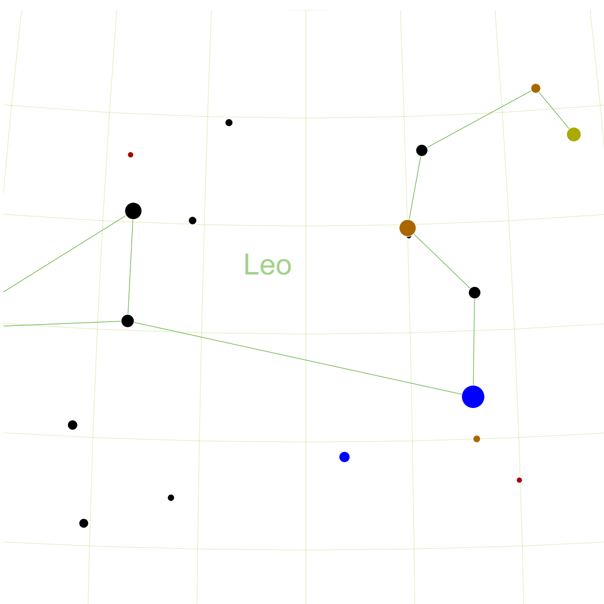
Bortle Scale (Leo)



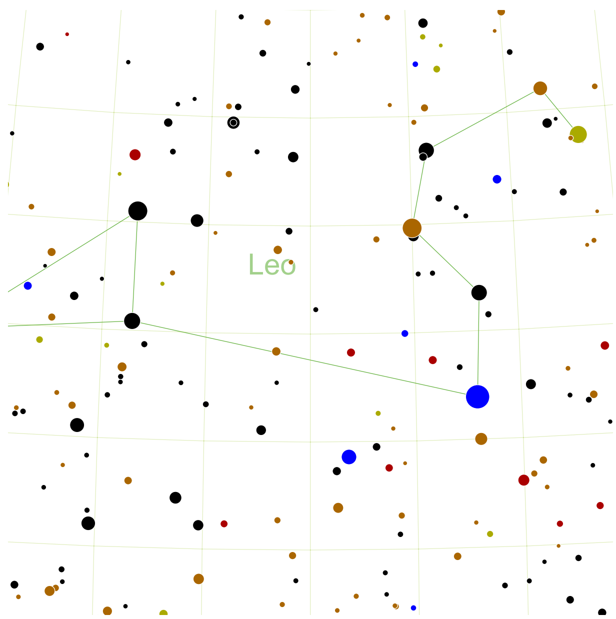
Bortle 9 (limiting magnitude 4.0)



Bortle 5 (limiting magnitude 6.0)

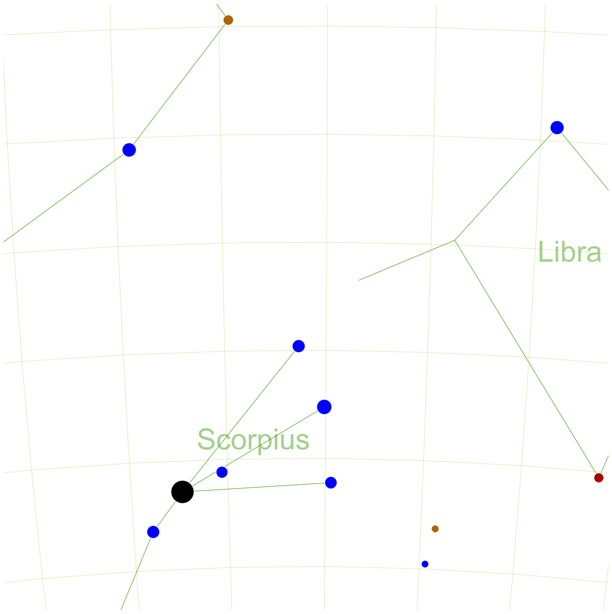


Bortle 7 (limiting magnitude 5.0)

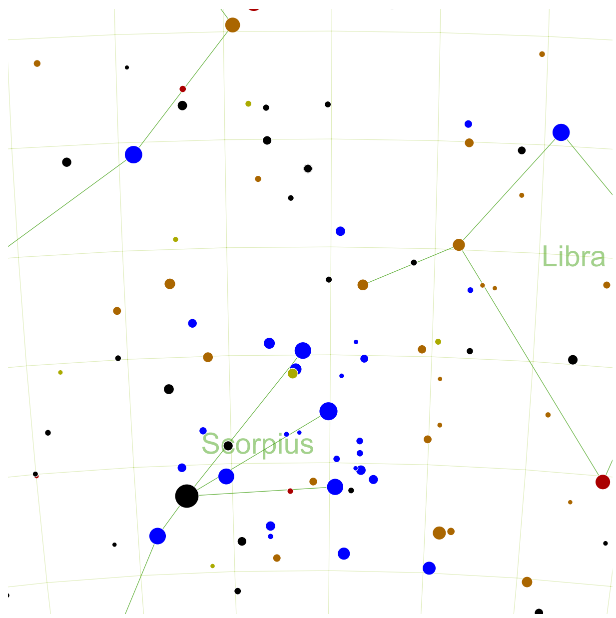


Bortle 3 (limiting magnitude 7.0)

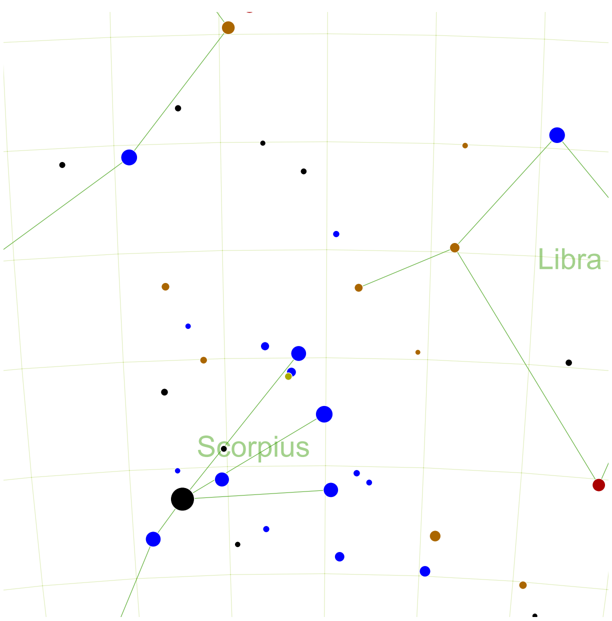
Bortle Scale (Scorpius)



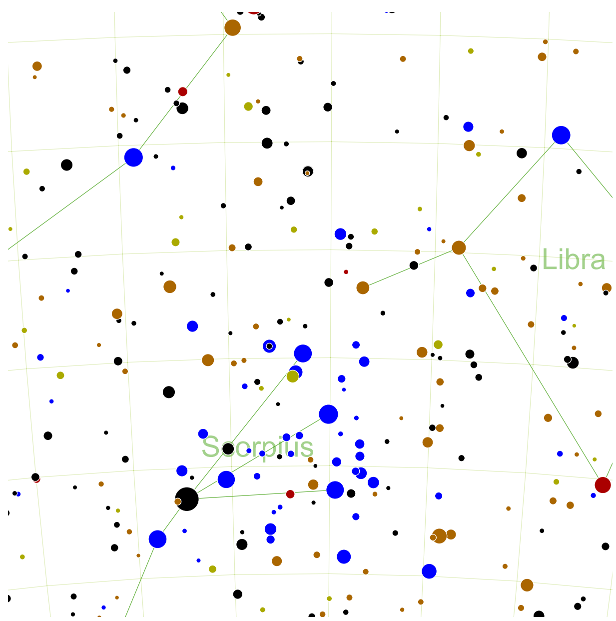
Bortle 9 (limiting magnitude 4.0)



Bortle 5 (limiting magnitude 6.0)

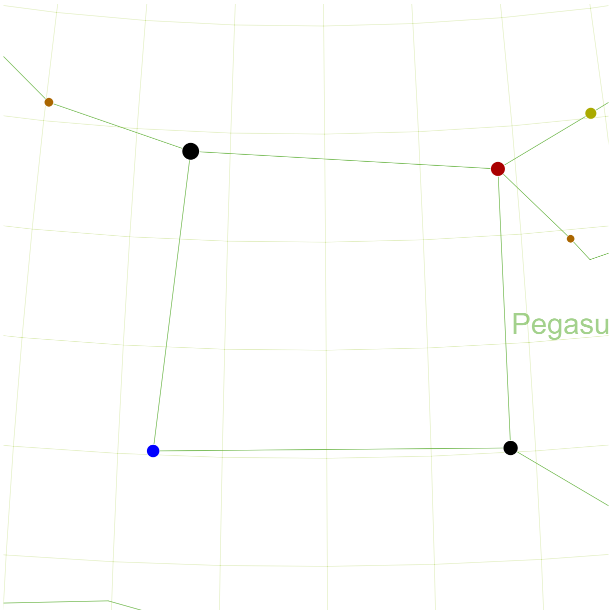


Bortle 7 (limiting magnitude 5.0)

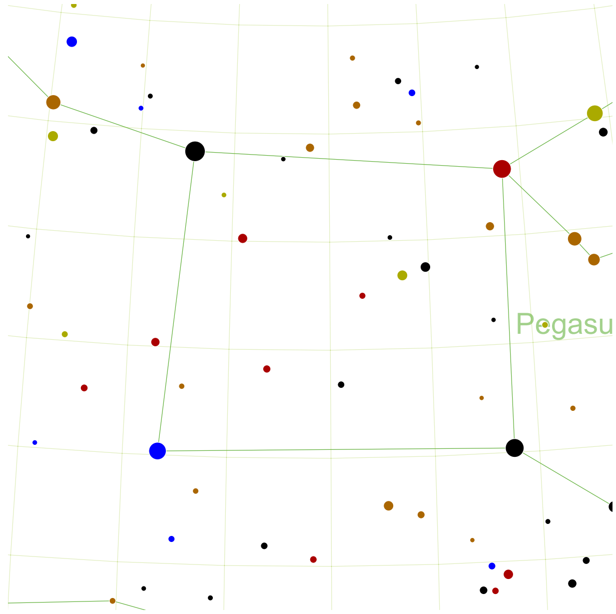


Bortle 3 (limiting magnitude 7.0)

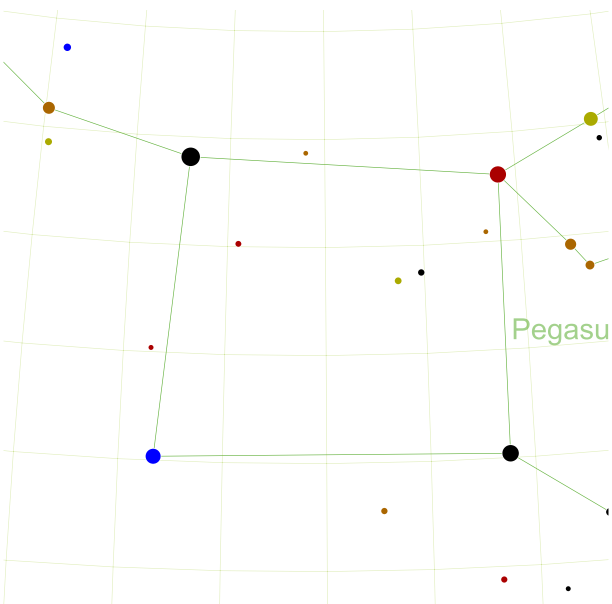
Bortle Scale (Pegasus)



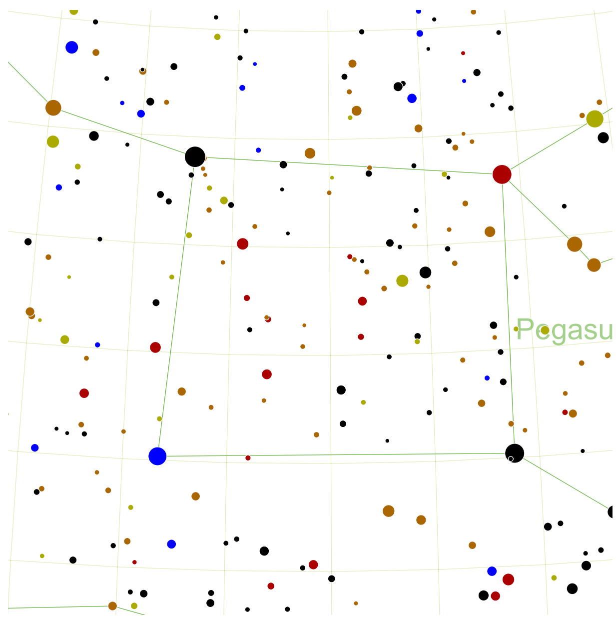
Bortle 9 (limiting magnitude 4.0)



Bortle 5 (limiting magnitude 6.0)

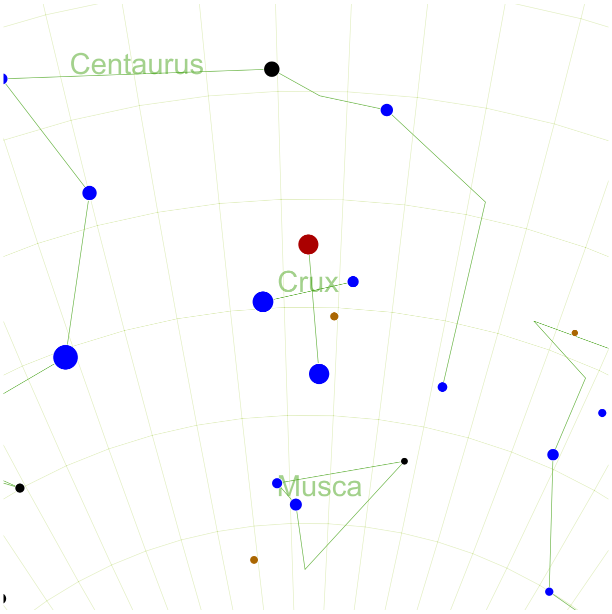


Bortle 7 (limiting magnitude 5.0)

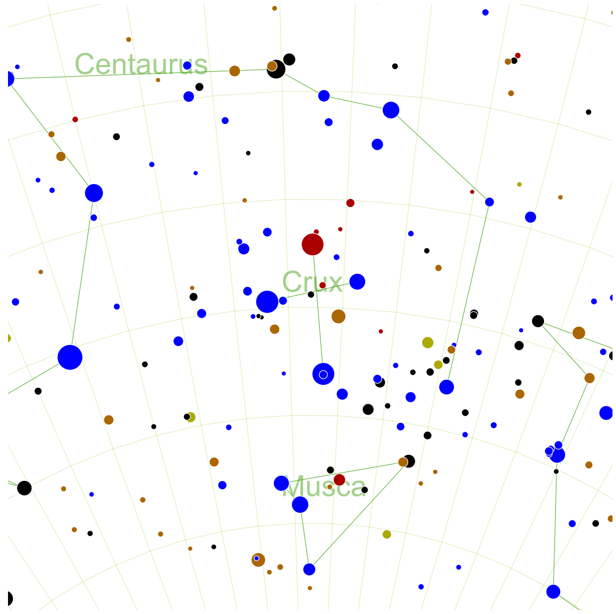


Bortle 3 (limiting magnitude 7.0)

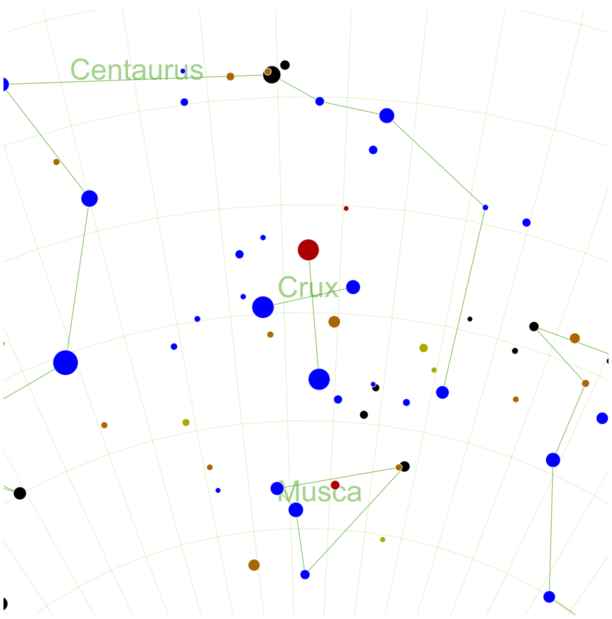
Bortle Scale (Crux)



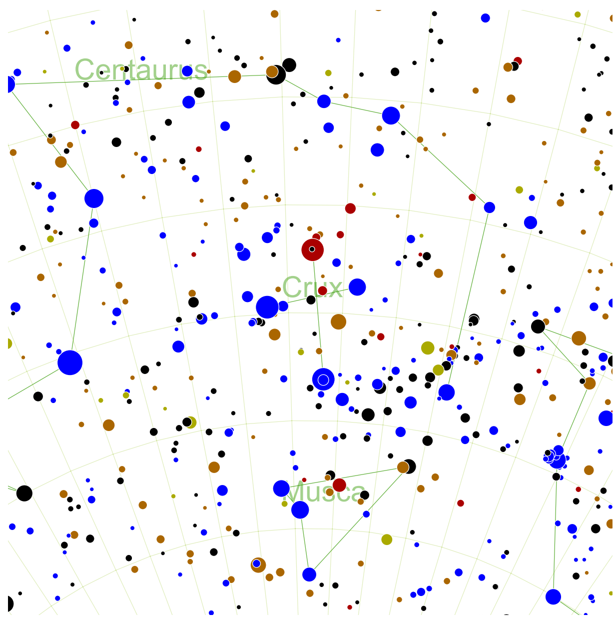
Bortle 9 (limiting magnitude 4.0)



Bortle 5 (limiting magnitude 6.0)

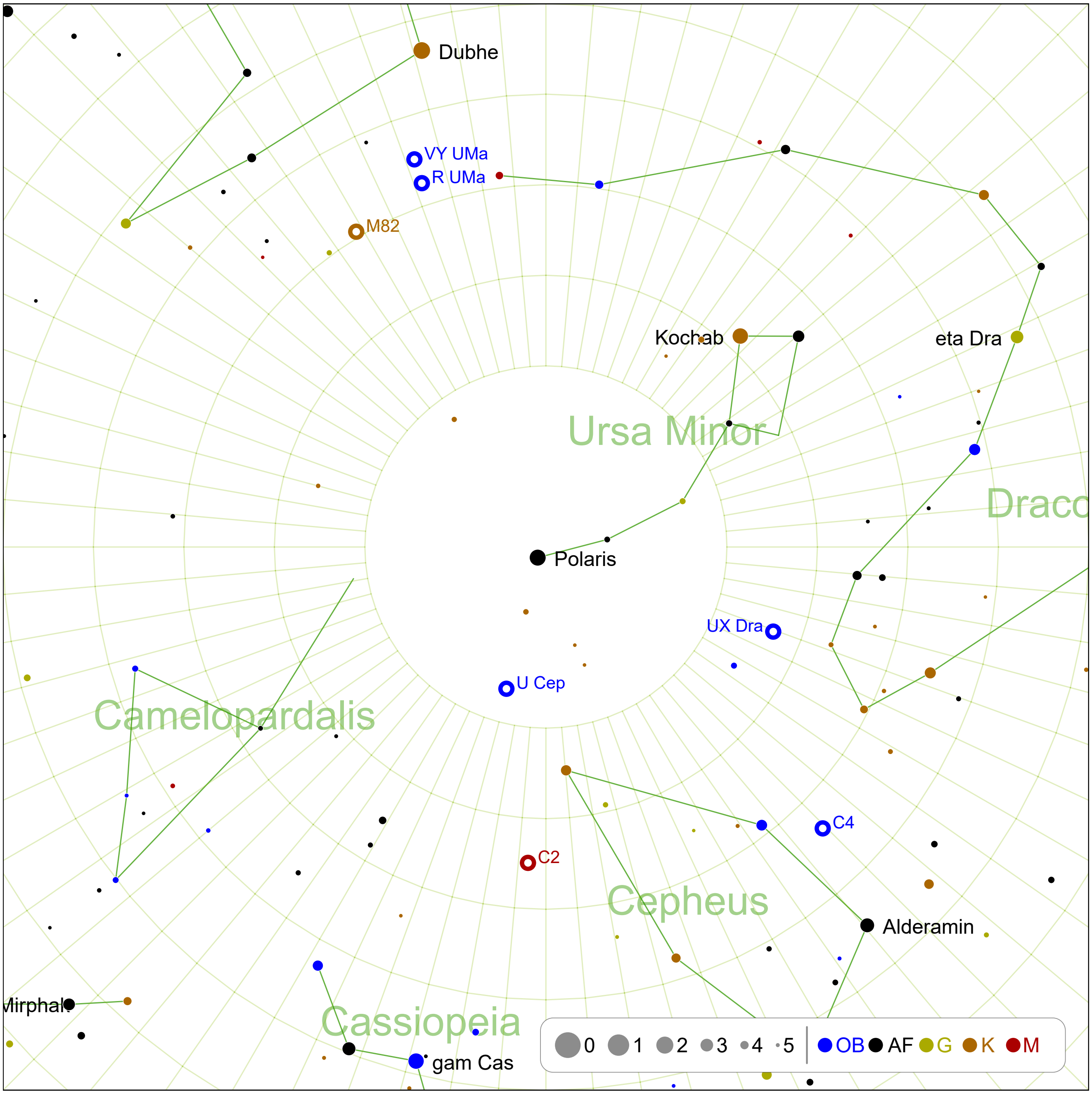


Bortle 7 (limiting magnitude 5.0)



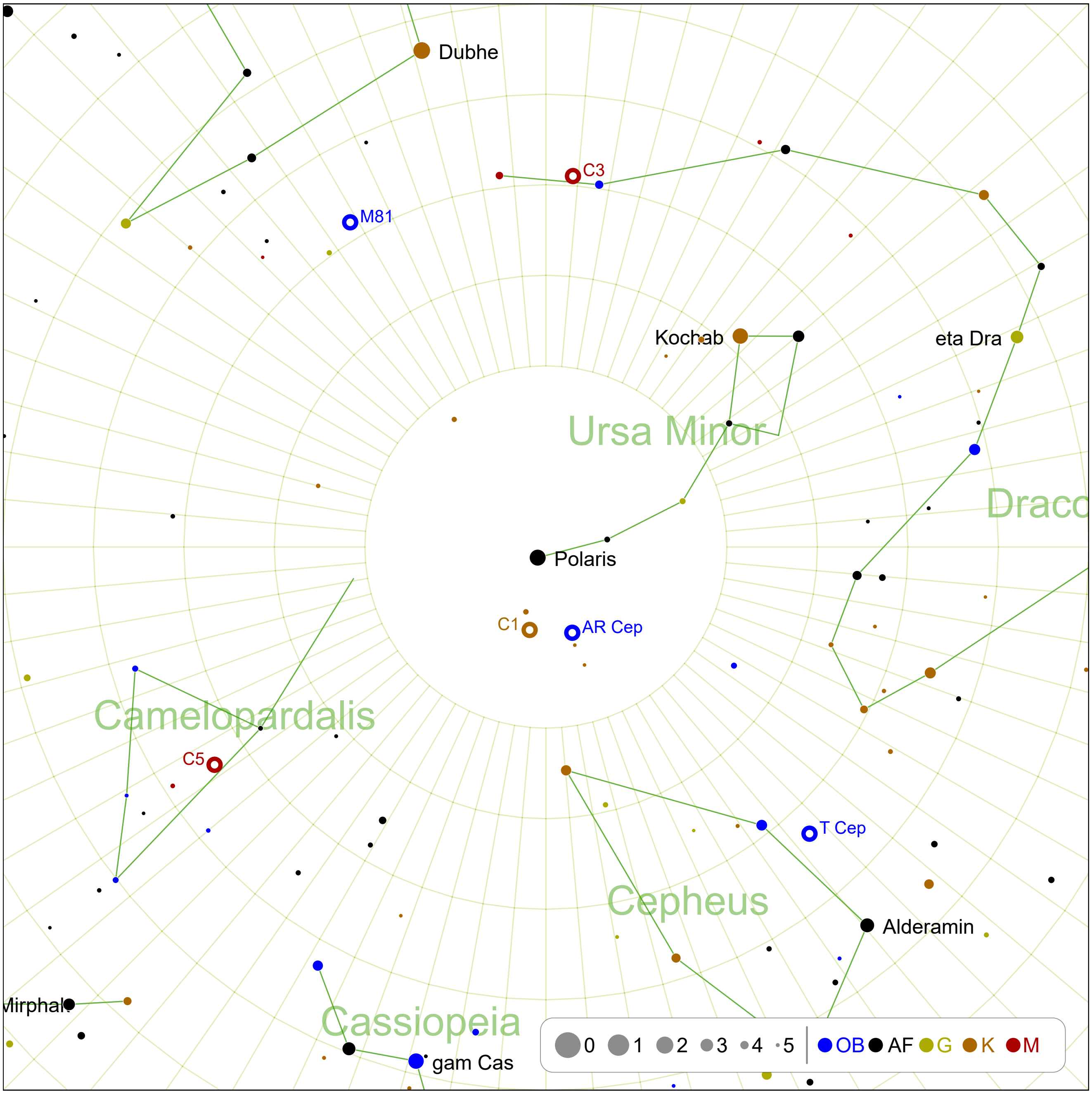
Bortle 3 (limiting magnitude 7.0)

Northern Circumpolar Sky (1)



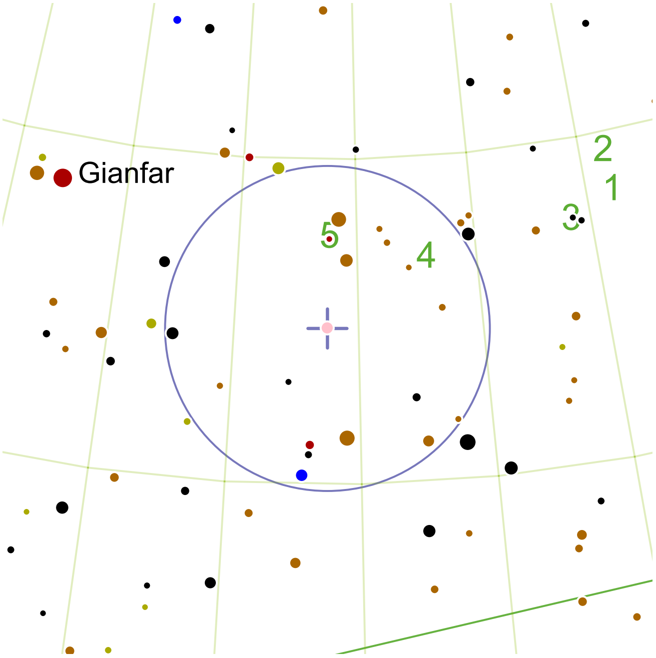
VY UMa: page 49 R UMa: page 49 M82: page 50 UX Dra: page 50
U Cep: page 51 C4: page 51 C2: page 52

Northern Circumpolar Sky (2)



C3: page 52 M81: page 53 C1: page 53 AR Cep: page 54

C5: page 54 T Cep: page 55



VY UMa

RA: 161.25° | 10h 45.0' — DEC: 67.4° | 67° 24'

VY UMa (HD 92839) is a magnitude 6.0 carbon star. Magnitude ranges from 6.6 to 6.0 (Δ mag. 0.6).

Travel from Merak to Dubhe in Ursa Major, then head toward Polaris for an equal distance.

VY UMa has less range in brightness than many carbon stars. Its B-V color index is a very red 2.4. The B-V color index is the difference in magnitude of the star measured in blue (B) light and yellow-green light (V).

Also visible:

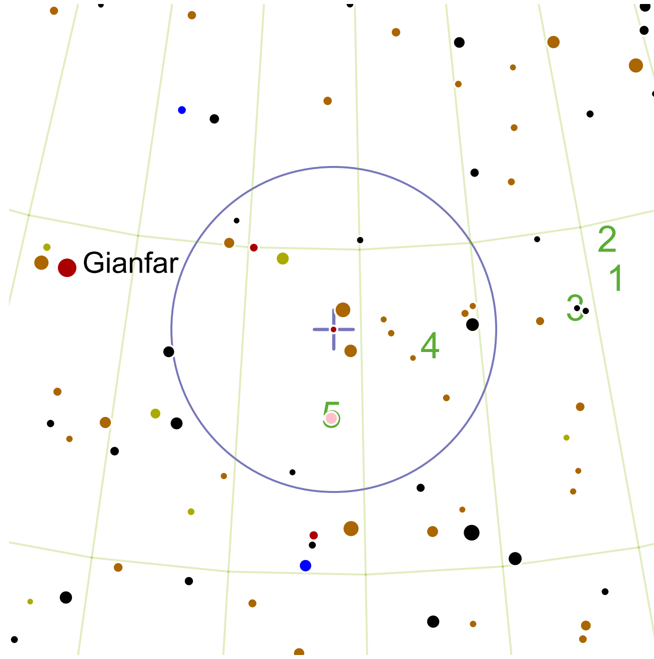
(1) M81 *(6.9$_m$ spiral galaxy)*

(2) M82 *(8.4$_m$ irregular galaxy)*

(3) NGC 3077 *(10.61$_m$ irregular galaxy)*

(4) IC 2574 *(10.8$_m$ Magellanic barred spiral galaxy)*

(5) R UMa *(6.5$_m$ variable star)*



R UMa

RA: 161.16° | 10h 44.64' — DEC: 68.78° | 68° 47'

R UMa (HD 092763) is a magnitude 6.5 variable star. Magnitude ranges from 13.7 to 6.5 (Δ mag. 7.2) with a period of 302d.

Travel from Merak to Dubhe in Ursa Major, then head toward Polaris by an one-and-a-half times the distance.

R UMa is just over a degree north of the carbon star VY UMa.

Also visible:

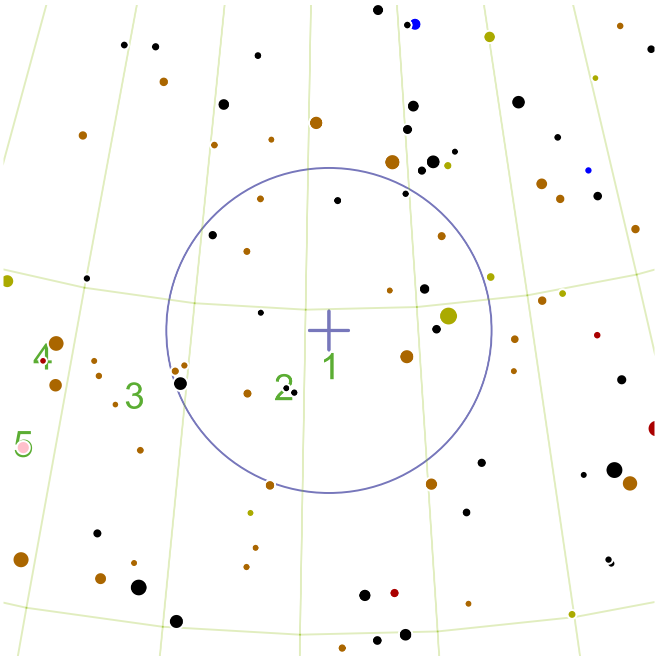
(1) M81 *(6.9$_m$ spiral galaxy)*

(2) M82 *(8.4$_m$ irregular galaxy)*

(3) NGC 3077 *(10.61$_m$ irregular galaxy)*

(4) IC 2574 *(10.8$_m$ Magellanic barred spiral galaxy)*

(5) VY UMa *(6.0$_m$ carbon star)*



M82

RA: 148.95° | 9h 55.79' — DEC: 69.68° | 69° 41'

M82 (Cigar Galaxy, NGC 3034) is a magnitude 8.4 irregular galaxy. Angular size is 9x4'.

Draw a line from Phecda through Dubhe, and extend it an equal length further. This brings you very close to M81 and M82.

This is the nearest large starburst galaxy; its core contains nearly 200 titanic clusters with masses averaging 200,000 solar masses. The many supernovae that occur in this region have ejected huge quantities of hydrogen gas that can be seen as reddish streams in photographs. A 100 mm telescope can reveal the lumpy texture of this galaxy caused by the prominent dark dust clouds.

Also visible:

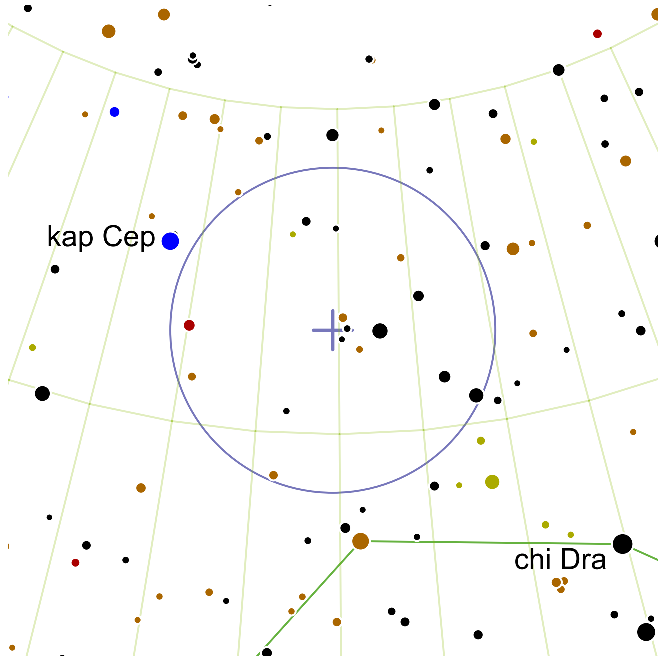
(1) M81 *(6.9$_m$ spiral galaxy)*

(2) NGC 3077 *(10.61$_m$ irregular galaxy)*

(3) IC 2574 *(10.8$_m$ Magellanic barred spiral galaxy)*

(4) R UMa *(6.5$_m$ variable star)*

(5) VY UMa *(6.0$_m$ carbon star)*



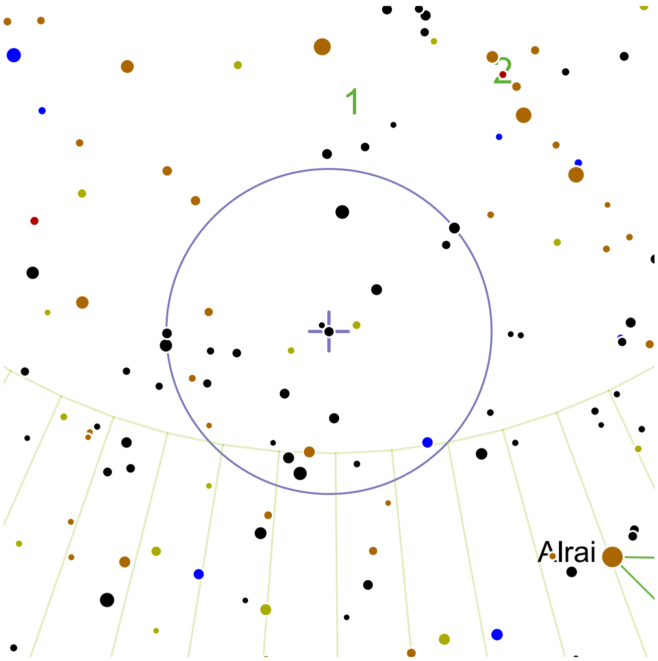
UX Dra

RA: 290.4° | 19h 21.59' — DEC: 76.6° | 76° 36'

UX Dra (HD 183556) is a magnitude 6.2 carbon star. Magnitude ranges from 7.0 to 6.2 (Δ mag. 0.8) with a period of 170d.

5.5° NE from mag.3.69 chi Dra.

UX Dra is a deep red with a B-V color index of 2.68. Its absolute magnitude is around -2.25.



U Cep

RA: 15.58° | 1h 2.3' — DEC: 81.88° | 81° 53'

U Cep (HD 5679) is a magnitude 6.75 variable star. Magnitude ranges from 9.24 to 6.75 (Δ mag. 2.5) with a period of 2.49305d.

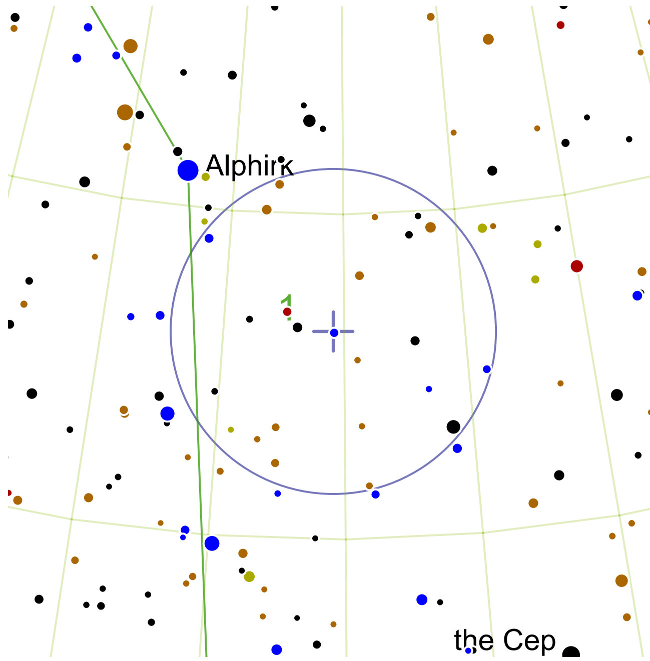
A quarter of the distance from Polaris to Ruchbah in Cassiopeia.

This eclipsing binary system is also a visual double, with a faint companion separated by 14" at position angle 62°.

Also visible:

(1) C1 *(8.1$_m$ open cluster)*

(2) AR Cep *(7.0$_m$ variable star)*



C4

RA: 315.45° | 21h 1.79' — DEC: 68.2° | 68° 12'

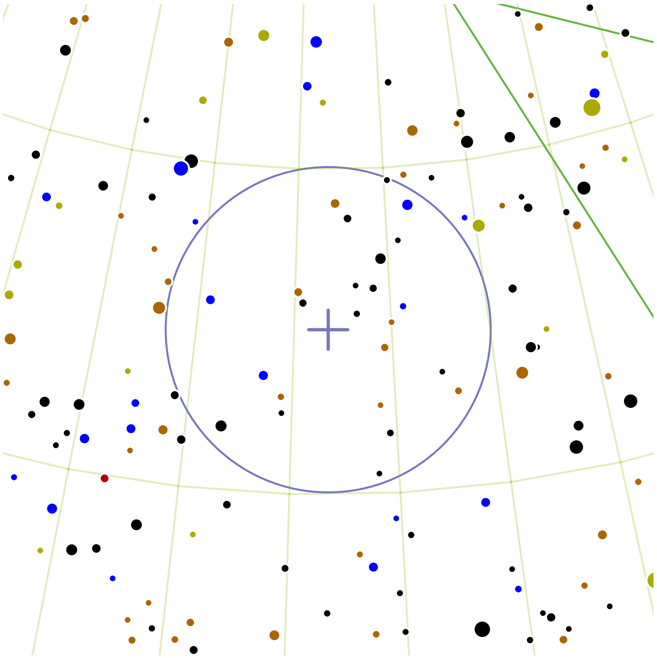
C4 (Iris Nebula, NGC 7023) is a magnitude 6.8 bright nebula. Angular size is 18x18'.

3.3° SW from mag.3.32 Alphirk.

The beautiful Iris Nebula, one of the brighter reflection nebula. Surrounded by dark dust clouds. This nebula shares the same finder circle as the variable T Cep, which lies one degree to the north east.

Also visible:

(1) T Cep *(5.2$_m$ variable star)*



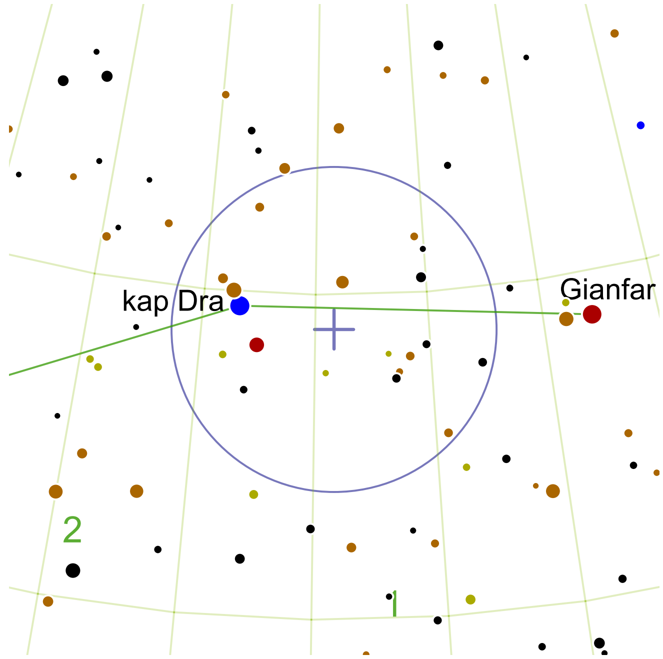
C2

RA: 3.25° | 0h 13.0' — DEC: 72.53° | 72° 32'

C2 (Bow Tie Nebula, NGC 40) is a magnitude 11.6 planetary nebula. Angular size is 0.6'.

Slightly over halfway from Polaris to Caph.

A relatively faint planetary nebula. The central white dwarf has a surface temperature of approximately 50,000°C.



C3

RA: 184.18° | 12h 16.7' — DEC: 69.47° | 69° 28'

C3 (NGC 4236) is a magnitude 9.7 barred spiral galaxy. Angular size is 22x7'.

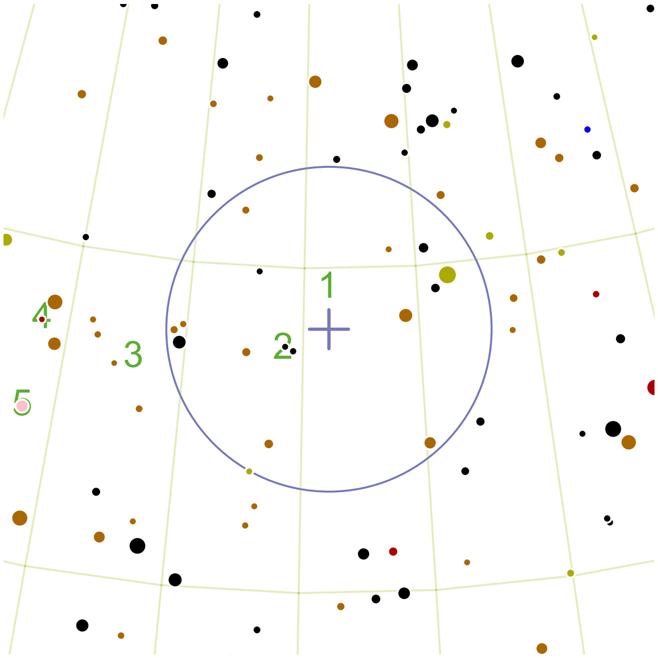
Just less than halfway from Dubhe to Kochab.

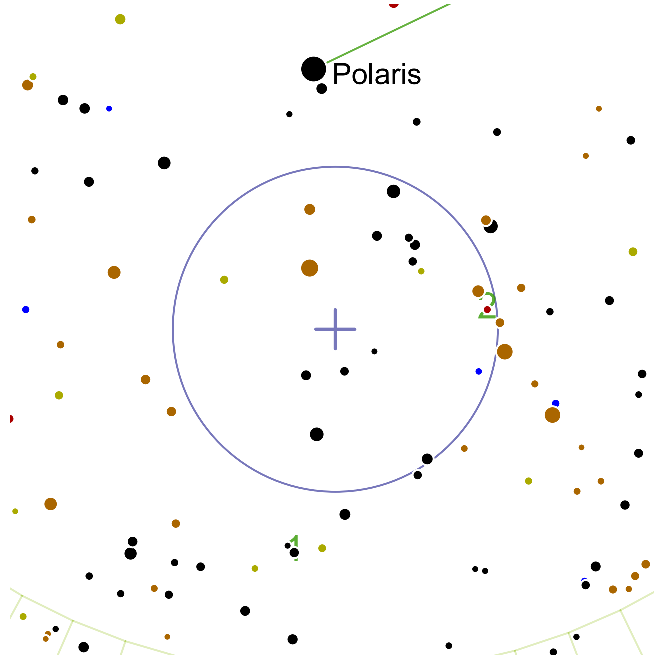
A faint, obliquely oriented barred spiral galaxy. This galaxy is a neglected member of the M81 Group.

Also visible:

(1) NGC 4125 *(10.65$_m$ elliptical galaxy)*

(2) RY Dra *(6.0$_m$ carbon star)*





M81

RA: 148.9° | 9h 55.6' — DEC: 69.07° | 69° 4'

M81 (Bode's Galaxy, NGC 3031) is a magnitude 6.9 spiral galaxy. Angular size is 21x10'.

Draw a line from Phecda through Dubhe, and extend it an equal length further. This brings you very close to M81 and M82.

This iconic spiral galaxy forms a delightful pair at lower magnifications with the nearby M82. The core contains a supermassive black hole with 70 million solar masses. M81 is the largest galaxy of the eponymous M81 Group, and at 11.7 million light years is one of the nearest large galaxies.

Also visible:

(1) M82 *(8.4_m irregular galaxy)*

(2) NGC 3077 *(10.61_m irregular galaxy)*

(3) IC 2574 *(10.8_m Magellanic barred spiral galaxy)*

(4) R UMa *(6.5_m variable star)*

(5) VY UMa *(6.0_m carbon star)*

C1

RA: 11.1° | 0h 44.4' — DEC: 85.33° | 85° 20'

C1 (Polarissima Cluster, NGC 188) is a magnitude 8.1 open cluster. Angular size is 15'.

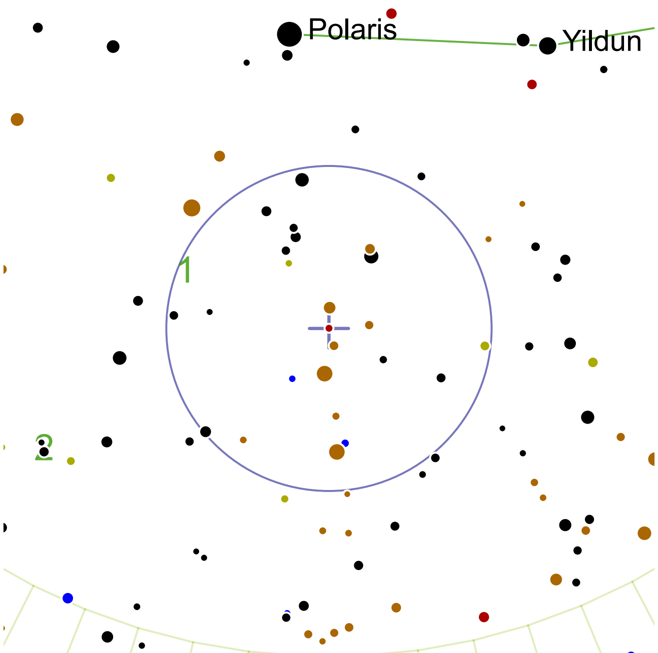
Five degrees from Polaris, in the direction of the W of Cassiopeia.

A sparse, loose grouping of middle-aged stars. With an age of nearly 7 billion years, this is an unusually old open cluster. Open clusters normally disperse after only a few hundred million years.

Also visible:

(1) U Cep *(6.75_m variable star)*

(2) AR Cep *(7.0_m variable star)*



AR Cep

RA: 342.89° | 22h 51.56' — DEC: 85.05° | 85° 3'

AR Cep (HD 217158) is a magnitude 7.0 variable star. Magnitude ranges from 7.9 to 7.0 (Δ mag. 0.9).

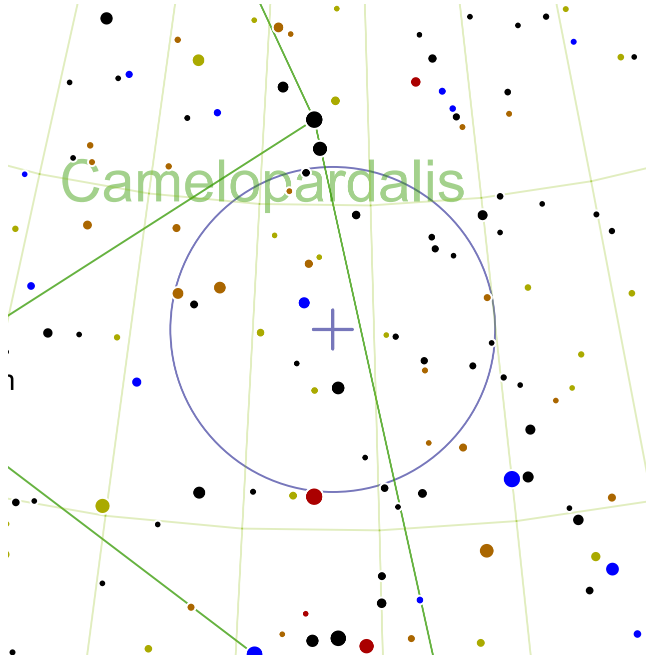
Travel from Kochab to Polaris, then turn left and travel a short distance roughly equal to the distance from Kochab to Pherkad.

An orange-yellow variable in a busy field with many points of reference for its narrow 1-magnitude range. The small Polarissima Cluster (Caldwell 1) is on the northeastern edge of the finder circle.

Also visible:

(1) C1 *(8.1$_m$ open cluster)*

(2) U Cep *(6.75$_m$ variable star)*



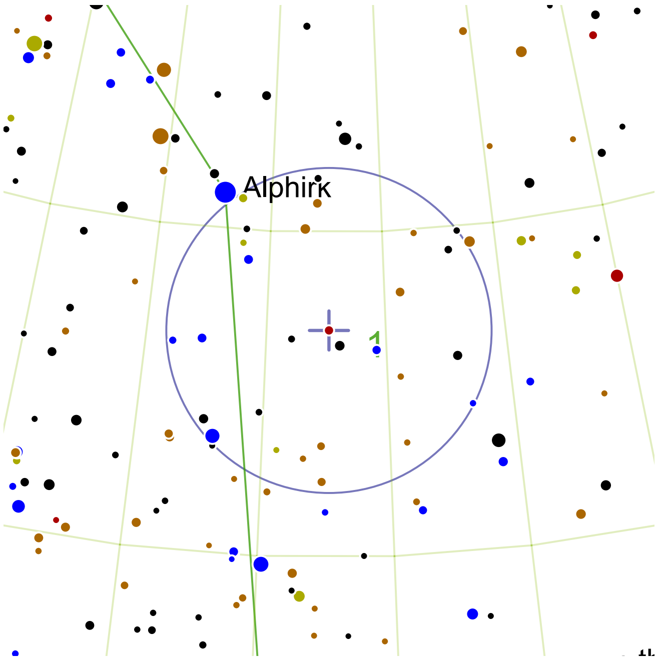
C5

RA: 56.7° | 3h 46.8' — DEC: 68.1° | 68° 6'

C5 (Maffei 1 Group, IC342) is a magnitude 9.2 spiral galaxy. Angular size is 21x21'.

Draw a line from Shedar to Segin in Cassiopeia, then double its length.

A bright face-on spiral galaxy easily lost in a busy star field. This large and bright spiral was initially thought to be part of our Local Group of galaxies, but now assigned to the neighboring Maffei Group.



T Cep

RA: 317.38° | 21h 9.52' — DEC: 68.49° | 68° 29'

T Cep (HD 202012) is a magnitude 5.2 variable star. Magnitude ranges from 11.3 to 5.2 (Δ mag. 6.1) with a period of 388d.

2.6° SW from mag.3.32 Alphirk.

T Cep can appear somewhat yellow-orange at its peak brightness.

Also visible:

(1) C4 *(6.8$_m$ bright nebula)*

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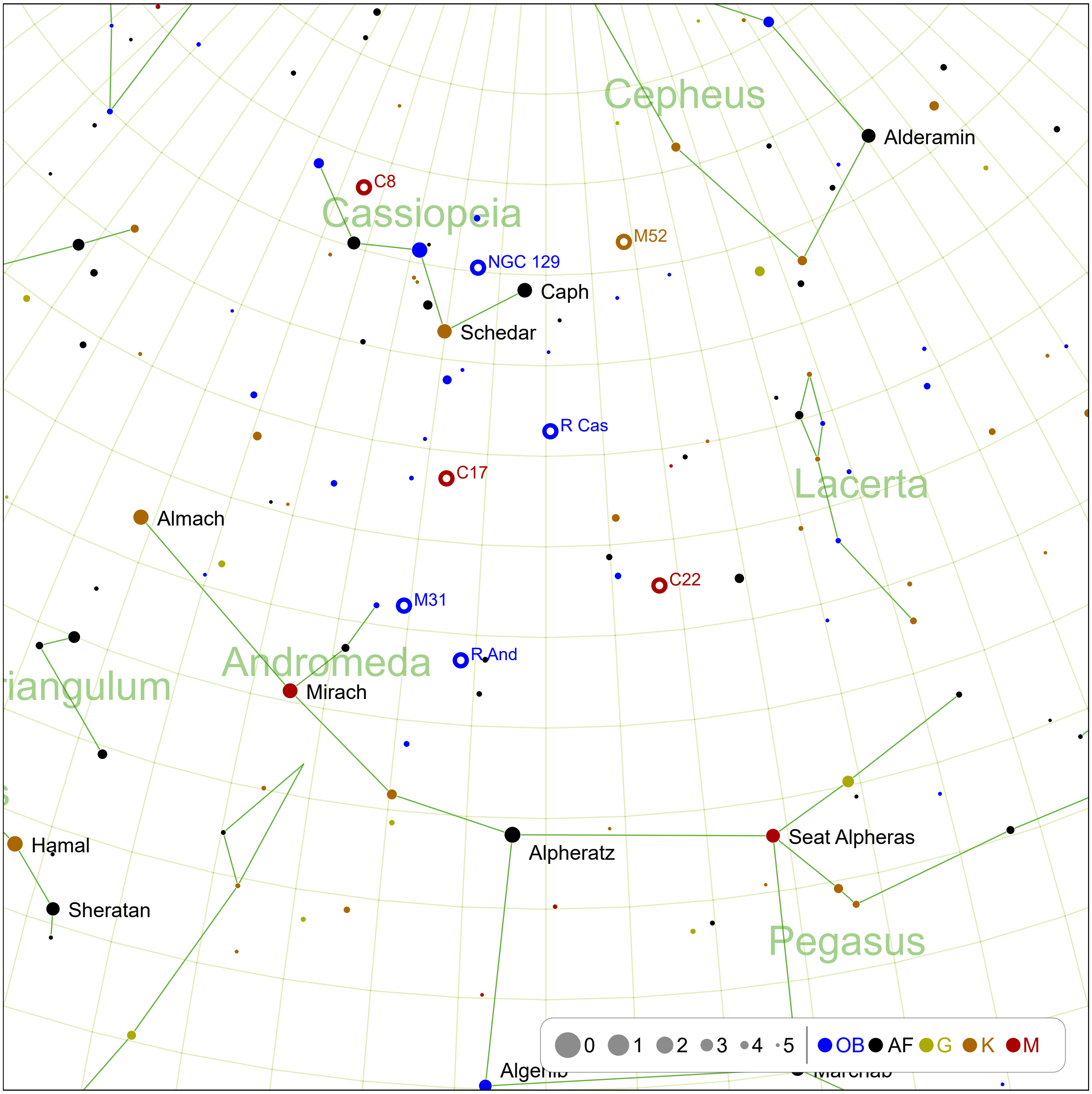
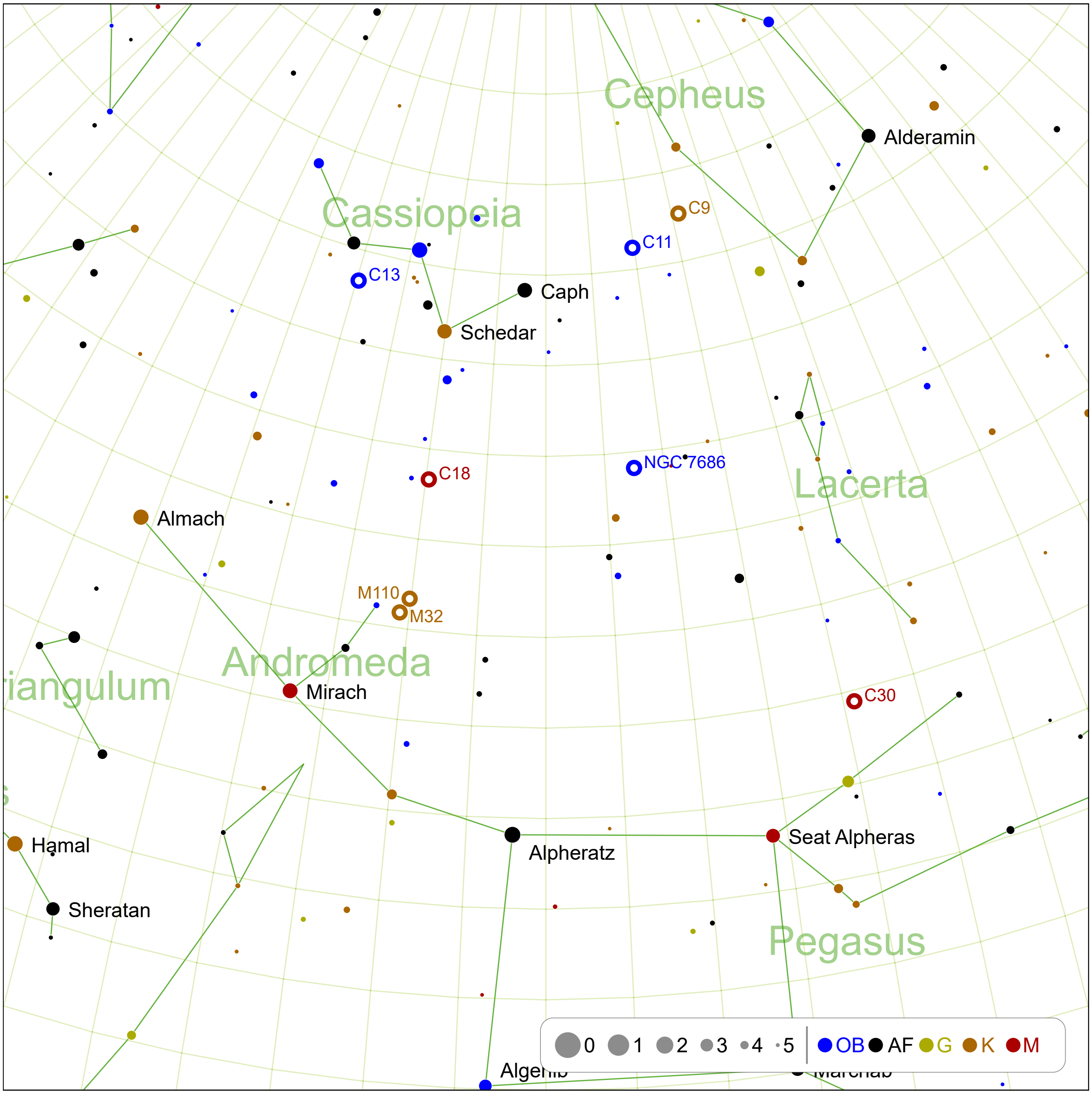
October: 45° North (1)

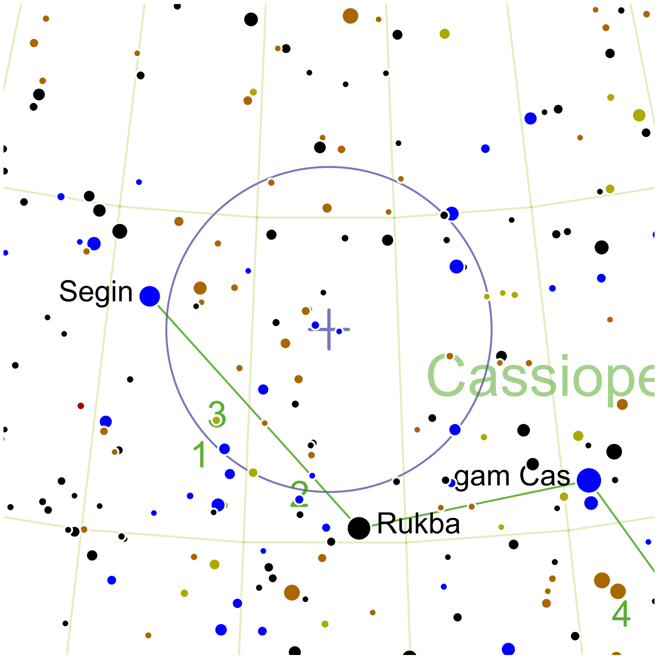


C8: page 59	M52: page 59	NGC 129: page 60	R Cas: page 60
C17: page 61	C22: page 61	M31: page 62	R And: page 62

October: 45° North (2)



C9: page 63	C11: page 63	C13: page 64	NGC 7686: page 64
C18: page 65	M110: page 65	M32: page 66	C30: page 66



C8

RA: 22.38° | 1h 29.5' — DEC: 63.3° | 63° 18'

C8 (NGC 559) is a magnitude 9.5 open cluster. Angular size is 7'.

2.8° W from mag.3.44 Segin.

A small and faint open cluster.

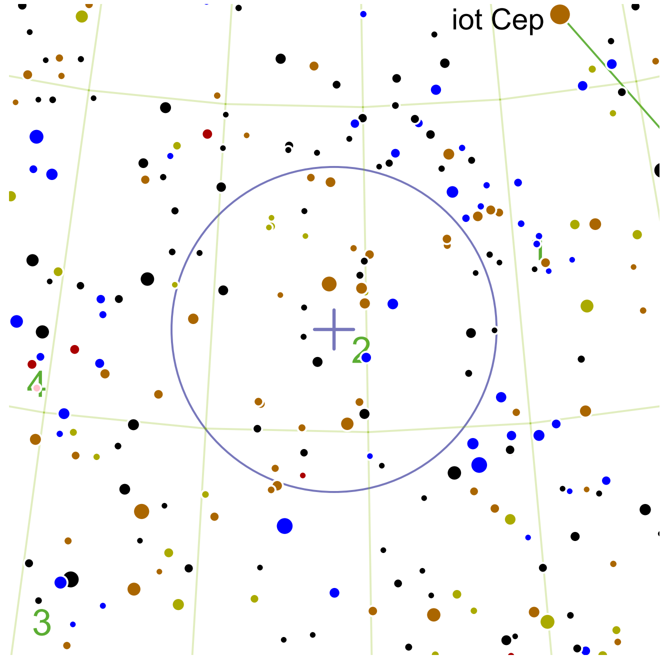
Also visible:

(1) C10 *(7.1$_m$ open cluster)*

(2) M103 *(7.4$_m$ open cluster)*

(3) NGC 654 *(6.5$_m$ open cluster)*

(4) W Cas *(7.8$_m$ variable star)*



M52

RA: 351.05° | 23h 24.2' — DEC: 61.58° | 61° 35'

M52 (NGC 7654) is a magnitude 7.3 open cluster. Angular size is 13'.

Draw a line from Shedar is Cassiopeia to Caph, and extend it an equal length.

A large open cluster (1,200 solar masses), M52 is 4,600 light-years from Earth. The southern half of this cluster is partially obscured by dust.

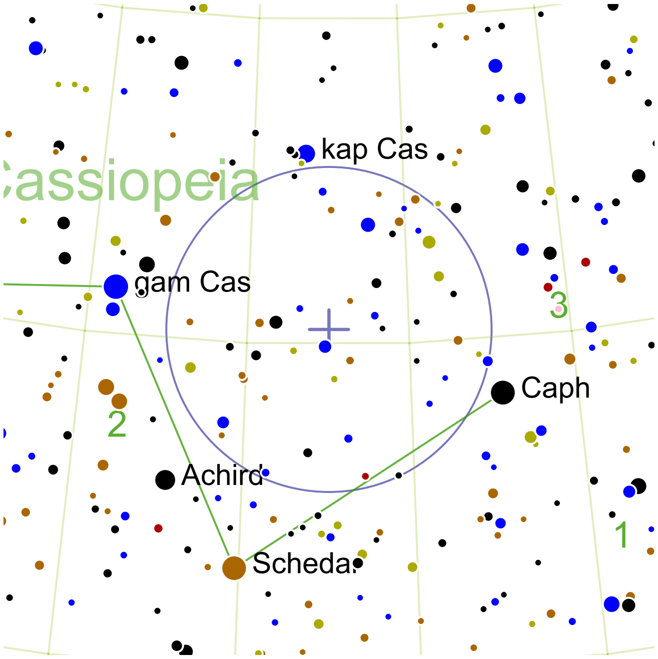
Also visible:

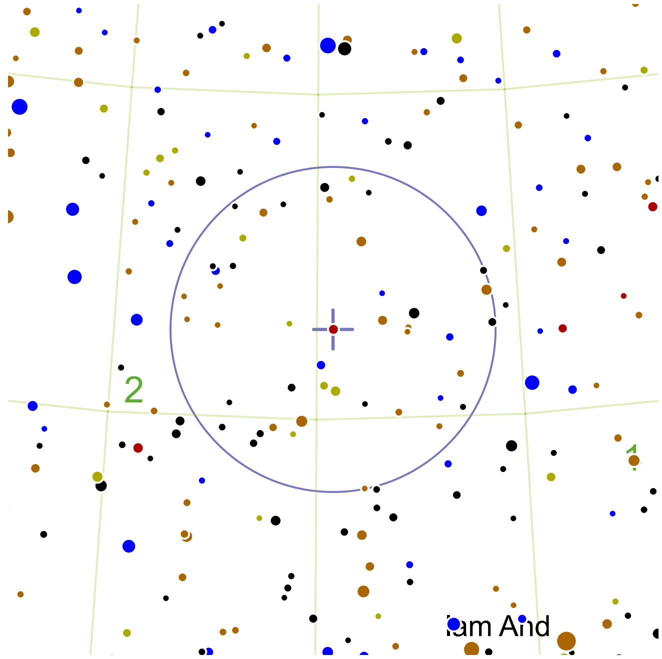
(1) C9 *(7.7$_m$ bright nebula)*

(2) C11 *(7.0$_m$ bright nebula)*

(3) NGC 7789 *(6.7$_m$ open cluster)*

(4) WZ Cas *(6.3$_m$ variable star)*





NGC 129

RA: 7.48° | 0h 29.9' — DEC: 60.23° | 60° 14'

NGC 129 is a magnitude 6.5 open cluster. Angular size is 21'.

Midway between Caph and Navi.

A large, scattered open cluster, its age is estimated at 76 million years.

Also visible:

(1) NGC 7789 *(6.7_m open cluster)*

(2) W Cas *(7.8_m variable star)*

(3) WZ Cas *(6.3_m variable star)*

R Cas

RA: 359.6° | 23h 58.41' — DEC: 51.39° | 51° 23'

R Cas (HD 224490) is a magnitude 4.7 variable star. Magnitude ranges from 13.5 to 4.7 (Δ mag. 8.8) with a period of 430d.

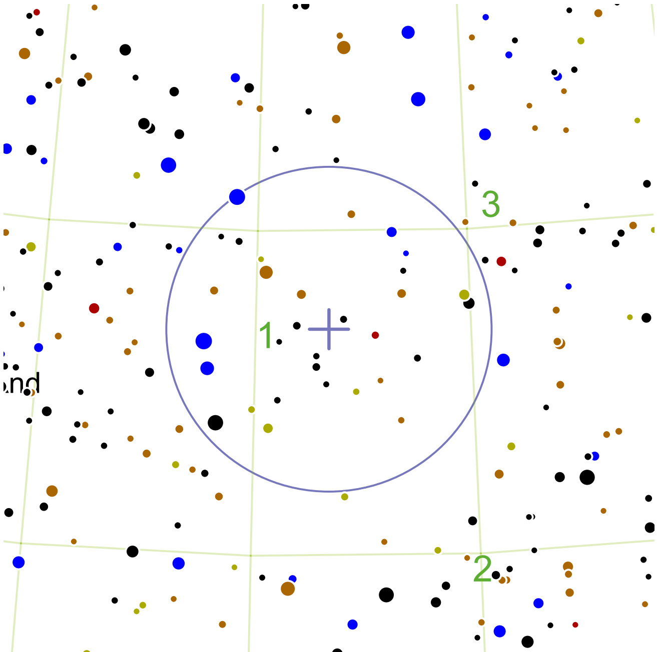
Forms the pointy end of long isosceles triangle with Caph and Shedar, twice as long as it is wide.

This light red star is about 610 light-years from Earth. R Cas has an exceedingly faint companion (magnitude 13.2) separated by 22", position angle 266°.

Also visible:

(1) NGC 7686 *(5.6_m open cluster)*

(2) ST Cas *(9.0_m carbon star)*



C17

RA: 8.3° | 0h 33.2' — DEC: 48.5° | 48° 30'

C17 (NGC 147) is a magnitude 9.3 elliptical galaxy. Angular size is 13x8'.

5.4° S from mag.3.72 zet Cas.

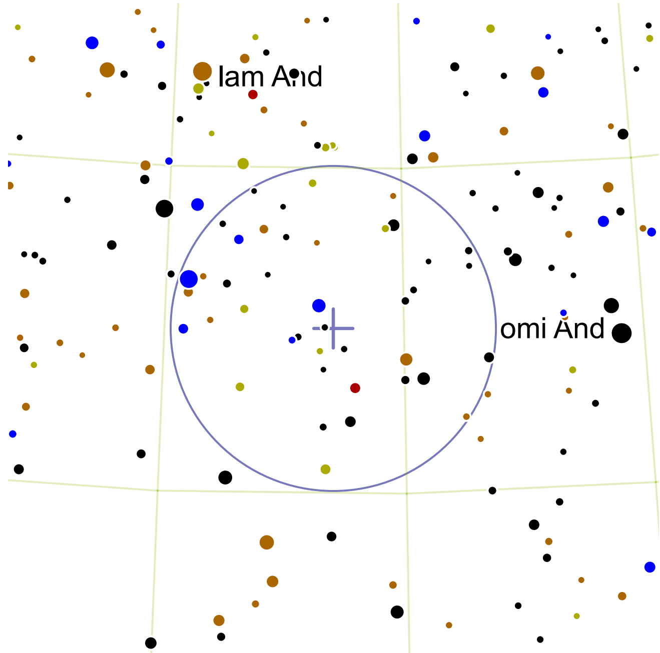
A diffuse and therefore difficult target, C17 is a satellite galaxy of M31 (the Andromeda Galaxy). As such C17 is a member of the Local Group of which the Milky way is a member. C17 seems to have ceased forming new stars three billion years ago.

Also visible:

(1) C18 *(9.2$_m$ elliptical galaxy)*

(2) VX And *(8.0$_m$ carbon star)*

(3) ST Cas *(9.0$_m$ carbon star)*



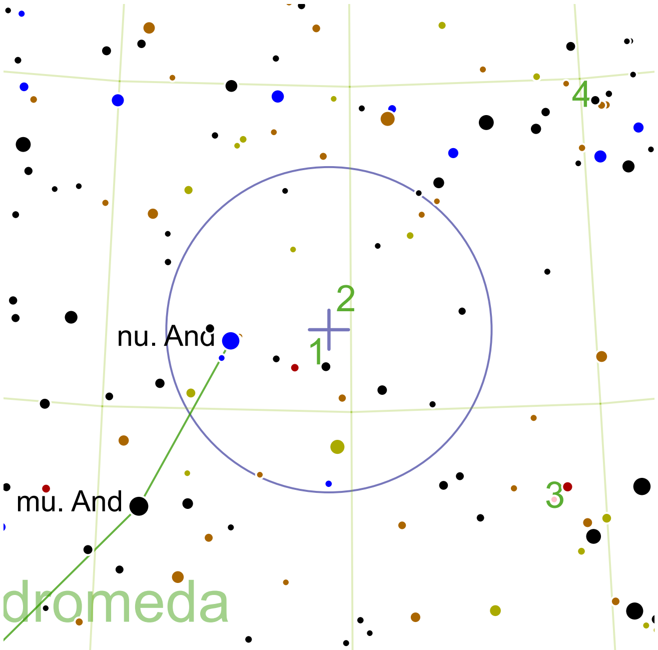
C22

RA: 351.48° | 23h 25.9' — DEC: 42.55° | 42° 33'

C22 (Blue Snowball, NGC 7662) is a magnitude 9.2 planetary nebula. Angular size is 0.6'.

Forms a rough equilateral triangle with Alpheratz and Scheat (the northern two stars of the Square of Pegasus).

This planetary nebula is 2,500 light-years from Earth.



M31

RA: 10.45° | 0h 41.8' — DEC: 41.27° | 41° 16'

M31 (Andromeda Galaxy, NGC 224) is a magnitude 3.4 spiral galaxy. Angular size is 178x63'.

The deepest V in the W of Cassiopeia (formed by Navi, Shedar and Caph) points to M31. Also, Almach, Mirach and M31 form a right-angle triangle.

The most fabulous galaxy in the northern hemisphere, M31 is our nearest grand spiral galaxy, and the largest member of our Local Group of galaxies. The Milky Way is on course to collide with it in billions of years time. Given the huge extent of the galaxy (six Moons wide), the galaxy is best appreciated in dark skies with a small wide-field telescope or binoculars.

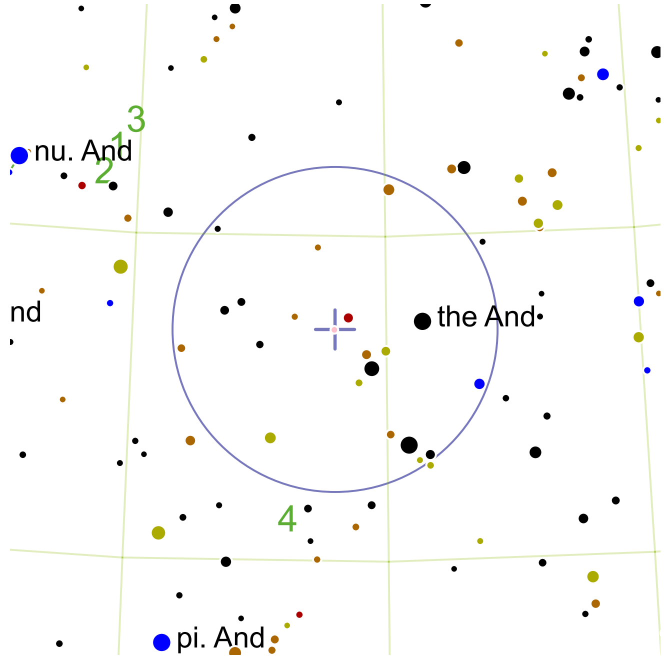
Also visible:

(1) M32 *(8.1$_m$ elliptical galaxy)*

(2) M110 *(8.5$_m$ elliptical galaxy)*

(3) R And *(5.8$_m$ variable star)*

(4) VX And *(8.0$_m$ carbon star)*



R And

RA: 6.01° | 0h 24.03' — DEC: 38.58° | 38° 35'

R And (HD 1967) is a magnitude 5.8 variable star. Magnitude ranges from 14.9 to 5.8 (Δ mag. 9.1) with a period of 409d.

6.3° W from mag.3.94 mu. And.

This red star is 790 light-years from Earth. R And is also a double star with a faint magnitude 12.37 companion separated by 83.5", position angle 142°.

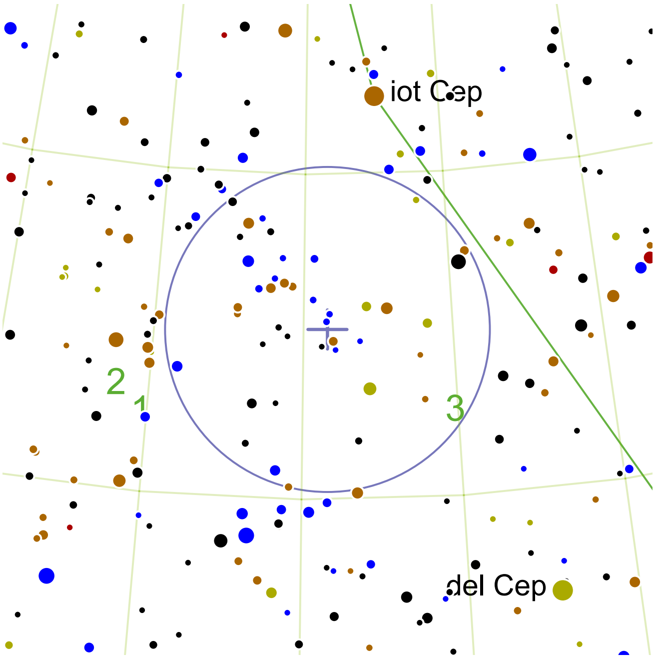
Also visible:

(1) M31 *(3.4$_m$ spiral galaxy)*

(2) M32 *(8.1$_m$ elliptical galaxy)*

(3) M110 *(8.5$_m$ elliptical galaxy)*

(4) AQ And *(6.9$_m$ carbon star)*



C9

RA: 344.2° | 22h 56.79' — DEC: 62.62° | 62° 37'

C9 (Cave Nebula, Sh2-155) is a magnitude 7.7 bright nebula. Angular size is 50x30'.

Draw a line from Shedar (Alpha Cas) to to Caph (Beta Cas) and extend it twice the distance.

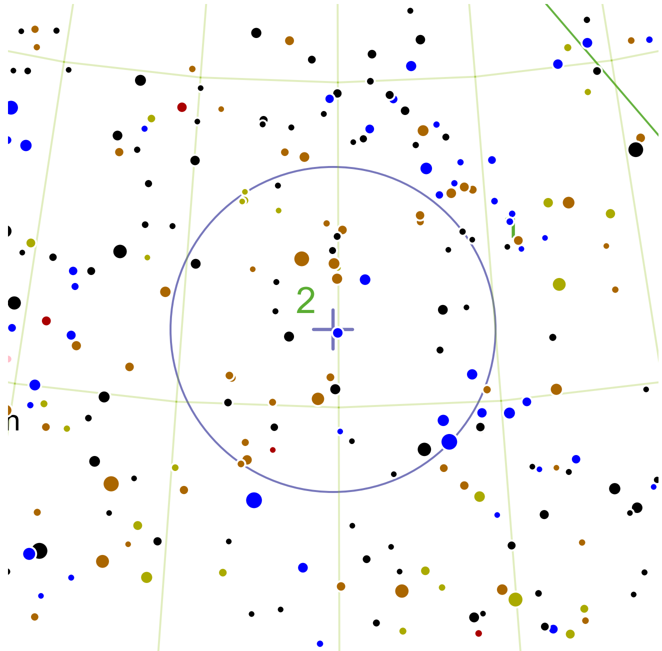
A very faint emission nebula, the Cave Nebula is one of the most difficult Caldwell objects to spot visually. The Cave Nebula appears to be in the very earliest stages of collapsing to form a star cluster.

Also visible:

(1) C11 *(7.0_m bright nebula)*

(2) M52 *(7.3_m open cluster)*

(3) NGC 7354 *(12.5_m planetary nebula)*



C11

RA: 350.18° | 23h 20.7' — DEC: 61.2° | 61° 12'

C11 (Bubble Nebula, NGC 7635) is a magnitude 7.0 bright nebula. Angular size is 15x8'.

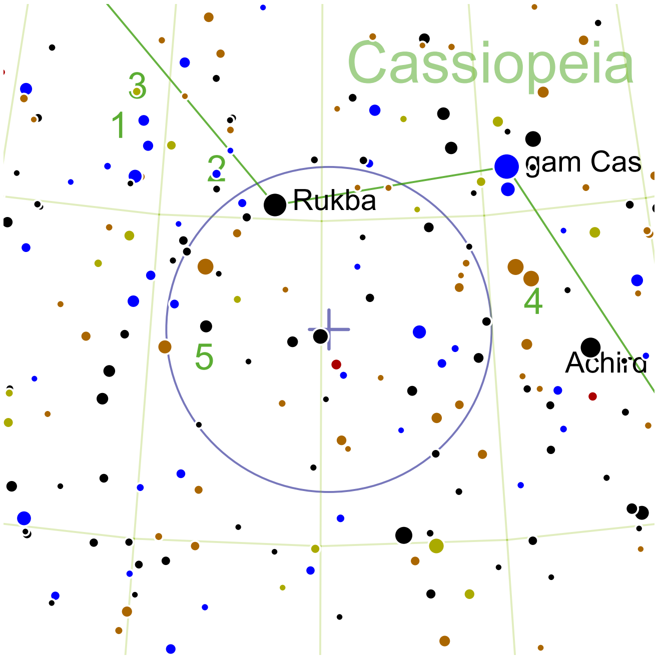
6.0° SE from mag.3.68 iot Cep.

A diffuse but fascinating emission nebula, best known as the Bubble Nebula. This delicate nebula is formed by the radiation of a hot, massive star (15 solar masses) clearing its immediate neighborhood of hydrogen gas by the force of its radiation pressure. The bubble is about 6 light-years in diameter.

Also visible:

(1) C9 *(7.7_m bright nebula)*

(2) M52 *(7.3_m open cluster)*



C13

RA: 19.77° | 1h 19.09' — DEC: 58.33° | 58° 20'

C13 (Owl Cluster, NGC 457) is a magnitude 6.4 open cluster. Angular size is 13'.

2.0° SSW from mag.2.8 Rukba.

A bright grouping known as the Owl Cluster. The two bright stars forming the eyes of the owl are not members of the cluster.

Also visible:

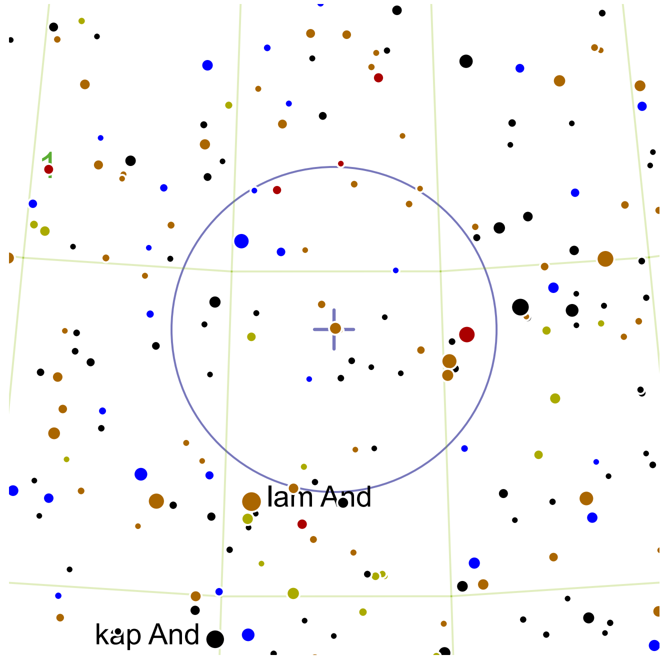
(1) C10 *(7.1$_m$ open cluster)*

(2) M103 *(7.4$_m$ open cluster)*

(3) NGC 654 *(6.5$_m$ open cluster)*

(4) W Cas *(7.8$_m$ variable star)*

(5) WW Cas *(9.1$_m$ carbon star)*



NGC 7686

RA: 352.55° | 23h 30.2' — DEC: 49.13° | 49° 8'

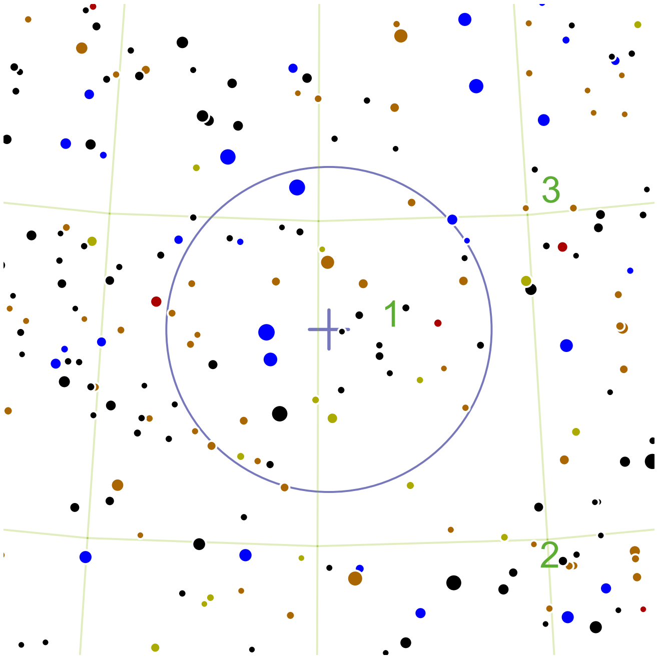
NGC 7686 is a magnitude 5.6 open cluster. Angular size is 15'.

Forms the pointy end of a long triangle with Caph and Shedar, roughly three times as long it is wide.

This bright cluster of stars is an easy binocular target. H L Johnson argued in 1961 that this is not an open cluster as the stars did not appear to share a common age.

Also visible:

(1) R Cas *(4.7$_m$ variable star)*



C18

RA: 9.75° | 0h 39.0' — DEC: 48.33° | 48° 20'

C18 (NGC 185) is a magnitude 9.2 elliptical galaxy. Angular size is 12x9'.

5.5° S from mag.3.72 zet Cas.

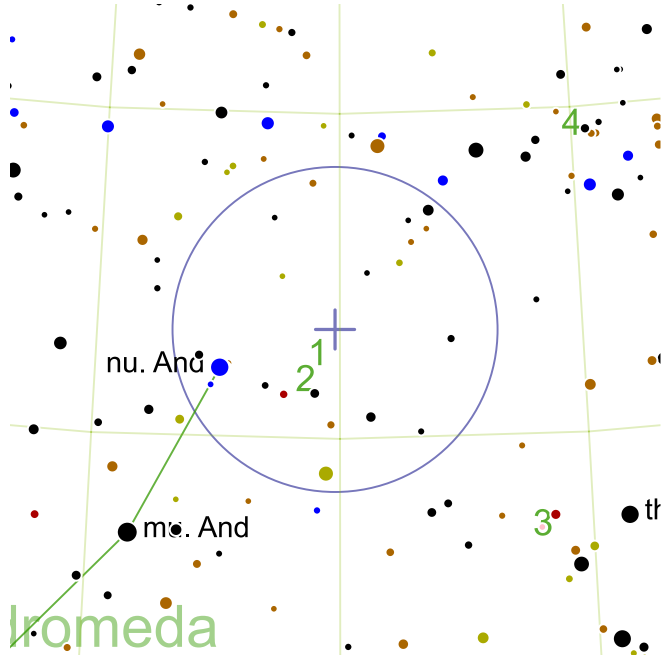
Like nearby C17, this is is a satellite galaxy of M31 (the Andromeda Galaxy). Being both less diffuse and somewhat brighter than C17, C18 is somewhat less difficuly target in light-polluted skies. C18 contains much younger stars than C17 and has an active nucleus; it may be classified as a Seyfert galaxy and would be the closest galaxy of such type to Earth.

Also visible:

(1) C17 *(9.3$_m$ elliptical galaxy)*

(2) VX And *(8.0$_m$ carbon star)*

(3) ST Cas *(9.0$_m$ carbon star)*



M110

RA: 10.1° | 0h 40.4' — DEC: 41.68° | 41° 41'

M110 (NGC 205) is a magnitude 8.5 elliptical galaxy. Angular size is 17x10'.

Once you have found M31, M110 is visible at the same time, slightly to the north west.

M110 is a dwarf elliptical galaxy orbiting M31. The full classification is "pec dE5": peculiar because it has traces of dust and star formation near its center, and "5" because it is 50% flattened. There is no evidence for a supermassive black hole in M110. Fourteen of the satellite galaxies orbiting M31 follow a similar orbit to M110, suggesting they were originally satellites of M110 that were separated by interactions with the far more massive M31.

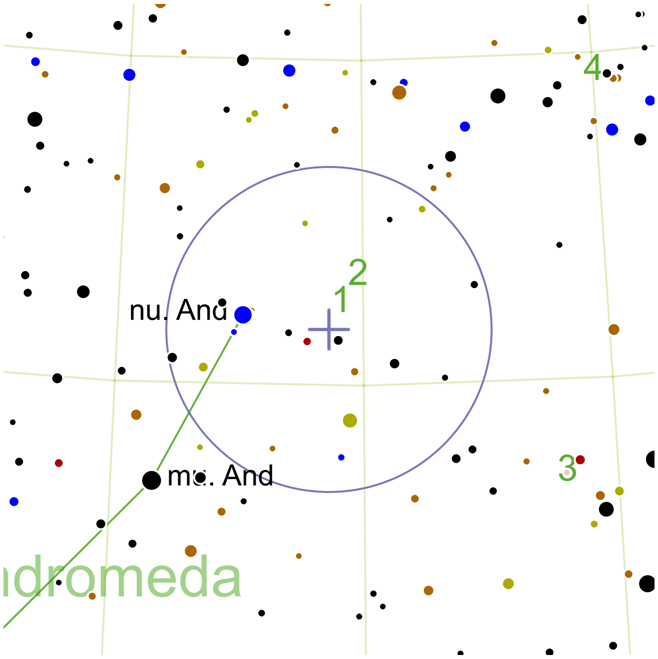
Also visible:

(1) M31 *(3.4$_m$ spiral galaxy)*

(2) M32 *(8.1$_m$ elliptical galaxy)*

(3) R And *(5.8$_m$ variable star)*

(4) VX And *(8.0$_m$ carbon star)*



M32

RA: 10.7° | 0h 42.8' — DEC: 40.87° | 40° 52'

M32 (NGC 221) is a magnitude 8.1 elliptical galaxy. Angular size is 8x6'.

Once you have found M31, M32 is visible at the same time, slightly to the south.

M32 is a compact elliptical (cE) galaxy orbiting M31. This kind of very dense and featureless dwarf galaxy is widely believed to form as a remnant of a larger galaxy that has had it outer parts stripped away. Possibly gas from the outer regions was forced into the core, resulting in a burst of star formation that helps to explain the high density of stars in the inner regions of a cE galaxy.

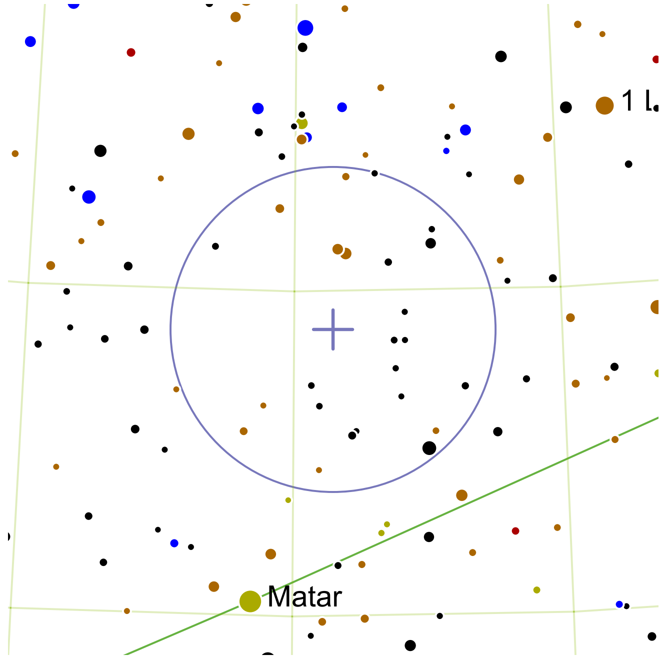
Also visible:

(1) M31 *(3.4$_m$ spiral galaxy)*

(2) M110 *(8.5$_m$ elliptical galaxy)*

(3) R And *(5.8$_m$ variable star)*

(4) VX And *(8.0$_m$ carbon star)*



C30

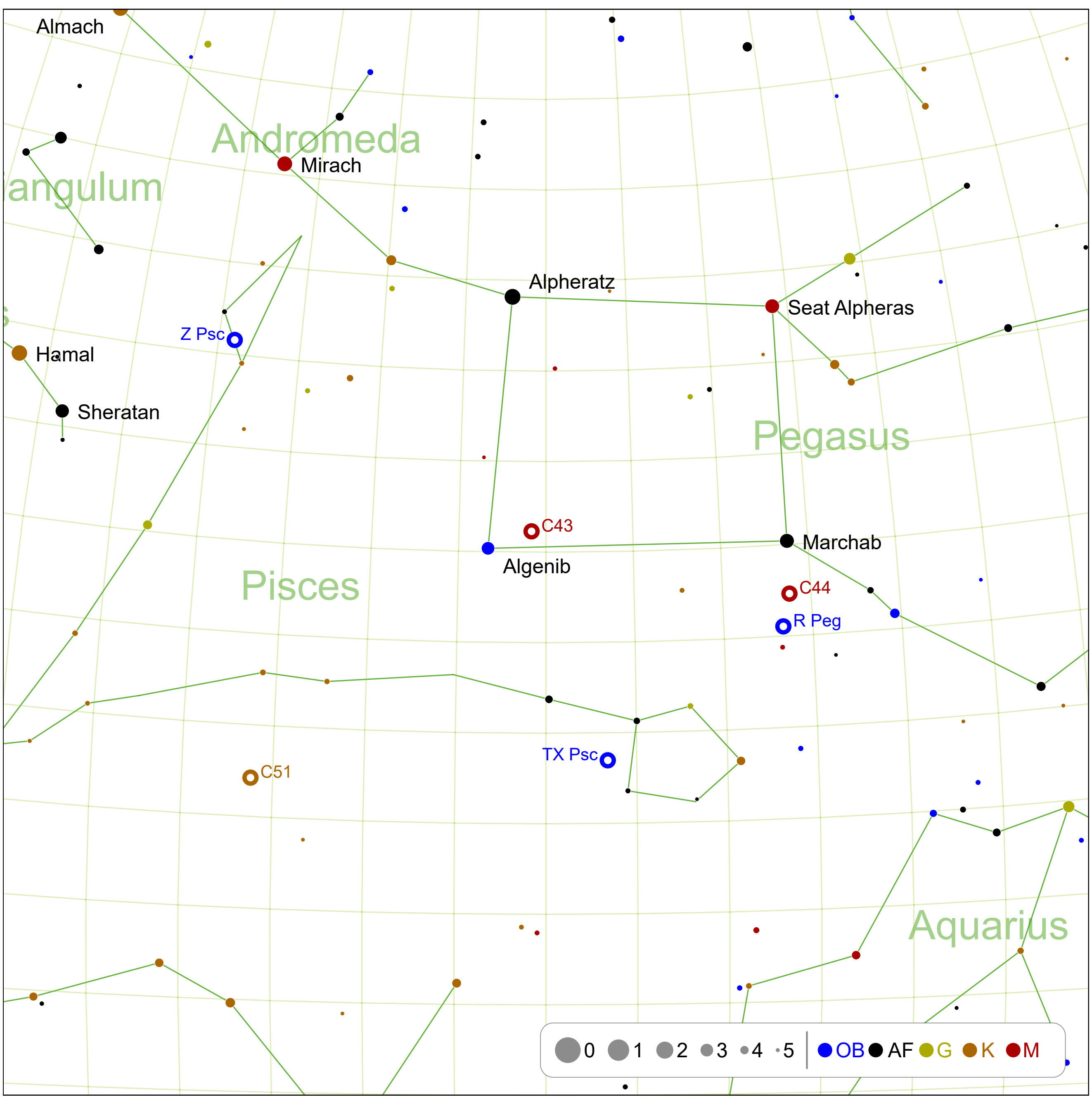
RA: 339.28° | 22h 37.09' — DEC: 34.42° | 34° 25'

C30 (Deer Lick Group, NGC 7331) is a magnitude 9.5 barred spiral galaxy. Angular size is 11x4'.

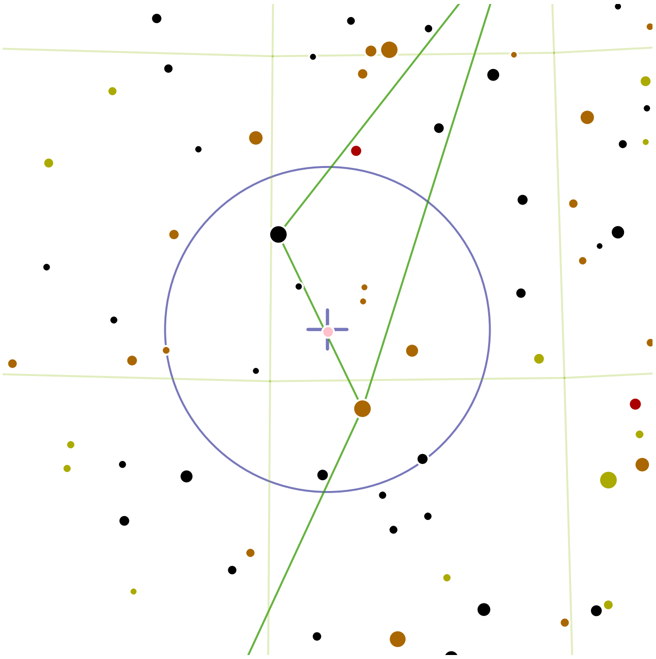
4.3° NNW from mag.3.1 Matar.

This photogenic spiral galaxy has a rich spiral structure with many dark dust clouds, and a prominent and bright yellow core. Dark skies and larger telescopes are needed to see the spiral structure, but the core can be seen under less perfect conditions.

October: 15° North



Z Psc: page 68	C43: page 68	C44: page 69	R Peg: page 69
TX Psc: page 70	C51: page 70		



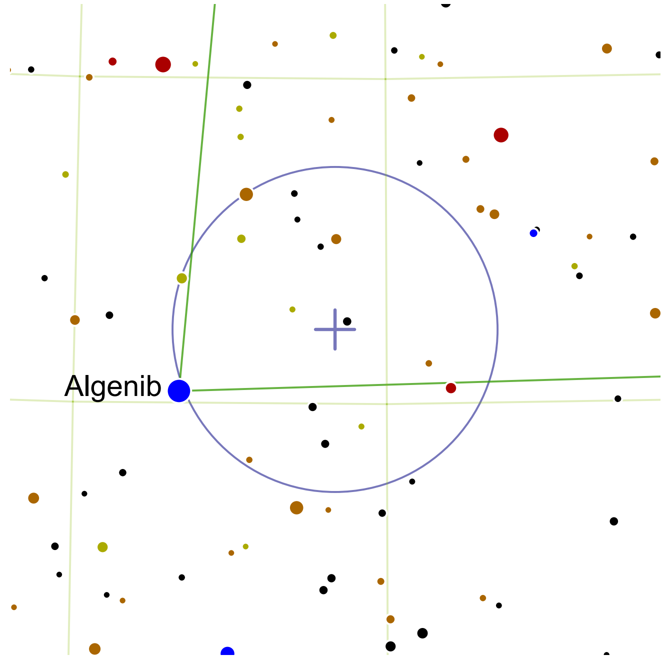
Z Psc

RA: 19.02° | 1h 16.09' — DEC: 25.8° | 25° 48'

Z Psc (HD 7561) is a magnitude 7.0 carbon star. Magnitude ranges from 7.9 to 7.0 (Δ mag. 0.9) with a period of 144d.

Halfway between Hamal of Aries and Alpheratz of Pegasus.

This carbon star has a B-V color index of 2.62. Messier 33, the Triangulum Galaxy is just over one finder circle to the north-east.



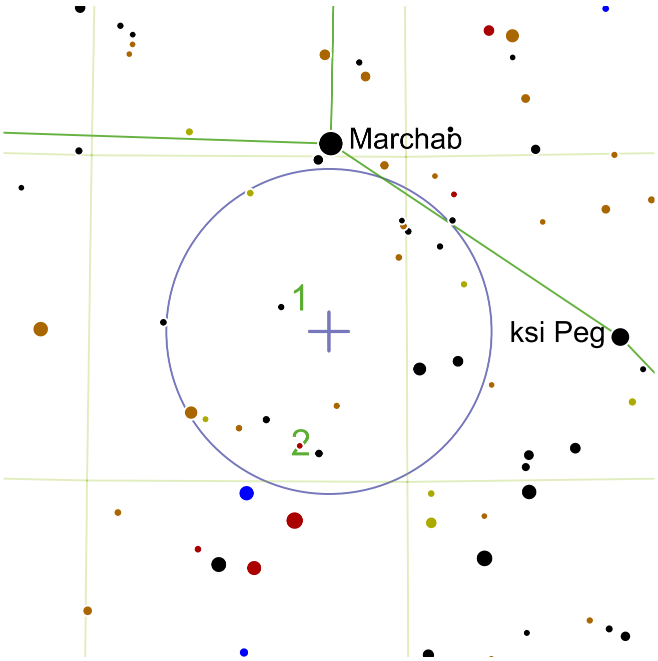
C43

RA: 0.83° | 0h 3.3' — DEC: 16.15° | 16° 9'

C43 (Little Sombrero Galaxy, NGC 7814) is a magnitude 10.5 barred spiral galaxy. Angular size is 6x2'.

2.5° NWW from mag.2.87 Algenib.

An ideal Caldwell object: a small galaxy graced with a bright core and dark dust lane, close to a prominent signpost in the form of bright Algenib, the south-eastern star of the Square of Pegasus.



C44

RA: 346.23° | 23h 4.9' — DEC: 12.32° | 12° 19'

C44 (NGC 7479) is a magnitude 11.0 barred spiral galaxy. Angular size is 4x3'.

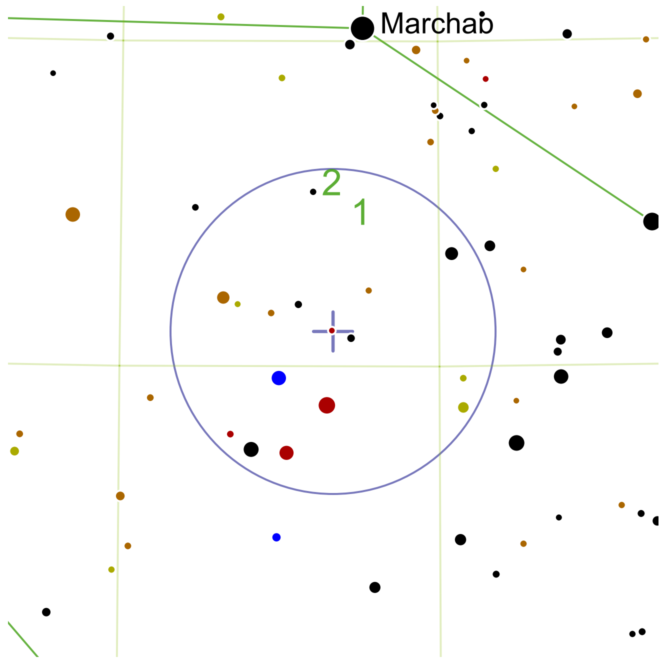
2.8° S from mag.2.57 Marchab.

A face-on galaxy with relatively bright spiral arms, this object benefits greatly from any increase in aperture. This galaxy is a starburst galaxy, with many bright star-forming regions, and two recent supernovae (1990 and 2009).

Also visible:

(1) Palomar 13 *(13.47$_m$ globular cluster)*

(2) R Peg *(6.9$_m$ variable star)*



R Peg

RA: 346.66° | 23h 6.65' — DEC: 10.54° | 10° 33'

R Peg (HD 218292) is a magnitude 6.9 variable star. Magnitude ranges from 13.8 to 6.9 (Δ mag. 6.9) with a period of 378d.

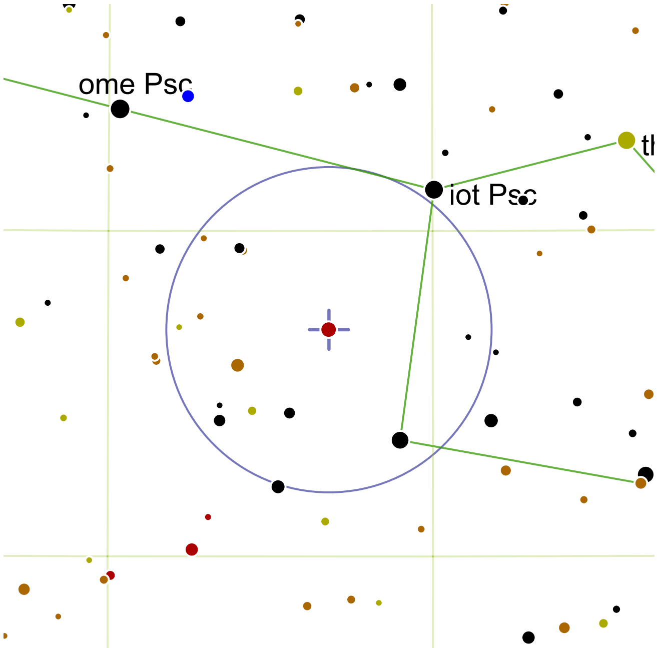
4.6° S from mag.2.57 Marchab.

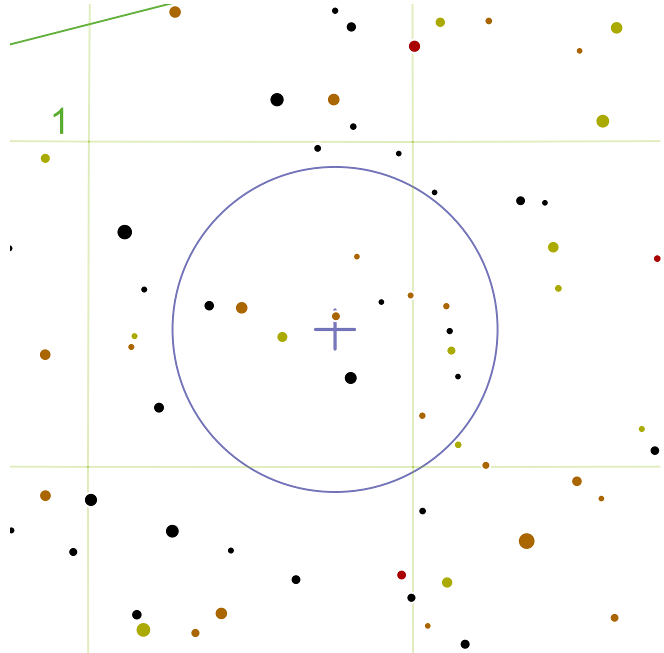
At its brightest this star can appear yellowish. Caldwell 44 is 2° to the NNW.

Also visible:

(1) C44 *(11.0$_m$ barred spiral galaxy)*

(2) Palomar 13 *(13.47$_m$ globular cluster)*





TX Psc

RA: 356.6° | 23h 46.39' — DEC: 3.49° | 3° 29'

TX Psc (HD 223075) is a magnitude 4.79 variable star. Magnitude ranges from 5.2 to 4.79 (Δ mag. 0.4).

Forms a triangle with Markab and Algenib or Pegasus.

This carbon star has a color index of 2.52 and spectral class of C-N6. It is about 650 light-years from Earth.

C51

RA: 16.2° | 1h 4.79' — DEC: 2.12° | 2° 7'

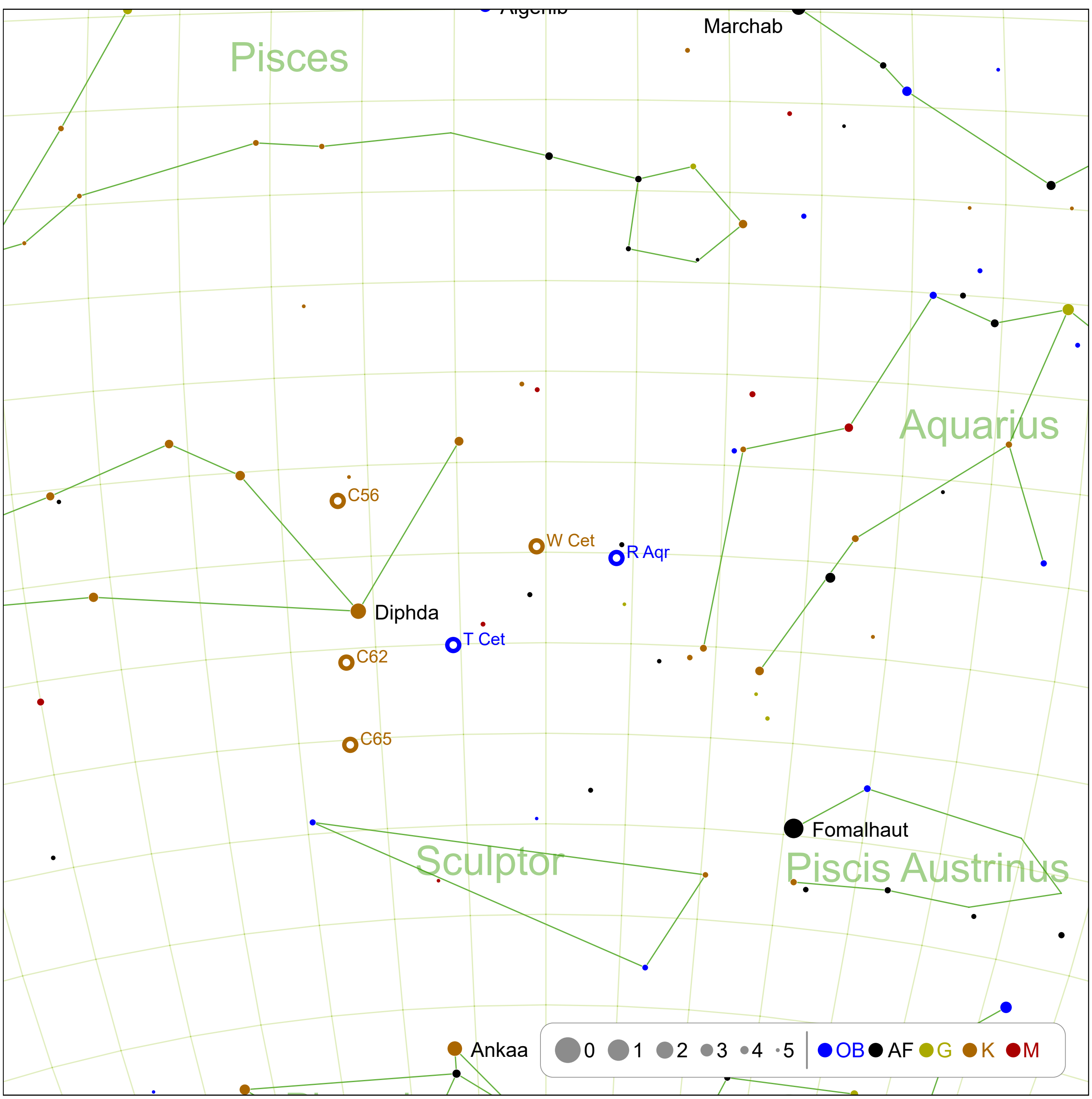
C51 (IC 1613) is a magnitude 9.0 irregular galaxy. Angular size is 12x11'.

Two and a half finder circles east and slightly south of Betelgeuse.

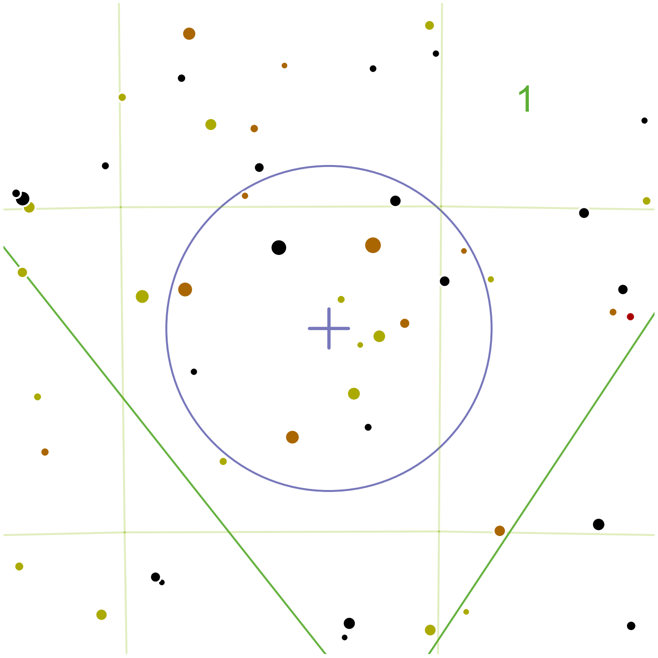
As might be guessed from its discovery date of 1906, this is a diffuse and difficult object, even under dark skies with a larger telescope. Caldwell 51 is a member of our Local Group of Galaxies and is roughly the same distance from us as the famous and vastly larger Andromeda Galaxy (M31).

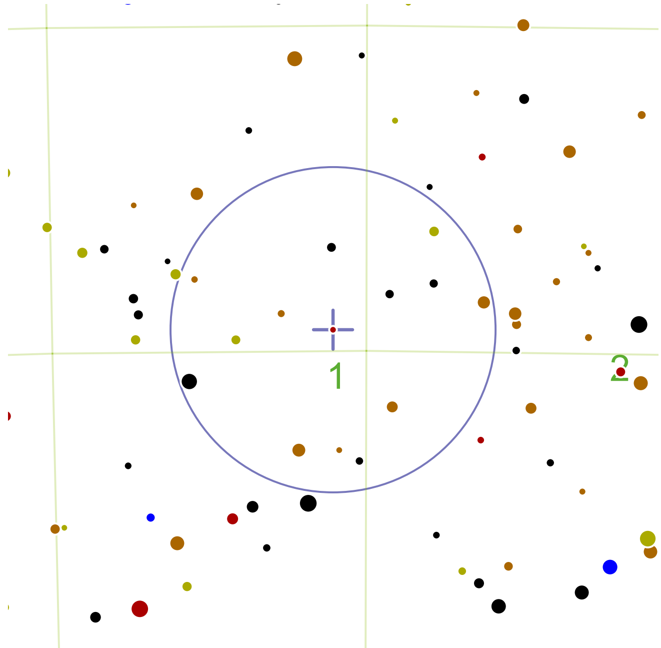
Also visible:
(1) NGC 488 *(11.15_m barred spiral galaxy)*

October: -15° South



C56: page 72 W Cet: page 72 R Aqr: page 73 T Cet: page 73
C62: page 74 C65: page 74





C56

RA: 11.75° | 0h 47.0' — DEC: -11.88° | -11° 52'

C56 (Skull Nebula, NGC 246) is a magnitude 8.0 planetary nebula. Angular size is 3.8'.

5.5° SWW from mag.3.6 Deneb Algenubi.

This diffuse planetary nebula is more challenging with light pollution, but under good skies it can be viewed with a small telescope.

Also visible:

(1) NGC 157 *(11.0$_m$ barred spiral galaxy)*

W Cet

RA: 0.53° | 0h 2.12' — DEC: -14.68° | -14° 40'

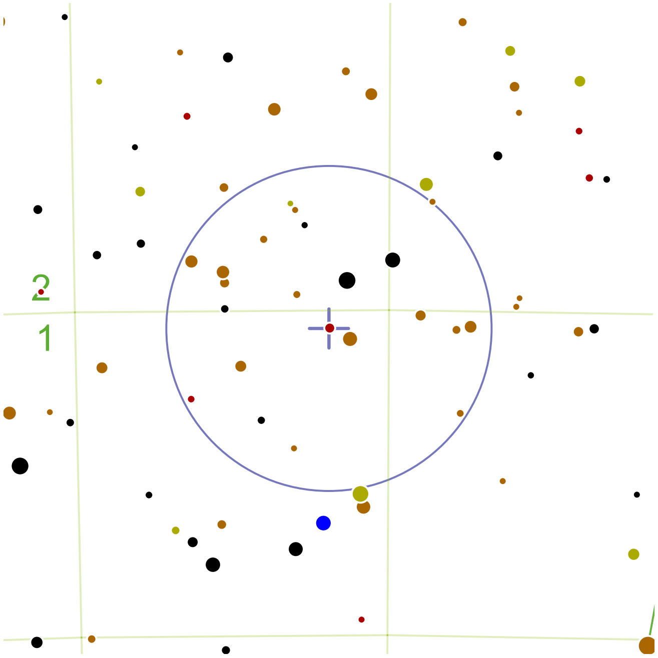
W Cet (HD 224960) is a magnitude 7.1 variable star. Magnitude ranges from 14.8 to 7.1 (Δ mag. 7.7) with a period of 351d.

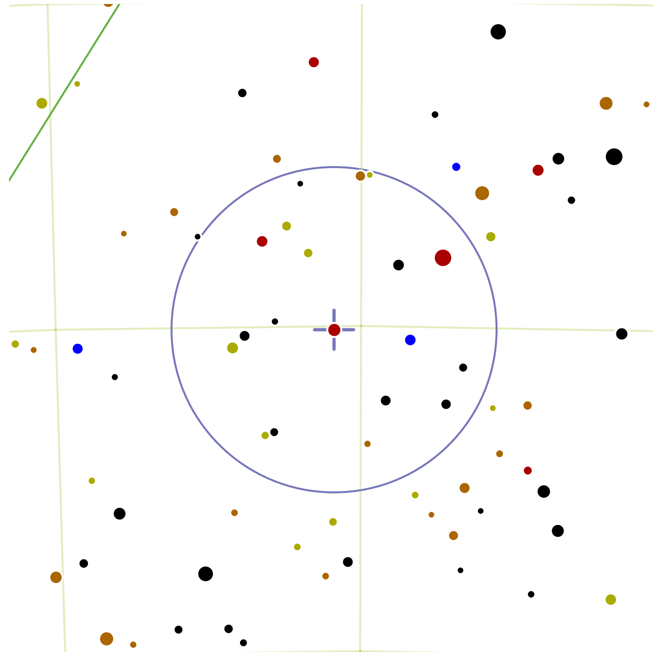
7.2° SW from mag.3.75 Deneb Kaitos Shemali.

Also visible:

(1) WLM *(11.03$_m$ irregular galaxy)*

(2) R Aqr *(5.8$_m$ variable star)*





R Aqr

RA: 355.96° | 23h 43.82' — DEC: -15.28° | -15° 16'

R Aqr (HD 222800) is a magnitude 5.8 variable star. Magnitude ranges from 12.4 to 5.8 (Δ mag. 6.6) with a period of 387d.

10.0° NE from mag.3.8 c02 Aqr.

This moderately red variable is around 1045 light-years from Earth.

Also visible:

(1) WLM *(11.03$_m$ irregular galaxy)*

(2) W Cet *(7.1$_m$ variable star)*

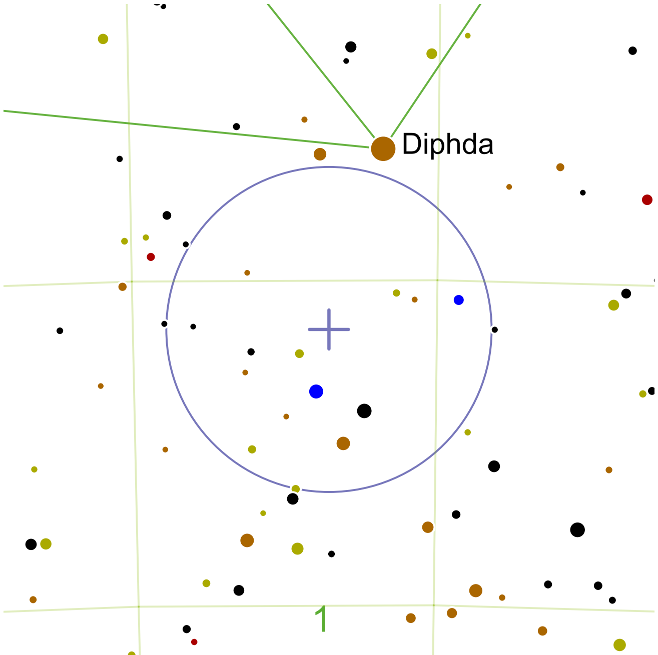
T Cet

RA: 5.44° | 0h 21.77' — DEC: -20.06° | -20° 2'

T Cet (HD 1760) is a magnitude 5.0 variable star. Magnitude ranges from 6.9 to 5.0 (Δ mag. 1.9) with a period of 159d.

5.5° SWW from mag.2.24 Diphda.

This moderately red variable has a less extreme range in brightness compared to many others in this book, but there are good stars in the finder view to make a comparison. Mag. 6.95 SAO 166174 is just over a degree to the southwest, and marks the minimum brightness for T Cet. 2 degrees to the northwest is 7 Cet, which at approximately mag. 4.4 is just a bit brighter than T Cet at its brightest. SAO 147275 is 2 degrees northeast, and marks the midpoint at mag. 6.2.



C62

RA: 11.78° | 0h 47.1' — DEC: -20.77° | -20° 45'

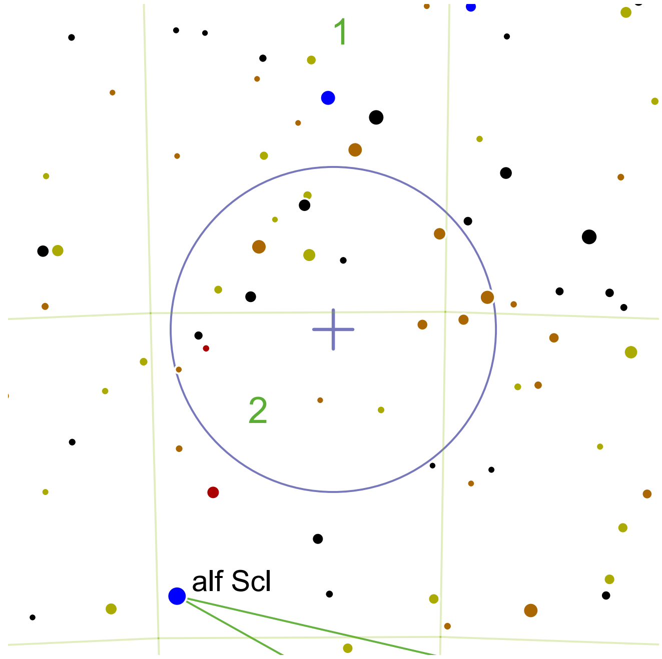
C62 (Needle's Eye Galaxy, NGC 247) is a magnitude 8.9 spiral galaxy. Angular size is 20x7'.

2.9° SSE from mag.2.24 Diphda.

The Needle's Eye galaxy is so named because it is almost edge-on, with a dark void in its disk. While this void is filled with older stars, it lacks gas clouds and bight young stars; it is believed the void is the result of an interaction with another galaxy. This dwarf spiral galaxy is about 11 million light-years from us in the nearby Sculptor Group of galaxies.

Also visible:

(1) C65 *(7.1_m spiral galaxy)*



C65

RA: 11.9° | 0h 47.6' — DEC: -25.28° | -25° 16'

C65 (Sculptor Galaxy, NGC 253) is a magnitude 7.1 spiral galaxy. Angular size is 25x7'.

7.3° S from mag.2.24 Diphda.

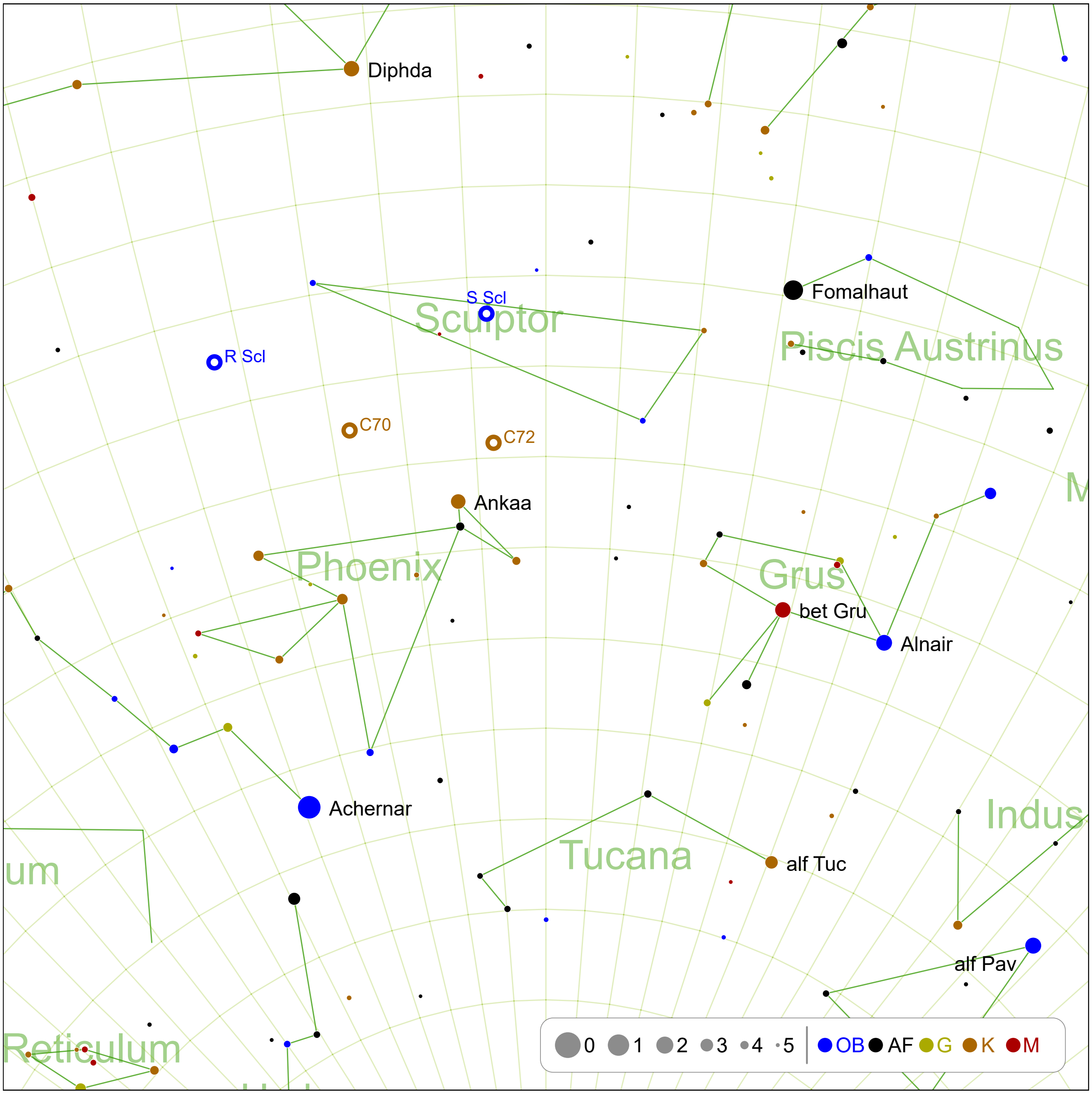
Discovered in 1783 by Caroline Herschel, this large and luminous galaxy is a gorgeous sight in any telescope.

Also visible:

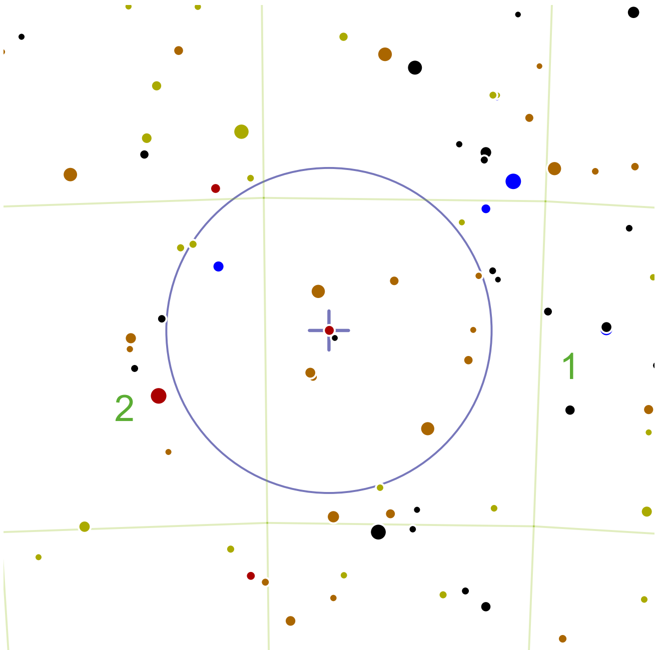
(1) C62 *(8.9_m spiral galaxy)*

(2) NGC 288 *(8.09_m globular cluster)*

October: -45° South



S Scl: page 76 R Scl: page 76 C70: page 77 C72: page 77



S Scl

RA: 3.84° | 0h 15.37' — DEC: -32.05° | -32° 2'

S Scl (HD 001115) is a magnitude 5.5 variable star. Magnitude ranges from 13.6 to 5.5 (Δ mag. 8.1) with a period of 363d.

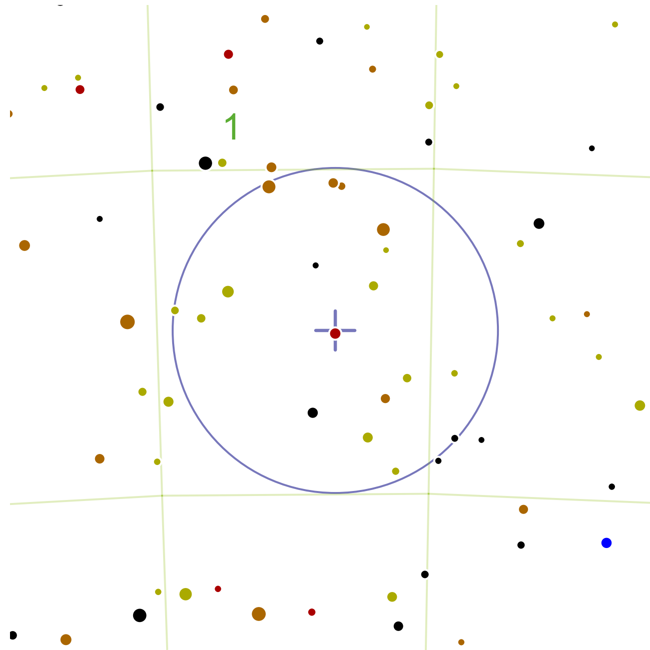
10.4° NNW from mag.2.44 Ankaa.

This yellowish variable star fades out of sight (for most telescopes) on an almost exactly annual basis. It is 3,507 light-years from Earth.

Also visible:

(1) NGC 7793 *(9.63$_m$ spiral galaxy)*

(2) NGC 134 *(11.23$_m$ barred spiral galaxy)*



R Scl

RA: 21.75° | 1h 27.0' — DEC: -32.5° | -32° 29'

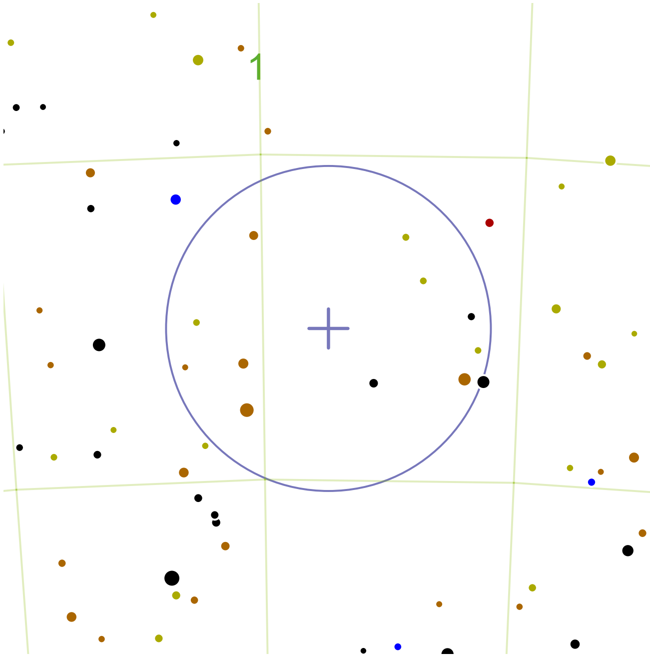
R Scl (HD 8879) is a magnitude 6.1 carbon star. Magnitude ranges from 8.8 to 6.1 (Δ mag. 2.7) with a period of 363d.

10.8° N from mag.3.4 gam Phe.

This carbon star has a B-V color index of 2.46 and spectral type C-N5+. It is approximately 1436 light-years from Earth.

Also visible:

(1) NGC 613 *(10.73$_m$ barred spiral galaxy)*



C70

RA: 13.73° | 0h 54.9' — DEC: -37.68° | -37° 40'

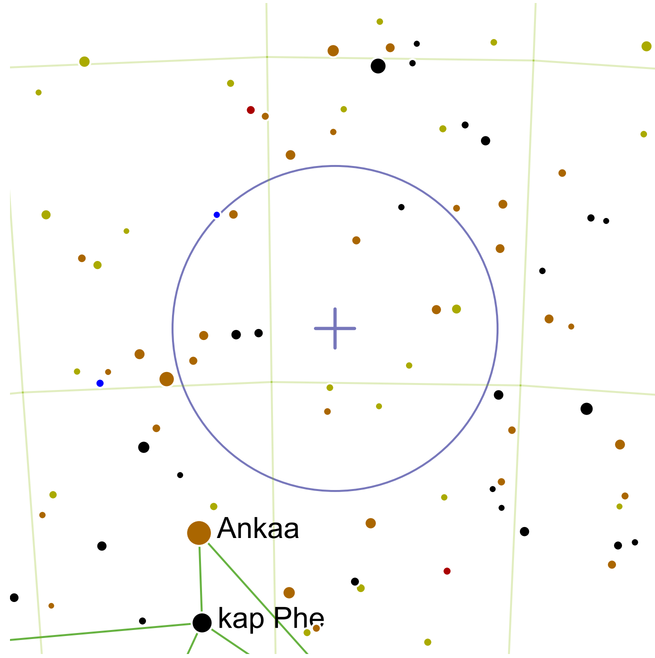
C70 (Southern Pinwheel Galaxy, NGC 300) is a magnitude 8.1 spiral galaxy. Angular size is 20x13'.

7.1° NE from mag.2.44 Ankaa.

This large and bright galaxy is only six million light-years from us and is a member of the Sculptor Group.

Also visible:

(1) Sculptor *(10.5$_m$ irregular galaxy)*



C72

RA: 3.73° | 0h 14.9' — DEC: -39.18° | -39° 10'

C72 (String of Pearls, NGC 55) is a magnitude 8.2 barred spiral galaxy. Angular size is 32x6'.

3.7° NW from mag.2.44 Ankaa.

This is another bright member of the nearby Sculptor Group of galaxies and is Magellanic-type galaxy, meaning it is intermediate between a small irregular galaxy and dwarf spiral galaxy.

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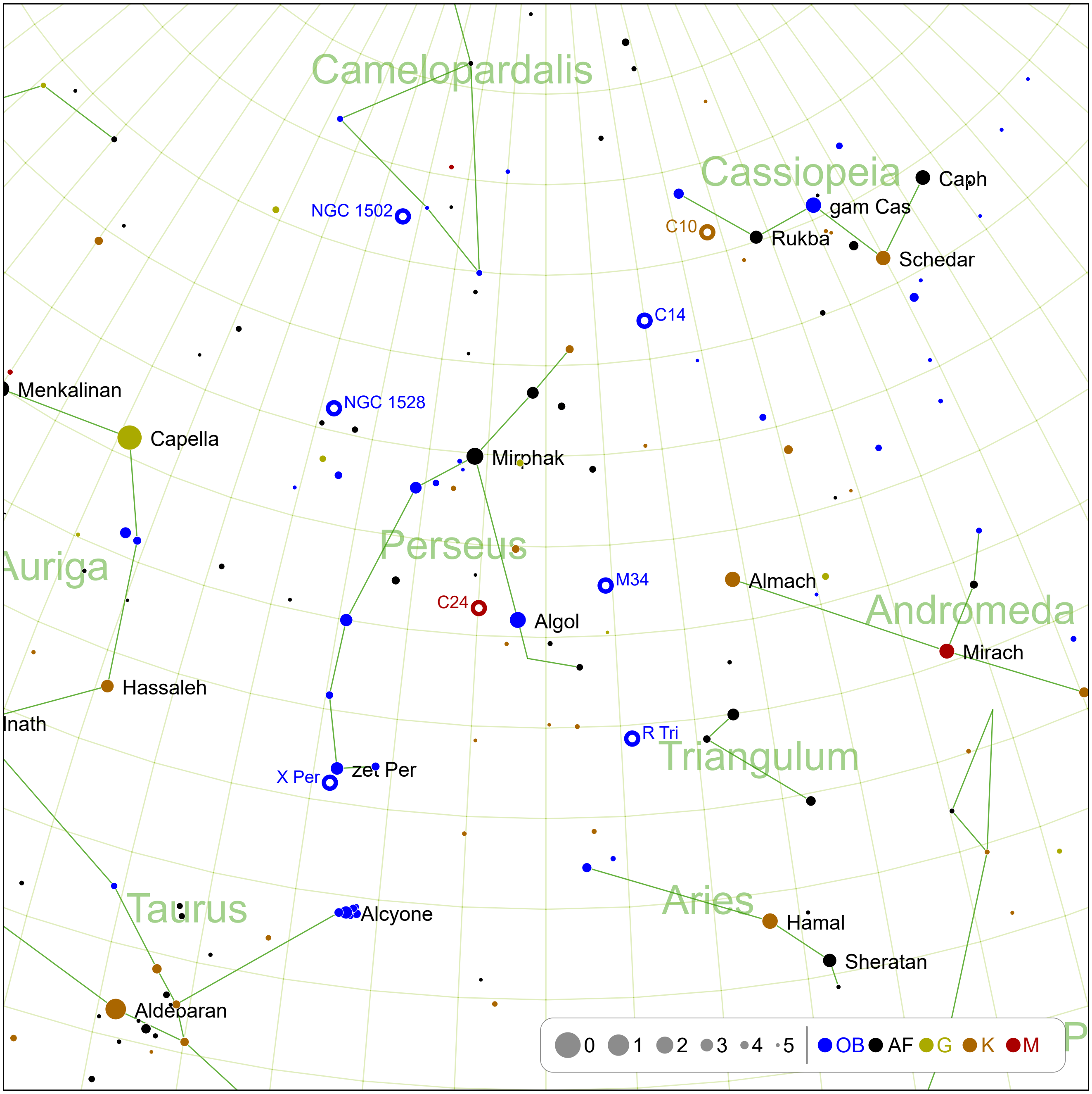
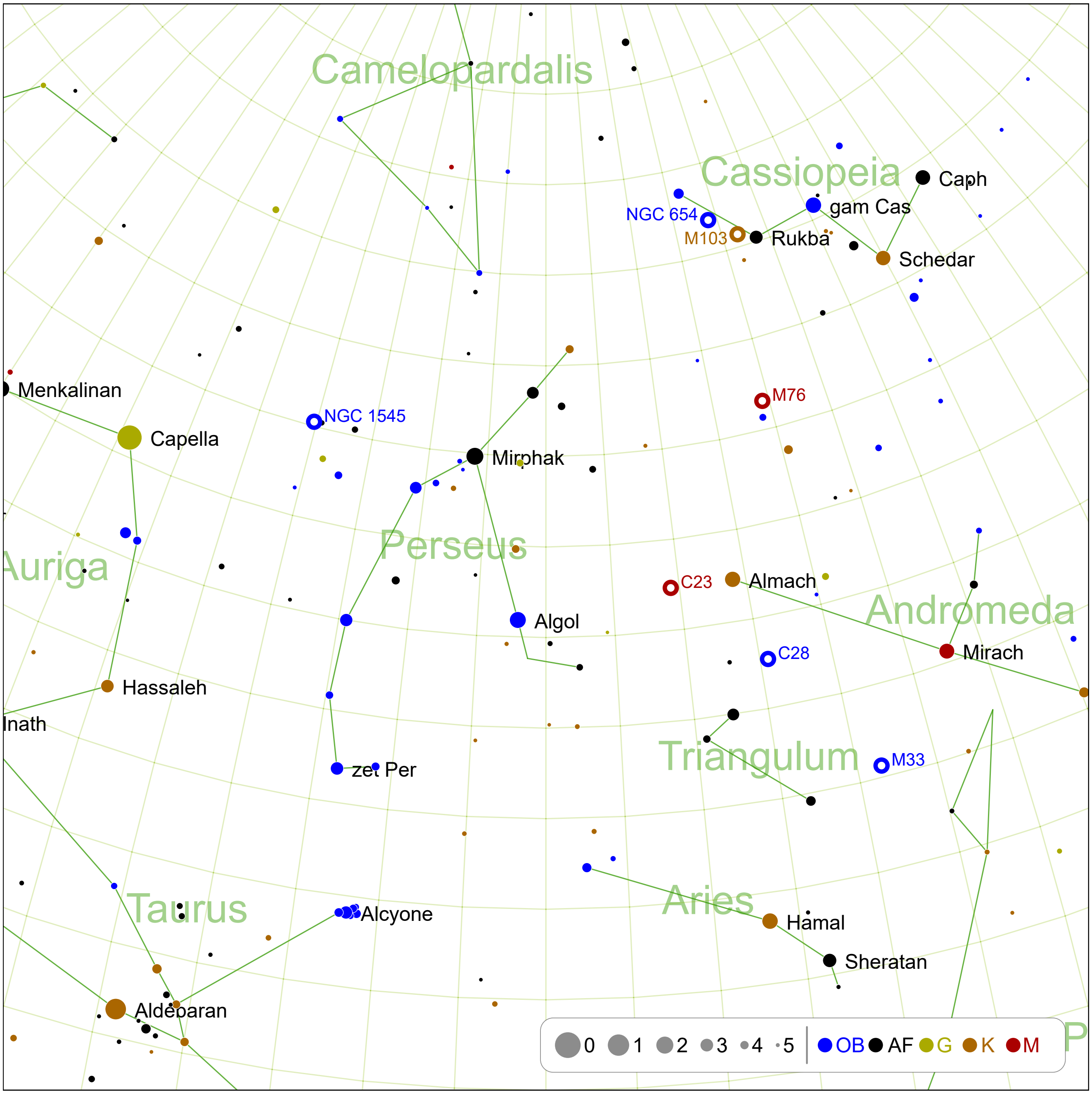
November: 45° North (1)

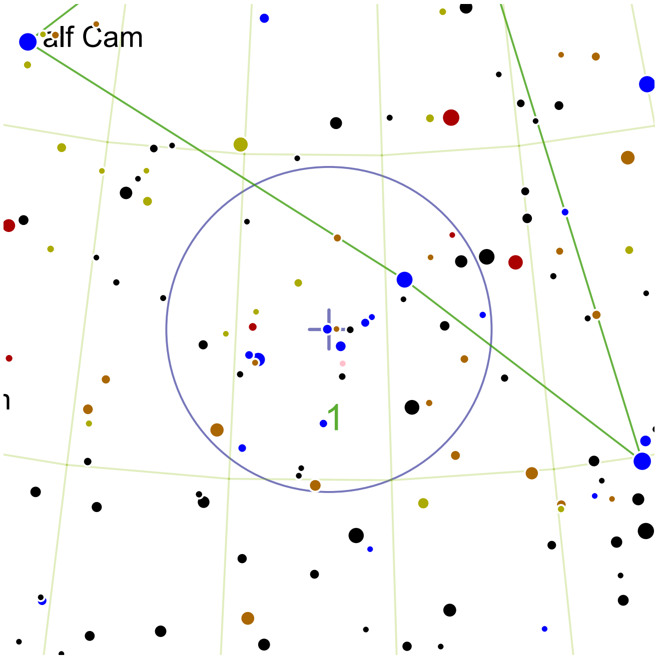


NGC 1502: page 81 | C10: page 81 | C14: page 82 | NGC 1528: page 82
M34: page 83 | C24: page 83 | R Tri: page 84 | X Per: page 84

November: 45° North (2)



NGC 654: page 85 | M103: page 85 | M76: page 86 | NGC 1545: page 86
C23: page 87 | C28: page 87 | M33: page 88



NGC 1502

RA: 61.93° | 4h 7.69' — DEC: 62.33° | 62° 20'

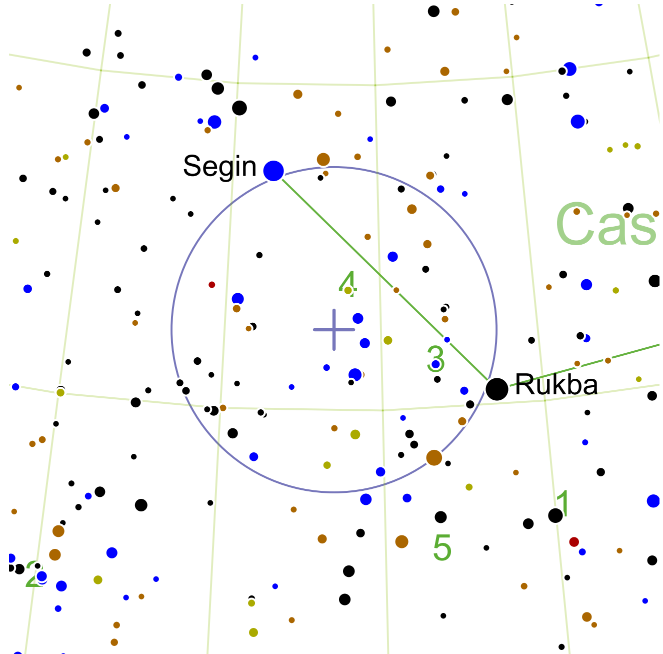
NGC 1502 is a magnitude 5.7 open cluster. Angular size is 8'.

11.7° NE from mag.3.93 Miram.

This young open cluster is estimated at 5-15 million years age, and contains about 60 stars of widely varying brightness. It is at one end of the unrelated Kemble's Cascade asterism, a three degree long straight line of over 20 5th to 10th magnitude stars.

Also visible:

(1) NGC 1501 *(12.5$_m$ planetary nebula)*



C10

RA: 26.5° | 1h 46.0' — DEC: 61.25° | 61° 15'

C10 (NGC 663) is a magnitude 7.1 open cluster. Angular size is 16'.

2.6° SSW from mag.3.44 Segin.

A rich open cluster, possibly bright enough to spotted with the naked eye from a dark site. The cluster is roughly 22 million years old, with many of its larger stars now in their later (and brighter) stages of life. The cluster is enhanced by an unrelated, more distant dust cloud behind it which clears the view of competing background stars.

Also visible:

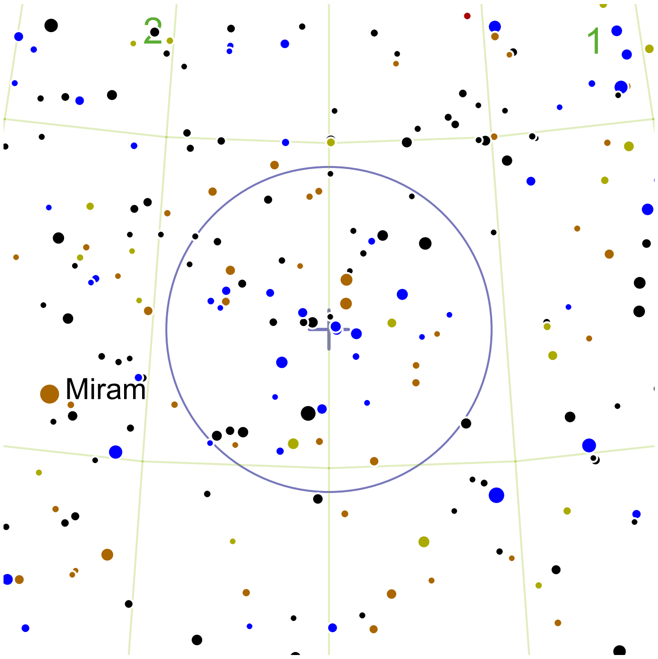
(1) C13 *(6.4$_m$ open cluster)*

(2) C14 *(4.3$_m$ open cluster)*

(3) M103 *(7.4$_m$ open cluster)*

(4) NGC 654 *(6.5$_m$ open cluster)*

(5) WW Cas *(9.1$_m$ carbon star)*



C14

RA: 35.0° | 2h 20.0' — DEC: 57.13° | 57° 8'

C14 (Double Cluster, NGC 869/884) is a magnitude 4.3 open cluster. Angular size is 60x30'.

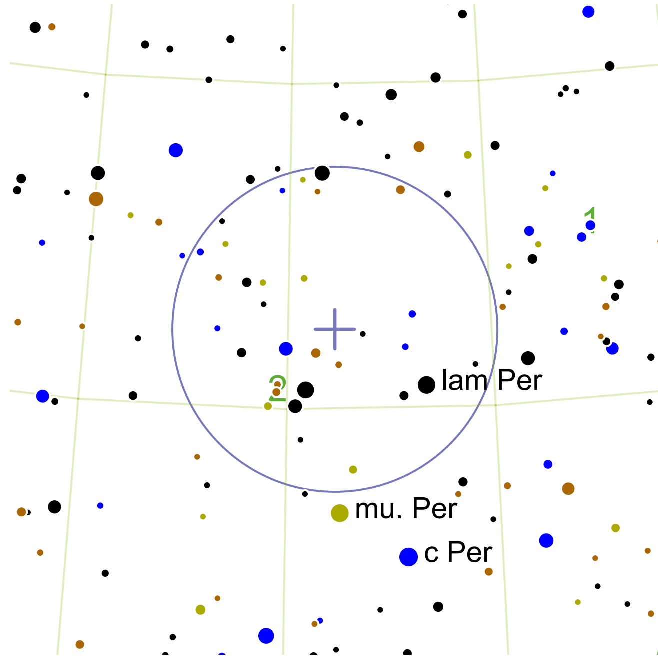
4.4° NWW from mag.3.93 Miram.

A gorgeous pair of brilliant open clusters, both bright enough to be spotted by the naked eye under dark skies. In addition to many hot blue members, the Double Cluster also hosts a number of older clearly red giants.

Also visible:

(1) C10 *(7.1_m open cluster)*

(2) NGC 1027 *(6.7_m open cluster)*



NGC 1528

RA: 63.85° | 4h 15.4' — DEC: 51.23° | 51° 14'

NGC 1528 is a magnitude 6.4 open cluster. Angular size is 24'.

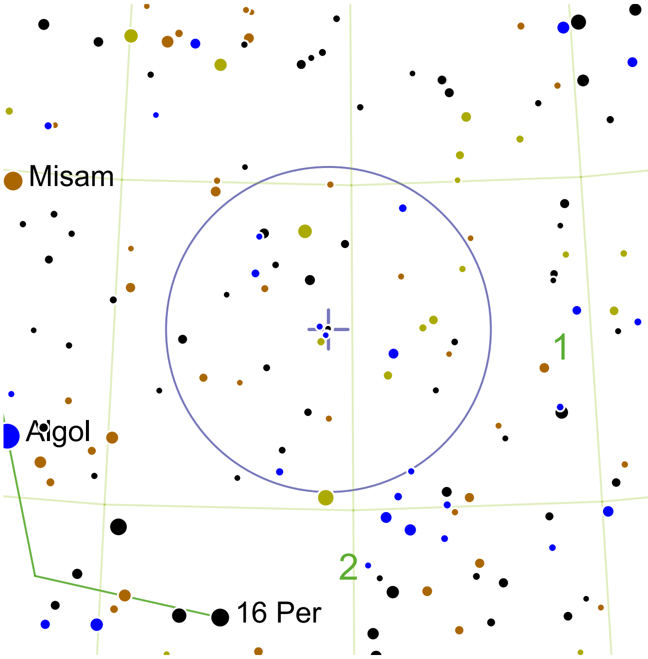
Draw a line from Shedar through Ruchbah in Cassiopeia, and extend it halfway to Capella.

At 110 million years old, this cluster of 165 stars can be seen with binoculars. The brightest star in the cluster is magnitude 8.7.

Also visible:

(1) NGC 1444 *(6.6_m open cluster)*

(2) NGC 1545 *(6.2_m open cluster)*



M34

RA: 40.5° | 2h 42.0' — DEC: 42.78° | 42° 47'

M34 (NGC 1039) is a magnitude 5.5 open cluster. Angular size is 35'.

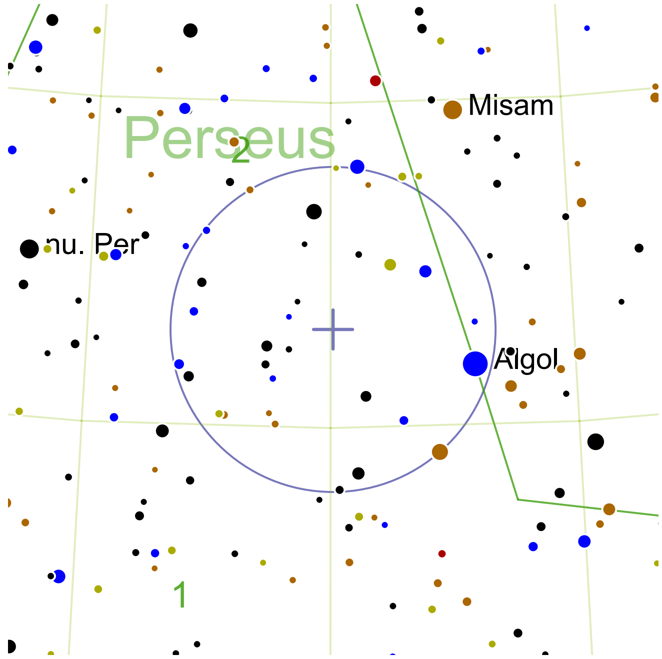
5.2° NWW from mag.2.12 Algol.

Covering a patch of sky the size of the Moon, the small stars of this cluster can be resolved with binoculars in suburban skies. It is estimated to be at least 200 million years old, so it also contains 19 white dwarfs which are the remnants of the larger, shorter-lived members of this cluster.

Also visible:

(1) C23 *(9.9_m barred spiral galaxy)*

(2) NGC 1023 *(10.35_m lenticular galaxy)*



C24

RA: 49.95° | 3h 19.8' — DEC: 41.52° | 41° 31'

C24 (Perseus A, NGC 1275) is a magnitude 11.6 seyfert galaxy. Angular size is 2'.

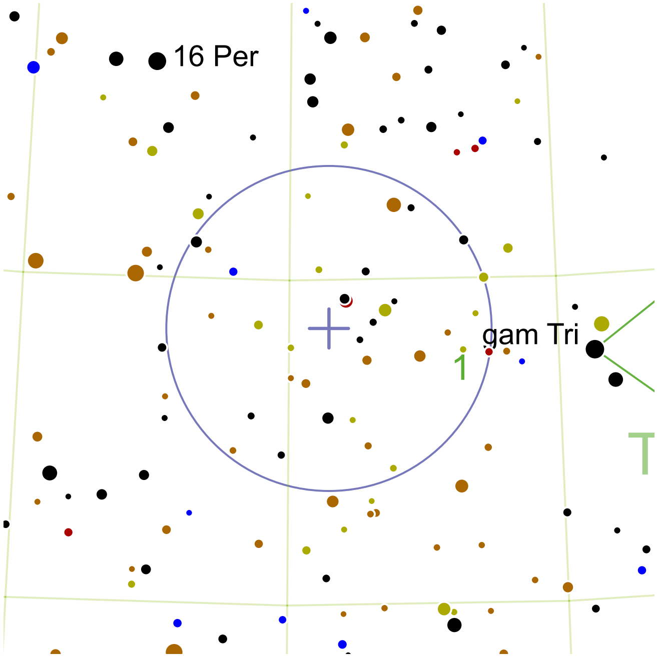
2.2° NEE from mag.2.12 Algol.

A faint and very difficult Caldwell object, this object consists of two interacting galaxies - a massive elliptical galaxy, and a highly disrupted spiral galaxy. In deep photographs, C24 is surrounded by a mysterious web of hydrogen filaments that are much cooler than the intergalactic medium. It is uncertain why they are cooler and also why they have not collapsed to form new stars.

Also visible:

(1) NGC 1342 *(6.7_m open cluster)*

(2) Y Per *(8.1_m carbon star)*



R Tri

RA: 39.26° | 2h 37.03' — DEC: 34.26° | 34° 16'

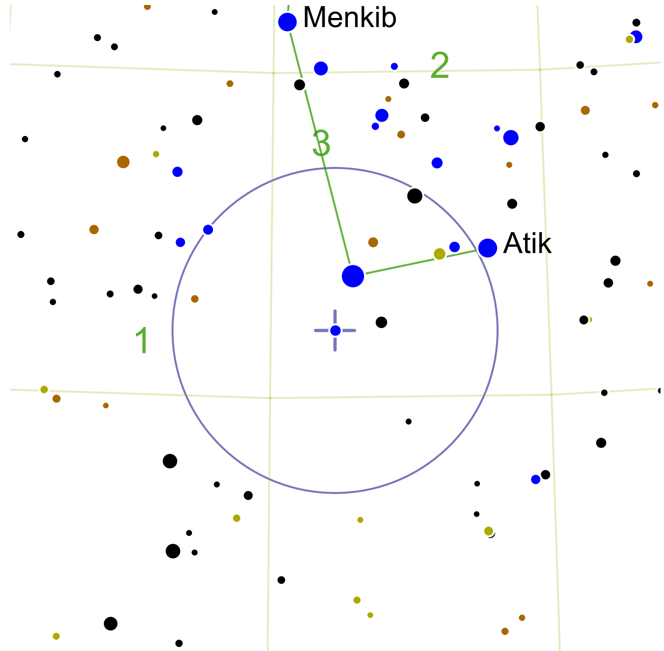
R Tri (HD 016210) is a magnitude 5.4 variable star. Magnitude ranges from 12.6 to 5.4 (Δ mag. 7.2) with a period of 267d.

Halfway between Algol and Hamal.

This orange-red variable is 3,000 light-years from Earth. There are four faint galaxies in the finder circle. NGC 959 is 2 degrees to the northwest (mag 12.4); NGC 925 is 2.5 degrees to the west (mag. 10.1); NGC 969 is less than 2 degrees south (mag. 12.4); NGC 1060 is 2.5 degrees to the southeast (mag. 11.8).

Also visible:

(1) NGC 925 *(10.69$_m$ barred spiral galaxy)*



X Per

RA: 58.85° | 3h 55.38' — DEC: 31.05° | 31° 3'

X Per (HD 024534) is a magnitude 6.03 variable star. Magnitude ranges from 7.0 to 6.03 (Δ mag. 1.0).

0.8° SSE from mag.2.91 zet Per.

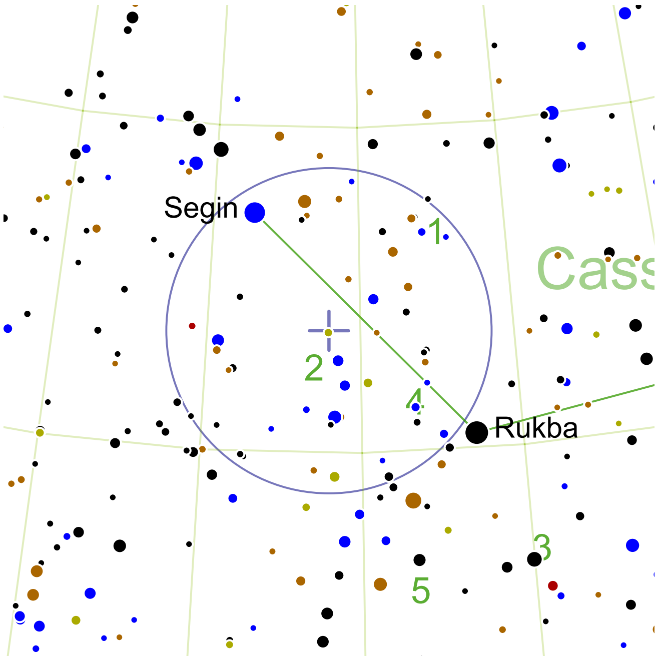
This white variable star is roughly 2,651 light-years from Earth. It is also a double star, with a magnitude 12.3 companion separated by 23.4", position angle 13°.

Also visible:

(1) NGC 1514 *(9.5$_m$ planetary nebula)*

(2) IC 351 *(12.0$_m$ planetary nebula)*

(3) IC 2003 *(12.0$_m$ planetary nebula)*



NGC 654

RA: 26.03° | 1h 44.09' — DEC: 61.88° | 61° 53'

NGC 654 is a magnitude 6.5 open cluster. Angular size is 5'.

2.1° SW from mag.3.44 Segin.

This cluster is possibly as young as 15 million years, but there is some uncertainty as star formation may have spanned 20 million years. The cluster has about 80 members and is dominated by HD 10494, a yellow supergiant with class F5Ia.

Also visible:

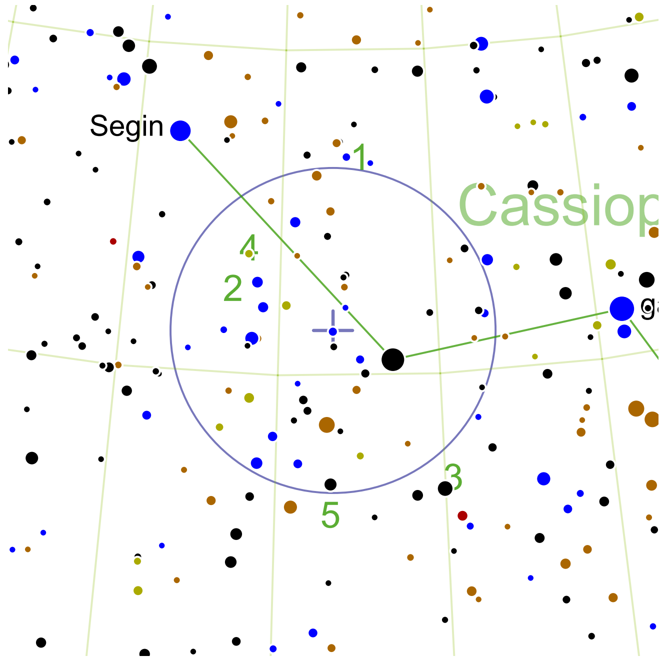
(1) C8 *(9.5$_m$ open cluster)*

(2) C10 *(7.1$_m$ open cluster)*

(3) C13 *(6.4$_m$ open cluster)*

(4) M103 *(7.4$_m$ open cluster)*

(5) WW Cas *(9.1$_m$ carbon star)*



M103

RA: 23.3° | 1h 33.2' — DEC: 60.7° | 60° 42'

M103 (NGC 581) is a magnitude 7.4 open cluster. Angular size is 6'.

1.0° NEE from mag.2.8 Rukba.

This open cluster is quite distant compared to other open clusters in the Messier catalog, being roughly 9,000 light-years from Earth, and is composed of about 40 faint stars. The view of the cluster is dominated by Struve 131, which is a foreground star and not a member of the cluster. Struve 131 is a double star (mag. 7.3 and 9.9, separation 13.9", position angle 143°).

Also visible:

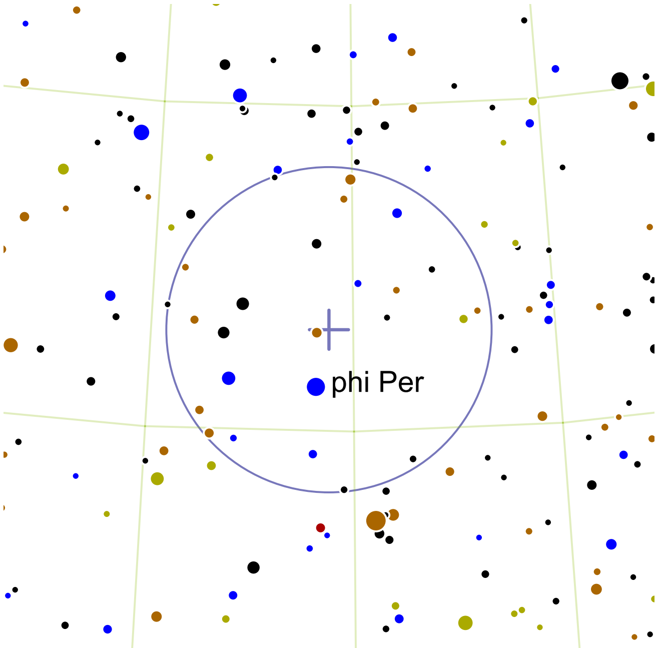
(1) C8 *(9.5$_m$ open cluster)*

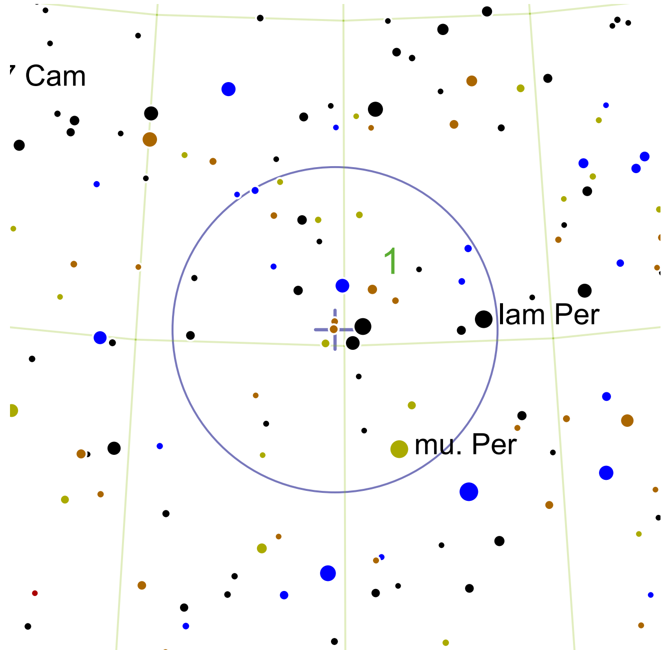
(2) C10 *(7.1$_m$ open cluster)*

(3) C13 *(6.4$_m$ open cluster)*

(4) NGC 654 *(6.5$_m$ open cluster)*

(5) WW Cas *(9.1$_m$ carbon star)*





M76

RA: 25.6° | 1h 42.4' — DEC: 51.57° | 51° 34'

M76 (Little Dumbbell Nebula, NGC 650) is a magnitude 10.1 planetary nebula. Angular size is 3x2'.

Midway between Almach and Ruchbah.

This planetary nebula is the same angular size as four Jupiters. It is graced with two NGC numbers, NGC 650 and NGC 651, as was originally thought to be two distinct nebulae (the double-lobed nature of this nebula is only apparent in telescopes over around 150 mm aperture). This object is quite difficult in light-polluted skies.

NGC 1545

RA: 65.22° | 4h 20.89' — DEC: 50.25° | 50° 15'

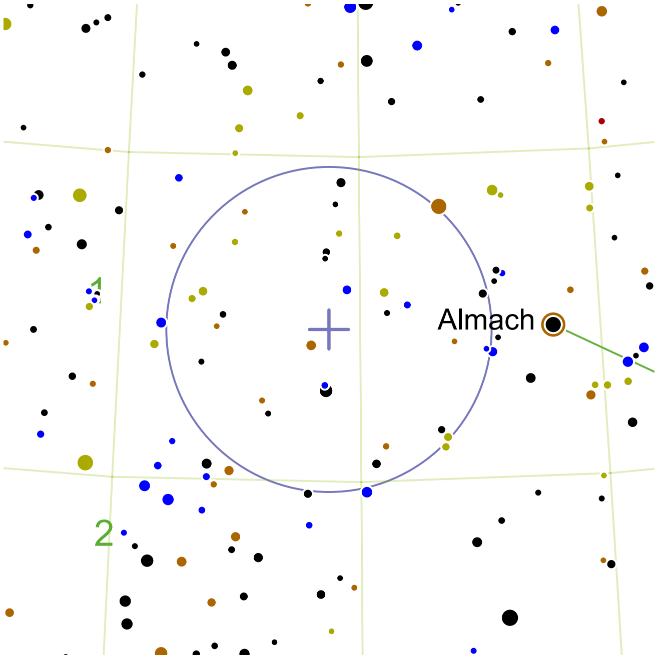
NGC 1545 is a magnitude 6.2 open cluster. Angular size is 18'.

Slightly north of a point halfway between Capella and Mirfak.

Only 1.5 degrees from southeast from the similar NGC 1528, this open cluster is around 2,320 light-years from Earth and around 280 million years old.

Also visible:

(1) NGC 1528 *(6.4$_m$ open cluster)*



C23

RA: 35.65° | 2h 22.59' — DEC: 42.35° | 42° 21'

C23 (NGC 891) is a magnitude 9.9 barred spiral galaxy. Angular size is 14x3'.

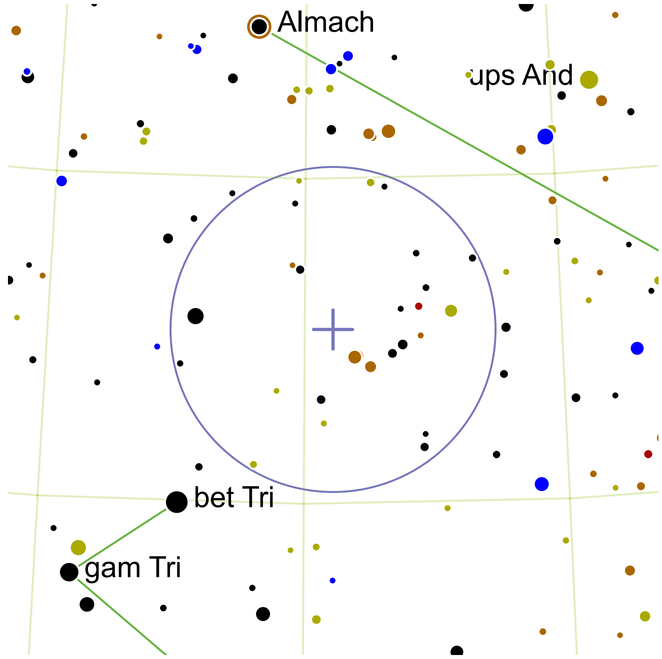
3.4° E from mag.2.28 Almach.

This edge-on spiral galaxy in challenging under light-polluted skies, but rewards those who find it with a prominent central dust lane. Studies of the extended halo of this galaxy (the halo is the diffuse region containing the globular clusters of a galaxy) showed that the halo material was most likely ejected from the galaxy, rather than being pulled in from intergalactic space.

Also visible:

(1) M34 *(5.5$_m$ open cluster)*

(2) NGC 1023 *(10.35$_m$ lenticular galaxy)*



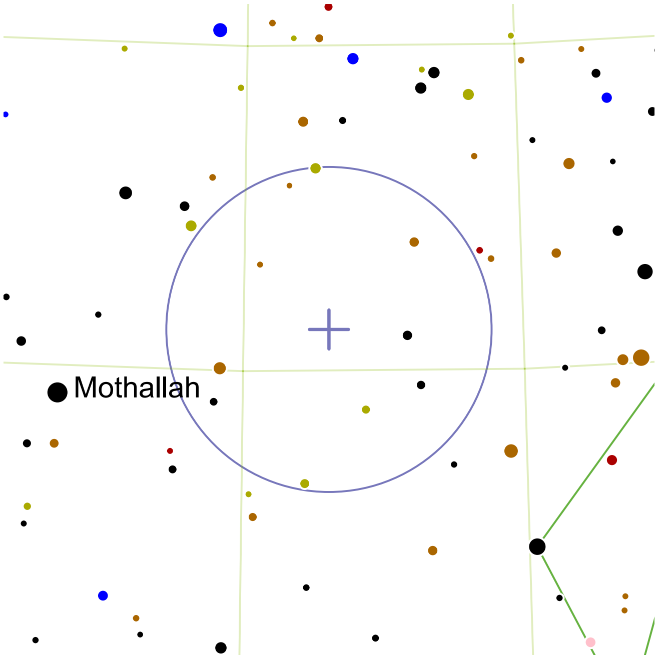
C28

RA: 29.45° | 1h 57.8' — DEC: 37.68° | 37° 41'

C28 (NGC 752) is a magnitude 5.7 open cluster. Angular size is 50'.

3.5° NW from mag.3.08 bet Tri.

A relatively bright cluster discovered by Caroline Herschel in 1783. Under very good skies this large, loose cluster is visible by the naked eye, but is an easy binocular target as it has a number of stars approaching 9th magnitude in brightness.



M33

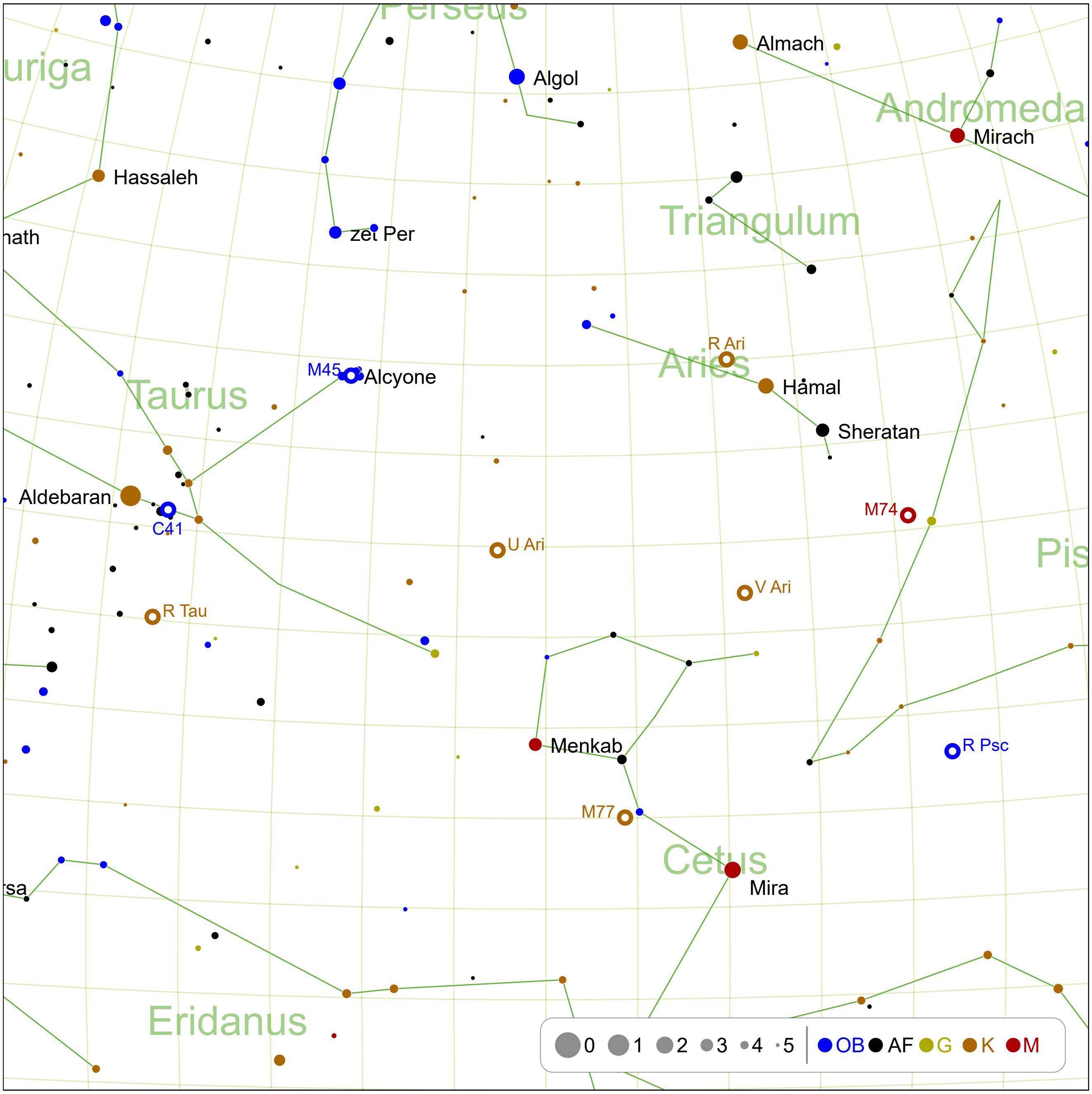
RA: 23.48° | 1h 33.9' — DEC: 30.65° | 30° 39'

M33 (Triangulum Galaxy, NGC 598) is a magnitude 5.7 spiral galaxy. Angular size is 73x45'.

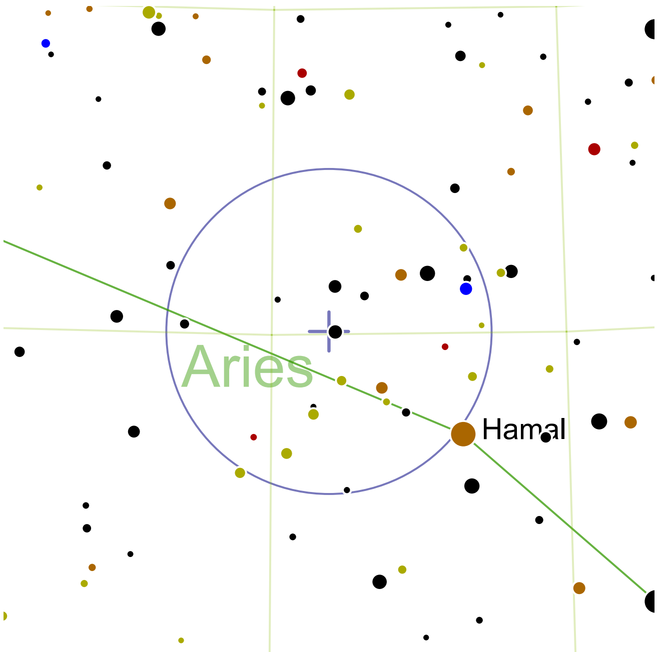
Travel from the lovely double star Almach to Mirach and turn right; continue half the distance again.

A large object spreading over a degree of sky, M33 (the Triangulum Galaxy) is the third largest galaxy in the Local Group, after M31 and the Milky Way. M33 is a challenging naked-eye target under dark skies, a challenging telescopic target in suburban skies, and virtually impossible under city skies. It has giant emission nebulae, including NGC 604 (spanning 1500 light-years) and three smaller regions (NGC 588, NGC 592, and NGC 595).

November: 15° North



R Ari: page 90
U Ari: page 92
M77: page 94
M45: page 90
V Ari: page 92
C41: page 91
R Tau: page 93
M74: page 91
R Psc: page 93



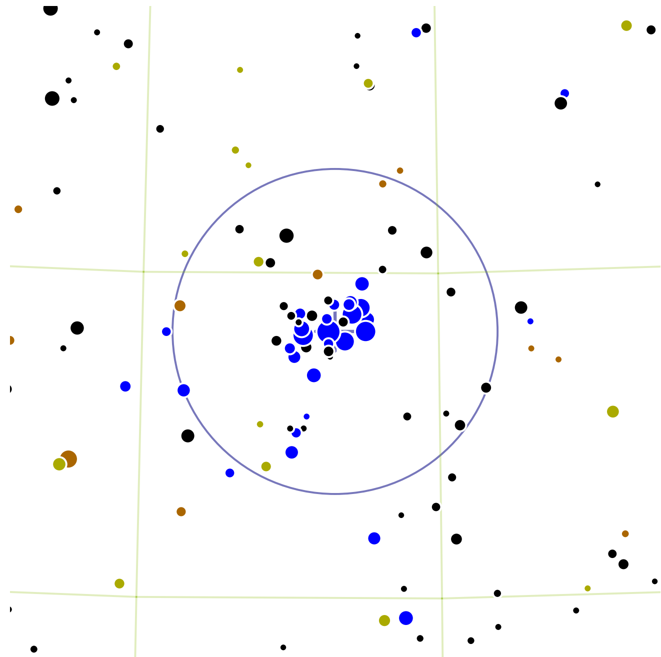
R Ari

RA: 34.03° | 2h 16.11' — DEC: 25.06° | 25° 3'

R Ari (HD 13913) is a magnitude 7.4 variable star. Magnitude ranges from 13.7 to 7.4 (Δ mag. 6.3) with a period of 187d.

2.5° NE from mag.2.23 Hamal.

At its brightest, this pulsating variable star forms a binocular double with 21 Ari (magnitude 6.4, separation 6').



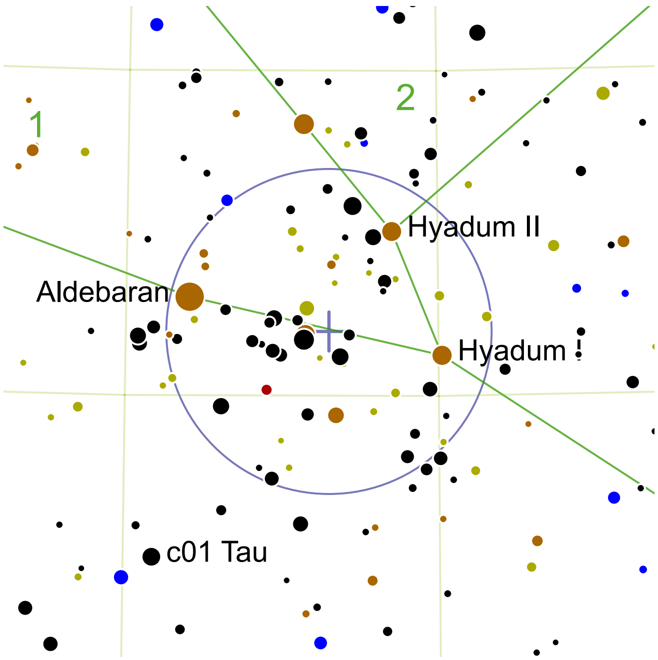
M45

RA: 56.75° | 3h 47.0' — DEC: 24.12° | 24° 7'

M45 (Pleiades, Mel 22) is a magnitude 1.6 open cluster. Angular size is 110'.

0.1° W from mag.2.96 Alcyone.

One of the nearest clusters to Earth, the Pleiades cuts through even the worst light pollution. Galileo sketched the Pleiades in 1610, noting 36 stars. In long exposures the Pleiades are veiled in dust; the cluster is drifting through a dusty region, and the dust is not in fact part of the cluster. It is possible to glimpse this dusty glow with a small telescope.



C41

RA: 66.75° | 4h 27.0' — DEC: 16.0° | 16° 0'

C41 (Hyades, Mel 25) is a magnitude 1.0 open cluster. Angular size is 330'.

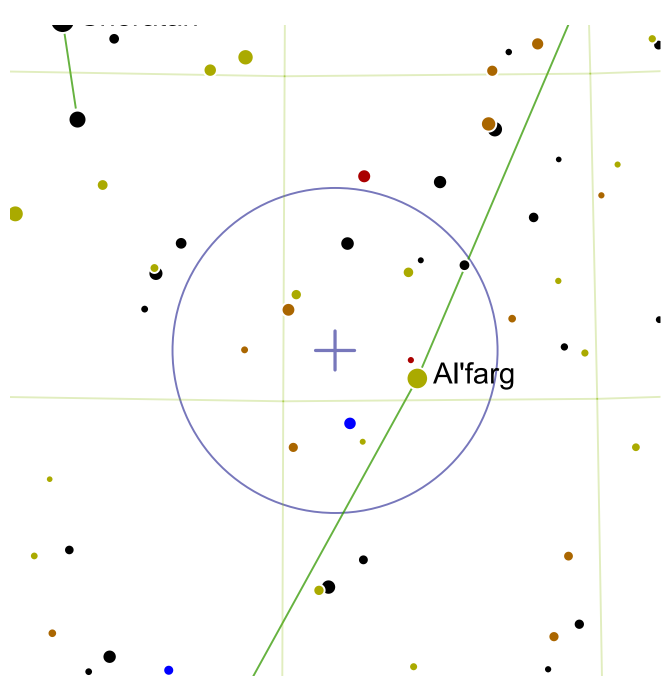
0.4° NWW from mag.3.62 the02 Tau.

The Hyades are an obvious feature of the northern sky, clustering around Aldebaran and easily seen with the naked eye even in light polluted conditions. The Hyades are the nearest open cluster to Earth. Despite appearances, Aldebaran is not a member of this cluster. This target is best viewed with binoculars or a small telescope.

Also visible:

(1) NGC 1647 *(6.4$_m$ open cluster)*

(2) T Tau *(9.3$_m$ variable star)*



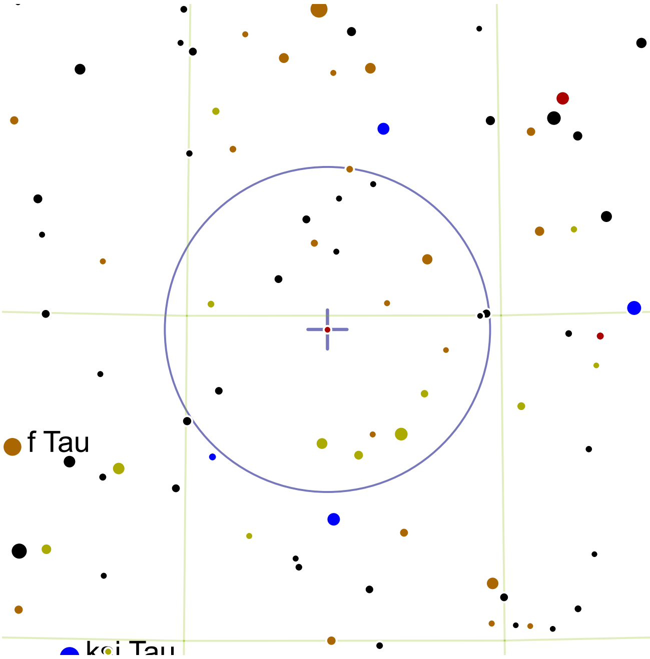
M74

RA: 24.18° | 1h 36.7' — DEC: 15.78° | 15° 47'

M74 (NGC 628) is a magnitude 9.4 spiral galaxy. Angular size is 10'.

1.3° NEE from mag.3.72 Al'farg.

A face-on grand design spiral galaxy, this object has a very low surface brightness and even larger telescopes struggle to reveal its two spiral arms, which are however clearly defined in photographs.



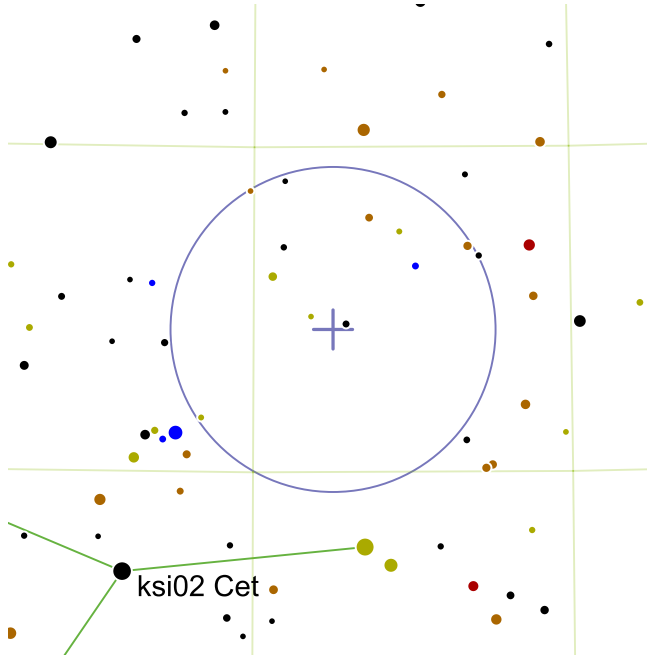
U Ari

RA: 47.76° | 3h 11.05' — DEC: 14.8° | 14° 48'

U Ari (HD 19737) is a magnitude 7.2 variable star. Magnitude ranges from 15.2 to 7.2 (Δ mag. 8.0) with a period of 371d.

Forms a parallel zig-zag with Aldebaran, the Pleiades and Hamal.

This Mira-type variable is over 3,300 light-years from Earth.



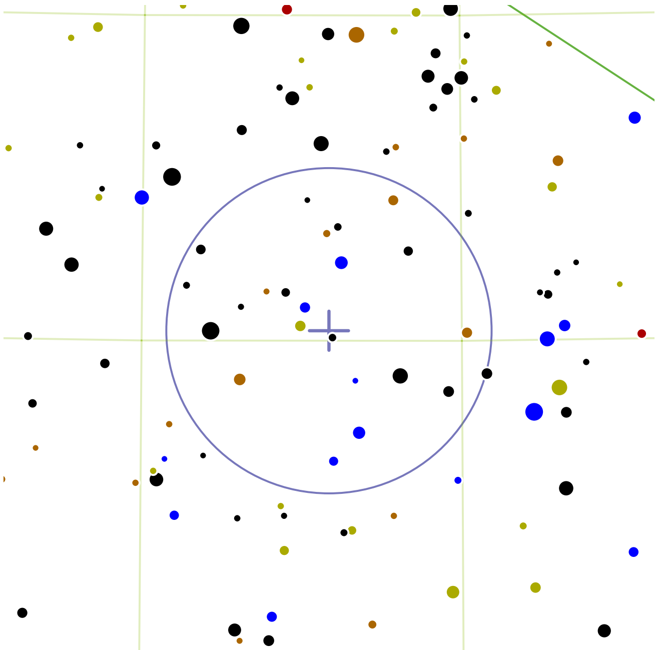
V Ari

RA: 33.75° | 2h 15.0' — DEC: 12.2° | 12° 12'

V Ari (HD 13826) is a magnitude 8.0 carbon star. Magnitude ranges from 8.6 to 8.0 (Δ mag. 0.6) with a period of 75d.

9.8° SSE from mag.2.72 Sheratan.

With a moderate B-V color index of 2.11, this isn't one of the reddest carbon stars. It is an innately bright object with an absolute magnitude of -2.07, dimmed by its great distance of roughly 4235 light-years.

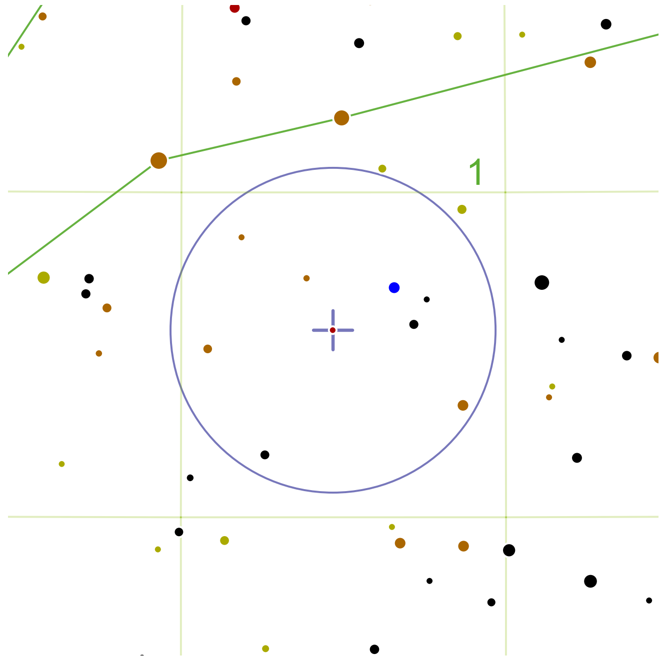


R Tau

RA: 67.08° | 4h 28.3' — DEC: 10.16° | 10° 10'

R Tau (HD 028309) is a magnitude 7.6 variable star. Magnitude ranges from 15.8 to 7.6 (Δ mag. 8.2) with a period of 321d.

5.7° S from mag.3.62 the02 Tau.



R Psc

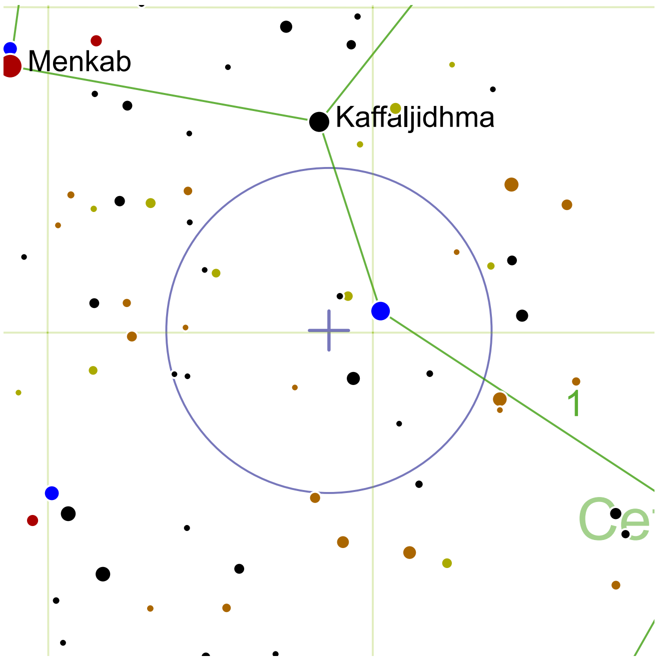
RA: 22.66° | 1h 30.64' — DEC: 2.88° | 2° 53'

R Psc (HD 009203) is a magnitude 7.0 variable star. Magnitude ranges from 14.8 to 7.0 (Δ mag. 7.8) with a period of 345d.

11.1° N from mag.3.83 the Cet.

This Mira-type variable is 1,853 light-years from Earth.

Also visible:
(1) NGC 488 *(11.15$_m$ barred spiral galaxy)*



M77

RA: 40.67° | 2h 42.69' — DEC: 0.03° | 0° 2'

M77 (NGC 1068) is a magnitude 8.9 spiral galaxy. Angular size is 7x6'.

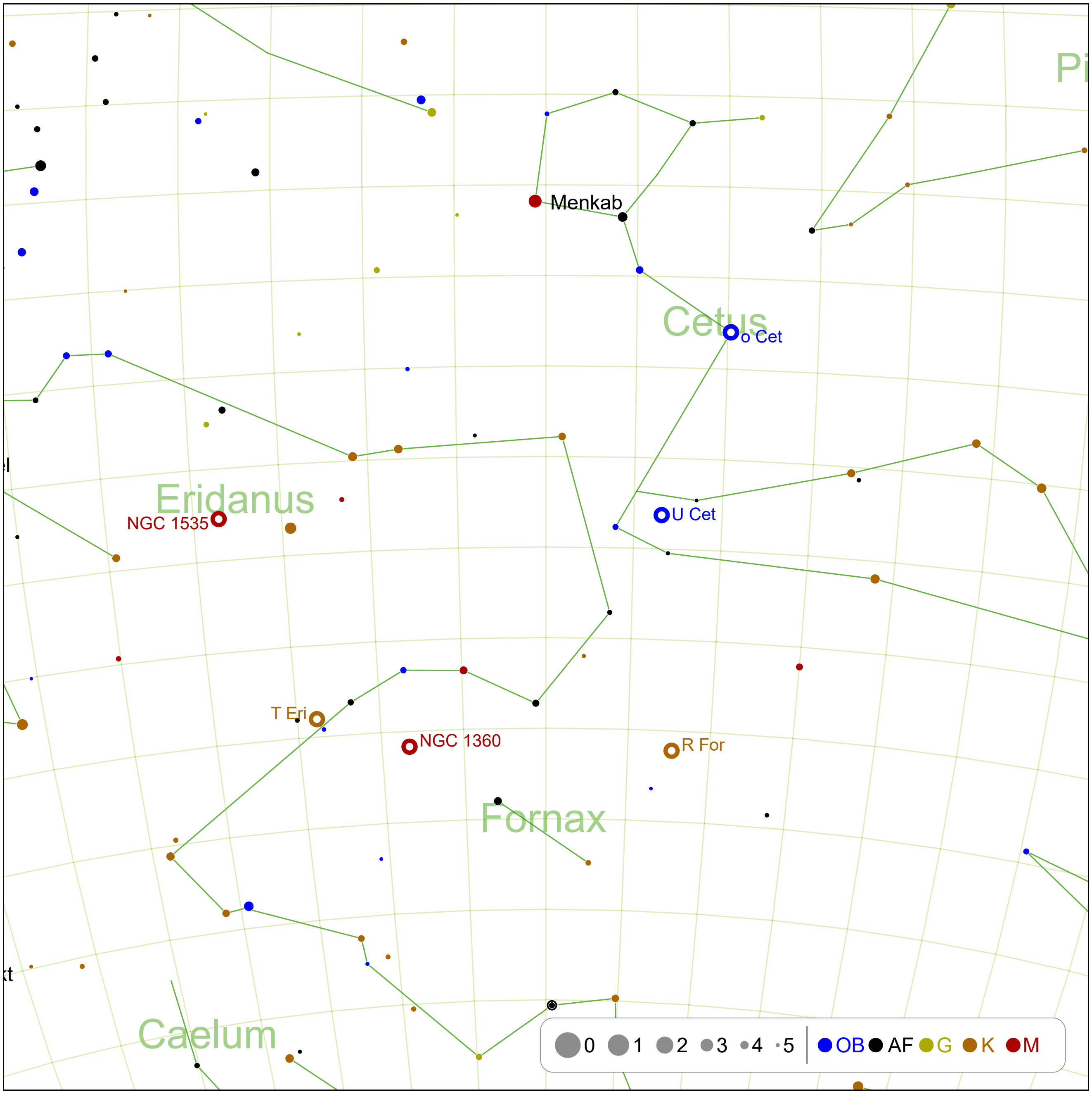
3.2° S from mag.3.58 Kaffaljidhma.

Messier 77 is one of the closest type 2 Seyfert galaxies, and is accordingly well-studied. Type 2 Seyfert galaxies have an active core that is thought to be veiled from sight by intervening clouds of dust.

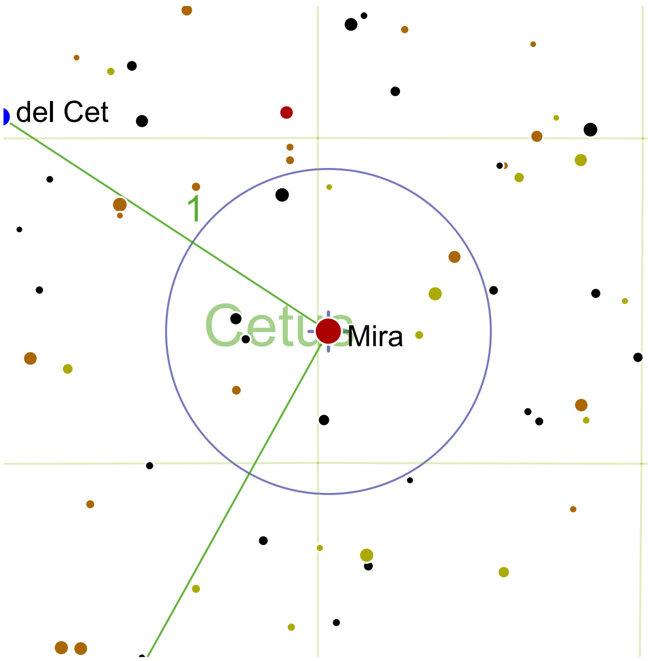
Also visible:

(1) NGC 936 *(11.12$_m$ lenticular galaxy)*

November: -15° South



o Cet: page 96 U Cet: page 96 NGC 1535: page 97 T Eri: page 97
NGC 1360: page 98 R For: page 98



o Cet

RA: 34.84° | 2h 19.34' — DEC: -2.98° | -2° 58'

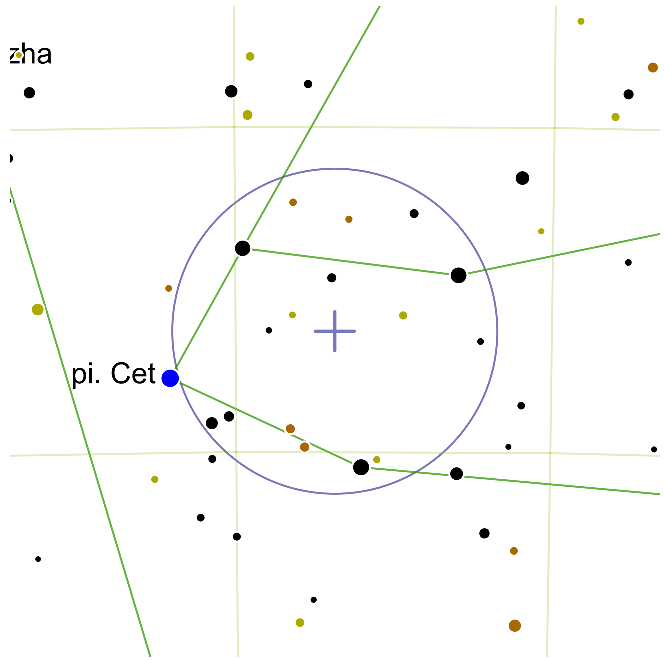
o Cet (Mira, HD 14386) is a magnitude 2.0 variable star. Magnitude ranges from 10.1 to 2.0 (Δ mag. 8.1) with a period of 332d.

At it brightest, a comfortable naked-eye target.

The first periodic variable star to be discovered, Mira's changeful nature was first observed by David Fabricius in 1596. Although it dims by a factor of around 600 in the visible spectrum, a lot of this energy is nevertheless radiated in the infrared spectrum instead. In infrared, Mira only varies by 2 magnitudes. It spends one third of its cycle brightening, and two-thirds fading. Mira is very close, only 200-400 light-years from Earth.

Also visible:

(1) NGC 936 *(11.12$_m$ lenticular galaxy)*



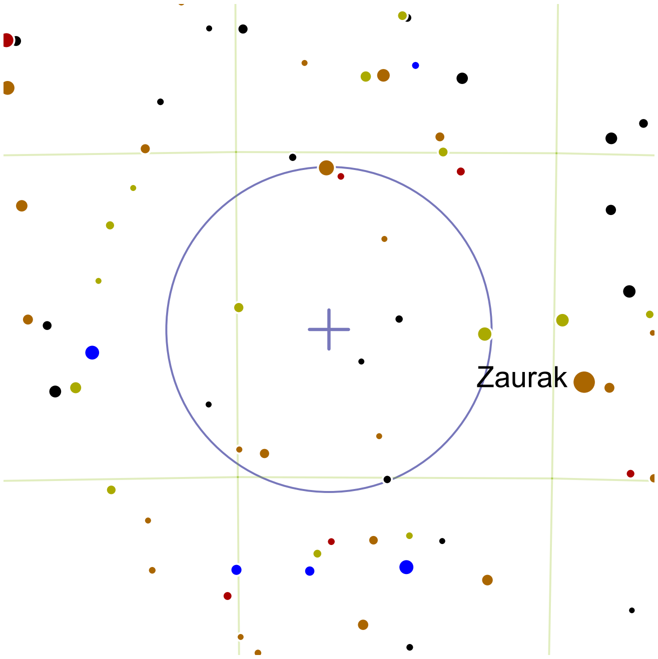
U Cet

RA: 38.43° | 2h 33.72' — DEC: -13.15° | -13° 8'

U Cet (HD 15971) is a magnitude 6.8 variable star. Magnitude ranges from 13.4 to 6.8 (Δ mag. 6.6) with a period of 235d.

10.7° SEE from mag.3.92 Baten Kaitos.

This red giant is 4,000 light years from Earth.



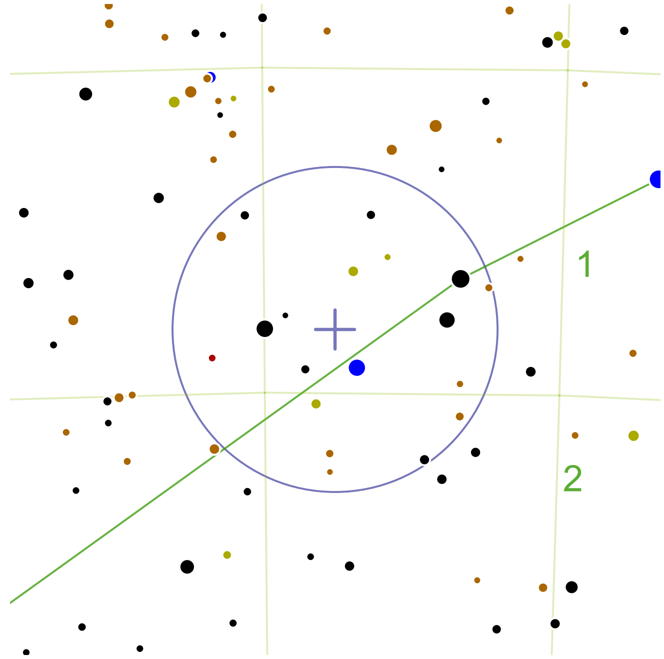
NGC 1535

RA: 63.55° | 4h 14.19' — DEC: -12.73° | -12° 43'

NGC 1535 (Cleopatra's Eye Nebula) is a magnitude 9.5 planetary nebula. Angular size is 18". The central star is magnitude 12.2.

4.0° E from mag.3.19 Zaurak.

This faint planetary nebula is relatively remote at 5,500 to 7,500 light-years distance, five times more distant than the first planetary to be discovered, Messier 27.



T Eri

RA: 58.81° | 3h 55.23' — DEC: -24.03° | -24° 1'

T Eri (HD 024754) is a magnitude 7.2 variable star. Magnitude ranges from 13.2 to 7.2 (Δ mag. 6.0) with a period of 252d.

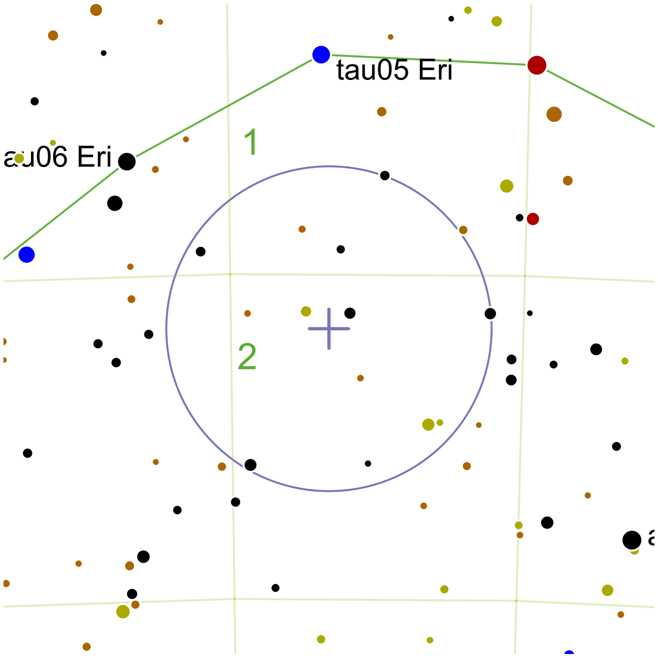
8.5° SEE from mag.3.95 tau04 Eri.

5,000 to 7,000 light years from Earth, this red giant has spectral class M5/6IIIe.

Also visible:

(1) NGC 1395 *(10.55$_m$ elliptical galaxy)*

(2) NGC 1398 *(10.57$_m$ barred spiral galaxy)*



NGC 1360

RA: 53.33° | 3h 33.3' — DEC: -25.85° | -25° 50'

NGC 1360 (Robin's Egg Nebula) is a magnitude 9.5 planetary nebula. Angular size is 380". The central star is magnitude 11.4.

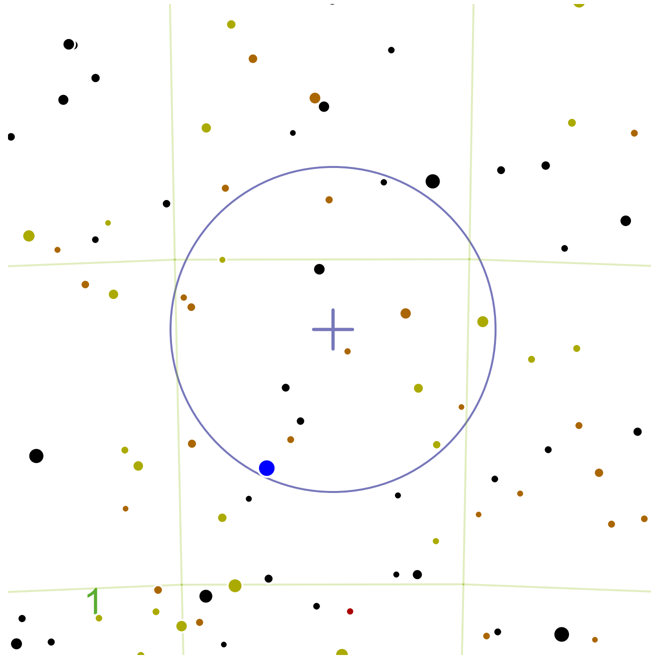
5.1° SE from mag.3.95 tau04 Eri.

This planetary nebula has an interesting pair of stars in its center: a white dwarf (as is usual for a planetary nebula) and a subdwarf O-type star, about half the mass of the Sun but somewhat brighter. The subdwarf O-type star is composed of a dense carbon-oxygen core surrounded by a helium burning shell. The atmosphere of the star is highly enriched in helium (or depleted in hydrogen).

Also visible:

(1) NGC 1395 *(10.55$_m$ elliptical galaxy)*

(2) NGC 1398 *(10.57$_m$ barred spiral galaxy)*



R For

RA: 37.31° | 2h 29.25' — DEC: -26.1° | -26° 5'

R For (HIP 011582) is a magnitude 7.5 variable star. Magnitude ranges from 13.0 to 7.5 (Δ mag. 5.5) with a period of 389d.

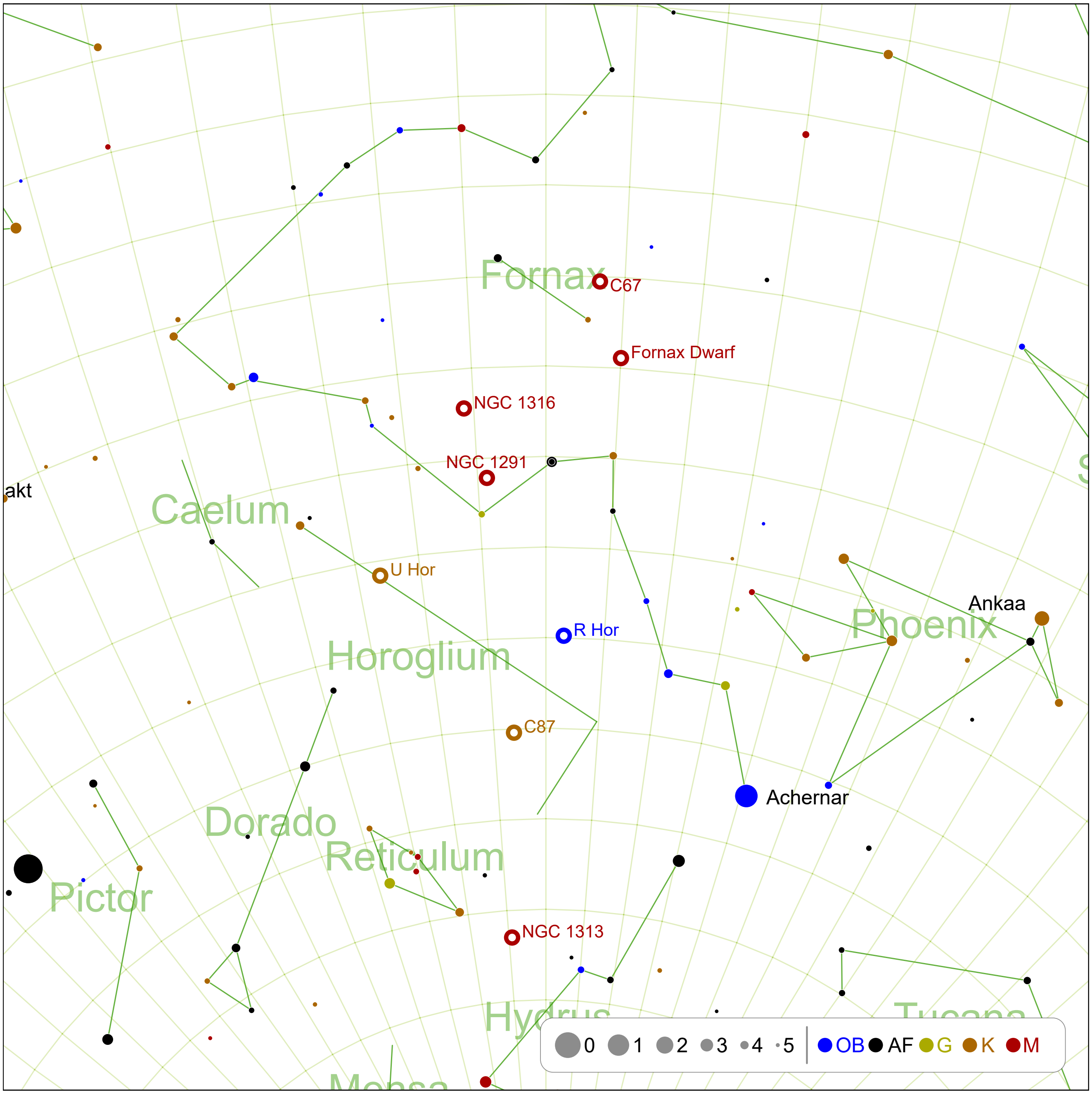
9.9° NWW from mag.3.95 alf For.

Two degrees to the northwest is the faint galaxy NGC 922 (magnitude 12.21). The star has the spectral class of C4,3e indicating it is a carbon star, but it has a low B-V color index of 1.61, so it is only moderately red. The star is roughly 2,000 light years from Earth.

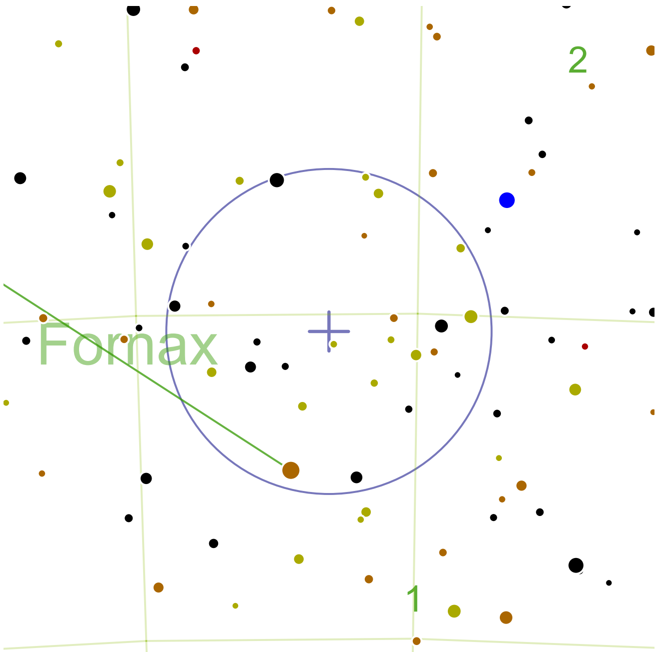
Also visible:

(1) C67 *(9.2$_m$ barred spiral galaxy)*

November: -45° South



C67: page 100	Fornax Dwarf: page 100	NGC 1316: page 101	NGC 1291: page 101
U Hor: page 102	R Hor: page 102	C87: page 103	NGC 1313: page 103



C67

RA: 41.58° | 2h 46.3' — DEC: -30.28° | -30° 16'

C67 (NGC 1097) is a magnitude 9.2 barred spiral galaxy. Angular size is 9x6'.

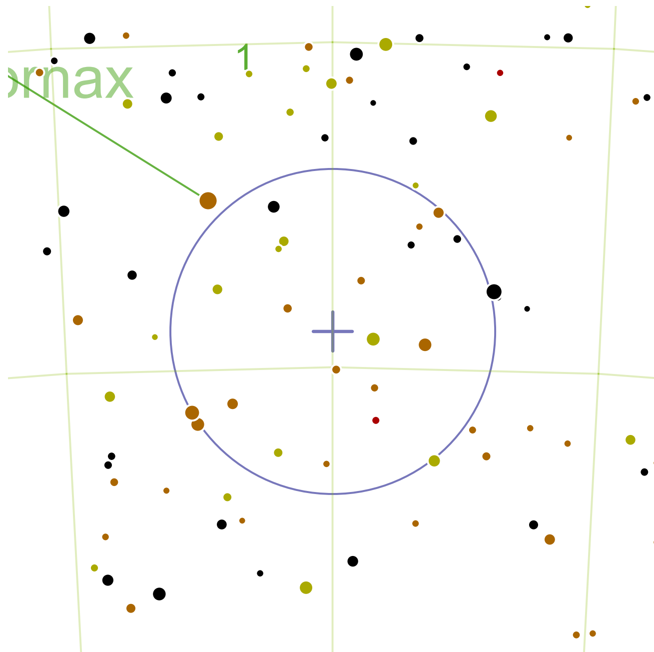
5.7° SWW from mag.3.95 alf For.

While the galaxy's core is bright and easy to observe, the spiral arms are much fainter.

Also visible:

(1) Fornax Dwarf *(9.3$_m$ irregular galaxy)*

(2) R For *(7.5$_m$ variable star)*



Fornax Dwarf

RA: 39.99° | 2h 39.97' — DEC: -34.45° | -34° 26'

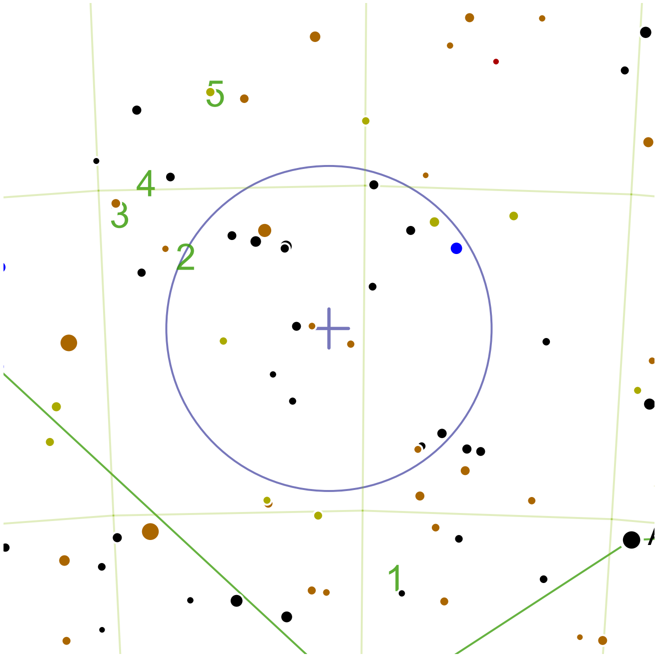
Fornax Dwarf is a magnitude 9.3 irregular galaxy. Angular size is 17'.

6.8° NNW from mag.3.42 Acamar.

Only discovered in 1938 in South Africa from photographic plates, this inconsequential satellite of the Milky Way is virtually invisible. It possesses six globular clusters, and one of these, NGC 1049, was discovered by John Herschel over a century before the parent galaxy was detected.

Also visible:

(1) C67 *(9.2$_m$ barred spiral galaxy)*



NGC 1316

RA: 50.68° | 3h 22.69' — DEC: -37.2° | -37° 11'

NGC 1316 is a magnitude 9.42 lenticular galaxy. Angular size is 12'.

5.6° NEE from mag.3.42 Acamar.

This lenticular galaxy is a respectable 60 million light-years from Earth, and despite the distance still managed to be the fourth-brightest radio sources in the sky. Since 1980, NGC 1316 has hosted four supernovae.

Also visible:

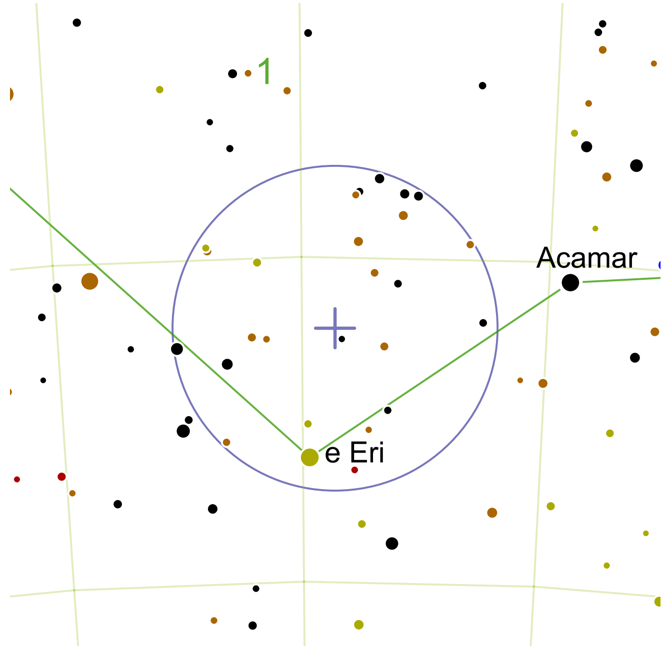
(1) NGC 1291 *(9.39$_m$ barred spiral galaxy)*

(2) NGC 1365 *(10.32$_m$ barred spiral galaxy)*

(3) NGC 1399 *(10.55$_m$ elliptical galaxy)*

(4) NGC 1380 *(10.87$_m$ lenticular galaxy)*

(5) NGC 1350 *(11.16$_m$ barred spiral galaxy)*



NGC 1291

RA: 49.33° | 3h 17.3' — DEC: -41.1° | -41° 5'

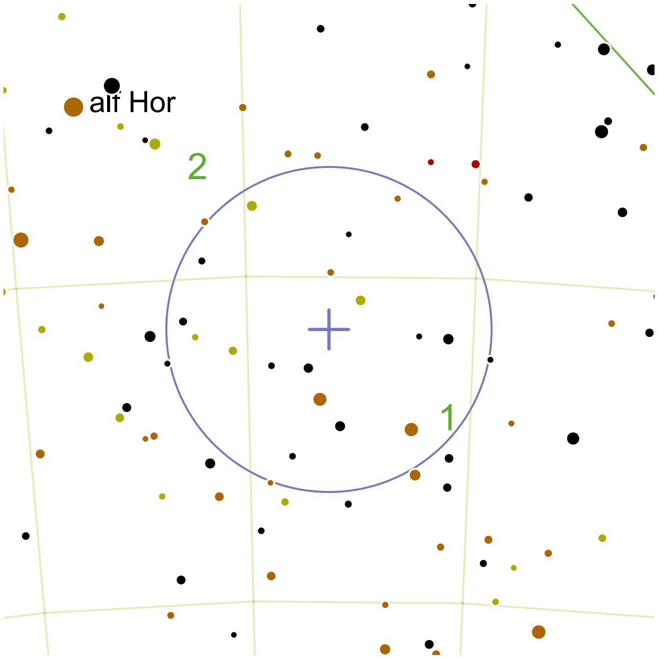
NGC 1291 is a magnitude 9.39 barred spiral galaxy. Angular size is 10'.

3.6° SEE from mag.3.42 Acamar.

This galaxy has a relatively bright, elongated core encircled by a dim ring with twice the diameter. If you spot this one, you can cross two NGCs off your list as it is also cataloged as NGC 1269.

Also visible:

(1) NGC 1316 *(9.42$_m$ lenticular galaxy)*



U Hor

RA: 58.2° | 3h 52.78' — DEC: -45.83° | -45° 49'

U Hor (HD 024607) is a magnitude 7.8 variable star. Magnitude ranges from 15.1 to 7.8 (Δ mag. 7.3) with a period of 348d.

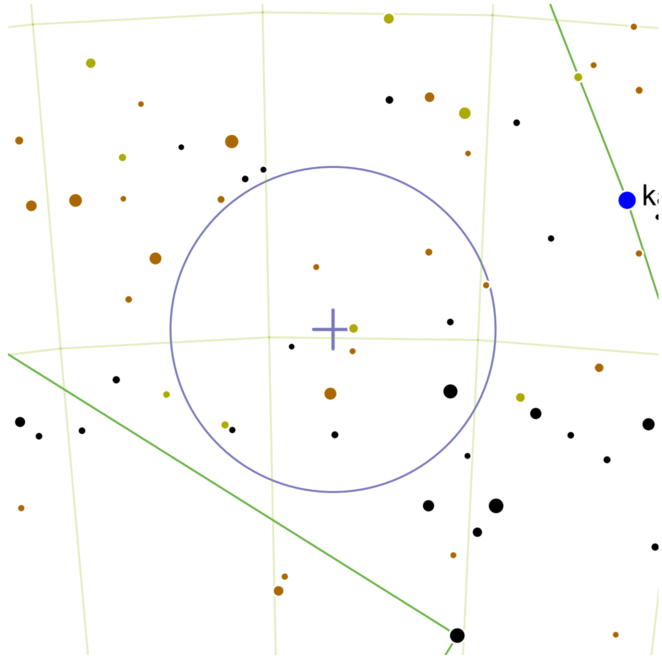
5.2° SW from mag.3.83 alf Hor.

On the south-western edge of the finder circle, you can find the barred spiral galaxy NGC 1433 (magnitude 10).

Also visible:

(1) NGC 1433 *(10.7$_m$ barred spiral galaxy)*

(2) NGC 1512 *(11.13$_m$ barred spiral galaxy)*



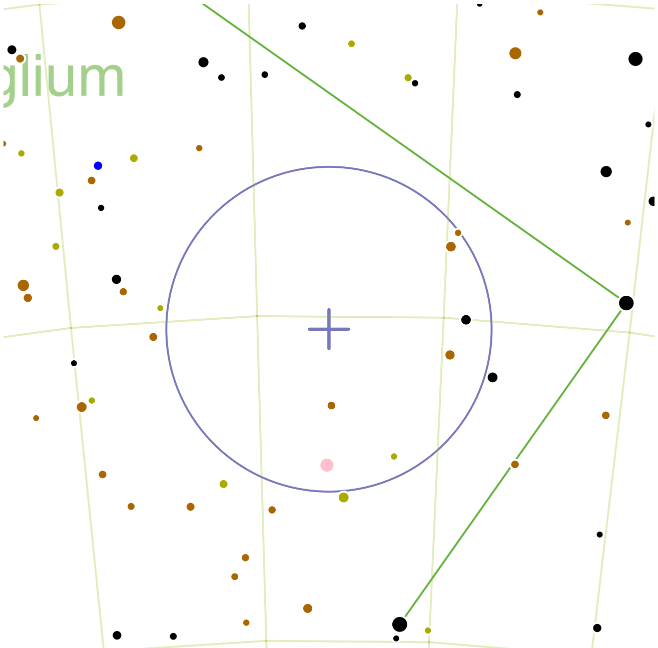
R Hor

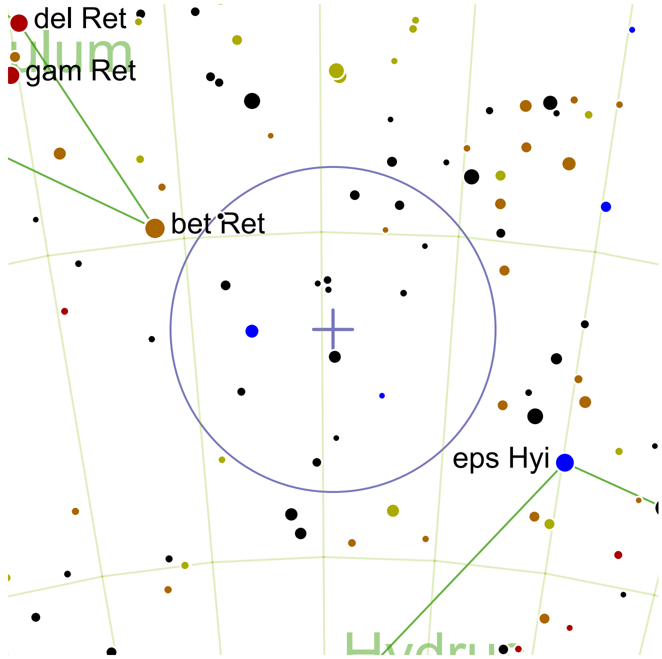
RA: 43.47° | 2h 53.87' — DEC: -49.89° | -49° 52'

R Hor (HD 018242) is a magnitude 4.7 variable star. Magnitude ranges from 14.3 to 4.7 (Δ mag. 9.6) with a period of 408d.

6.1° NEE from mag.3.78 phi Eri.

With a range from magnitude 4.7 to 14.3, R Horologii has one of the largest brightness ranges of stars visible to the unaided eye.





C87

RA: 48.08° | 3h 12.3' — DEC: -55.22° | -55° 12'

C87 (NGC 1261) is a magnitude 8.4 globular cluster. Angular size is 7'.

9.0° SEE from mag.3.78 phi Eri.

The globular cluster is quite distant at 50,000 light-years. Consequently it is dimmer and its member stars are exceedingly faint and unresolvable in anything but the most massive amateur telescopes.

NGC 1313

RA: 49.58° | 3h 18.3' — DEC: -66.5° | -66° 29'

NGC 1313 is a magnitude 9.2 barred spiral galaxy. Angular size is 9'.

3.1° SW from mag.3.8 bet Ret.

Also known as the Topsy Turvy Galaxy, NGC 1313 is a field galaxy, which means it is not part of a galaxy group. It has a diameter of 50,000 light years and is 12.9 million light-years from Earth.

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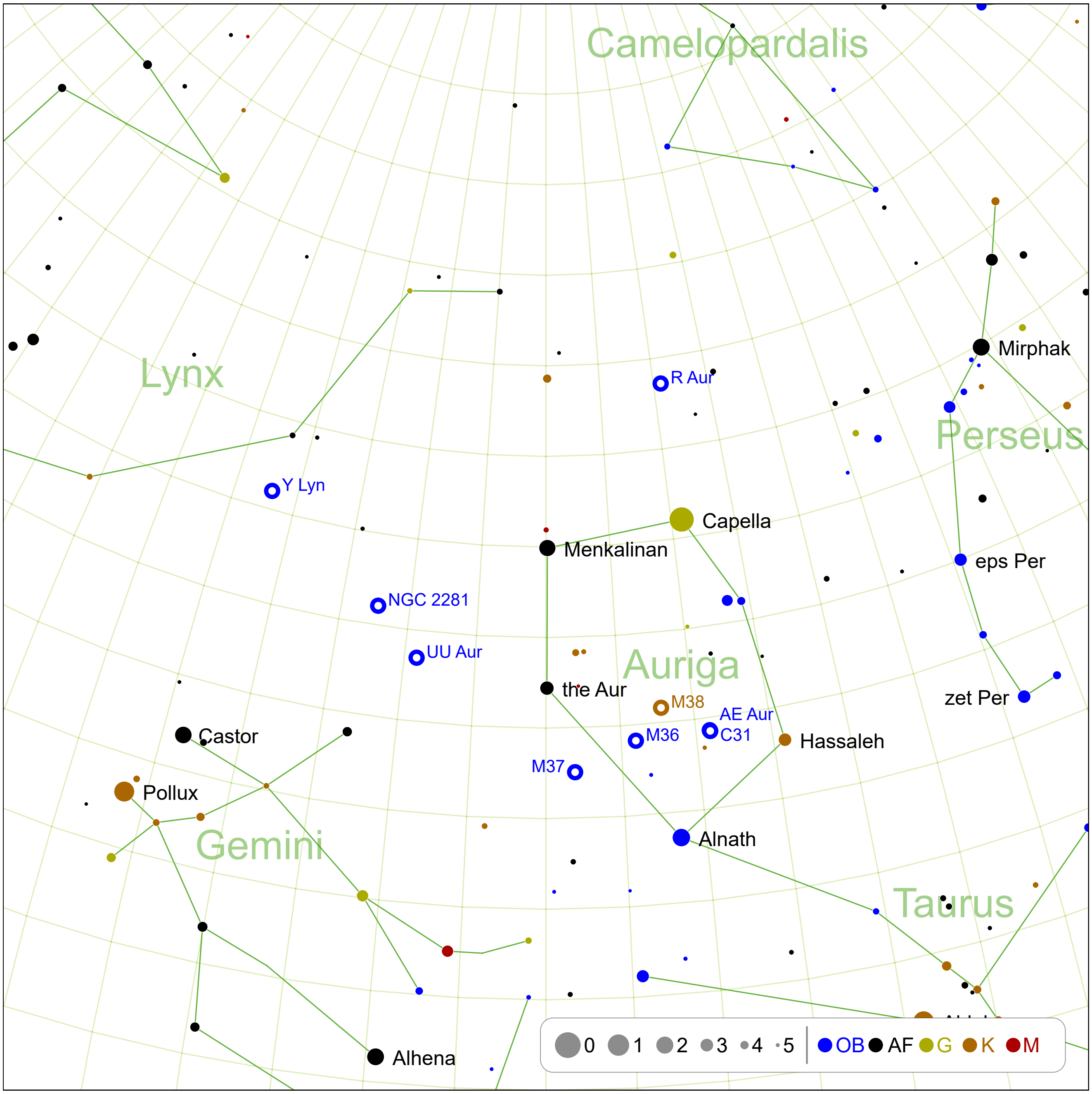
December: 45° North



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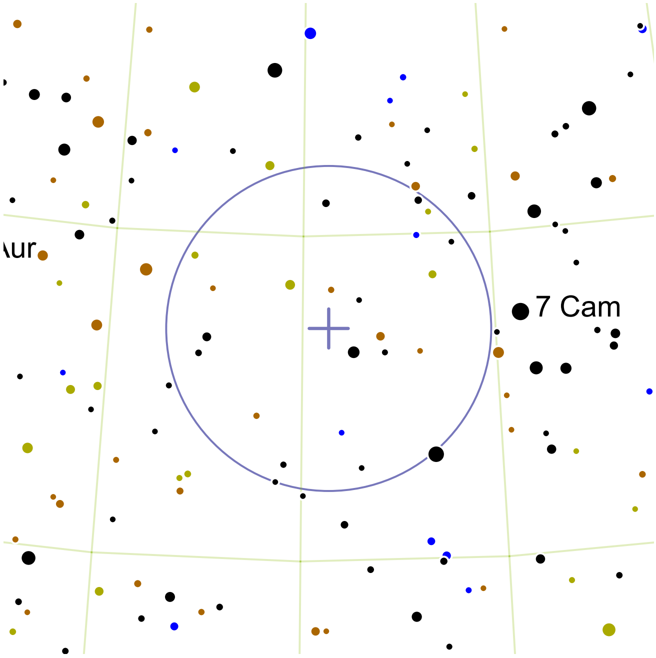
Y Lyn: page 106
NGC 2281: page 107
UU Aur: page 107
M38: page 108
AE Aur: page 108
C31: page 109
M36: page 109
M37: page 110



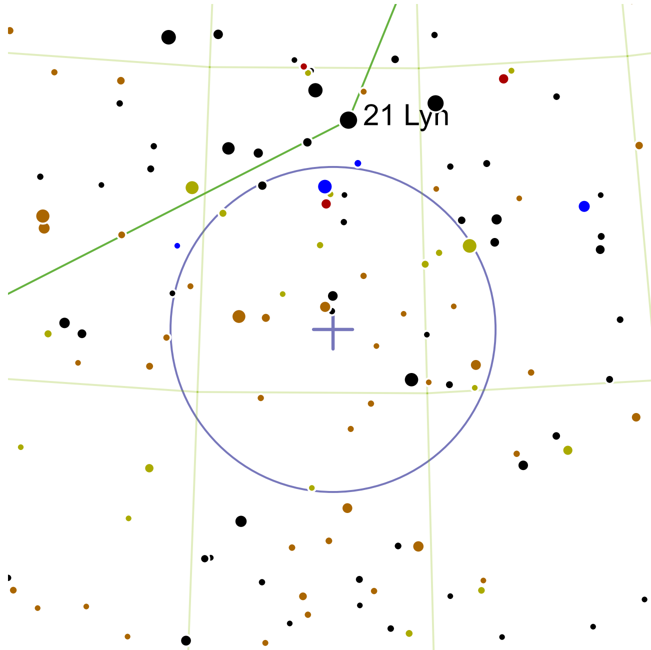
R Aur

RA: 79.32° | 5h 17.29' — DEC: 53.59° | 53° 35'

R Aur (HD 34019) is a magnitude 6.7 variable star. Magnitude ranges from 13.9 to 6.7 (Δ mag. 7.2) with a period of 458d.

6.2° W from mag.3.88 del Aur.

The moderately red variable is also a double star, with a faint magnitude 10.1 companion separated by 45.1" at position angle 53°.

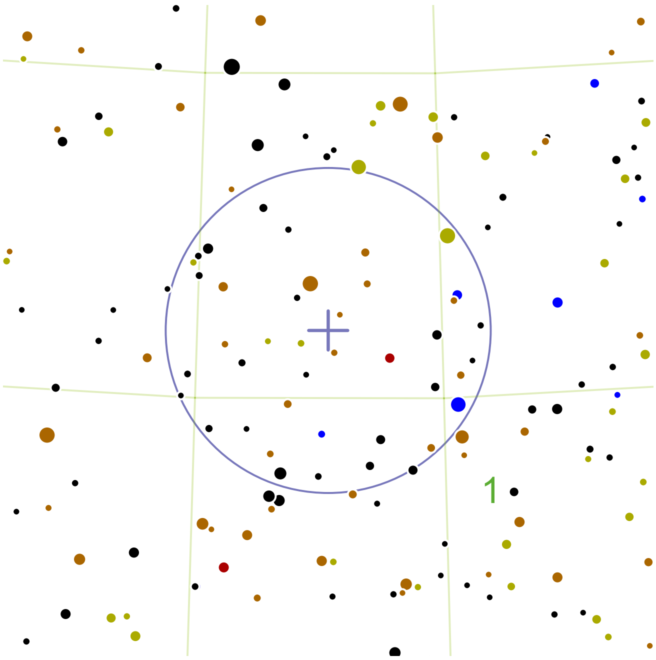


Y Lyn

RA: 112.05° | 7h 28.19' — DEC: 46.0° | 46° 0'

Y Lyn (HD 58521) is a magnitude 6.9 carbon star. Magnitude ranges from 7.5 to 6.9 (Δ mag. 0.6) with a period of 110d.

13.7° NNE from mag.3.64 the Gem.



NGC 2281

RA: 102.33° | 6h 49.3' — DEC: 41.07° | 41° 4'

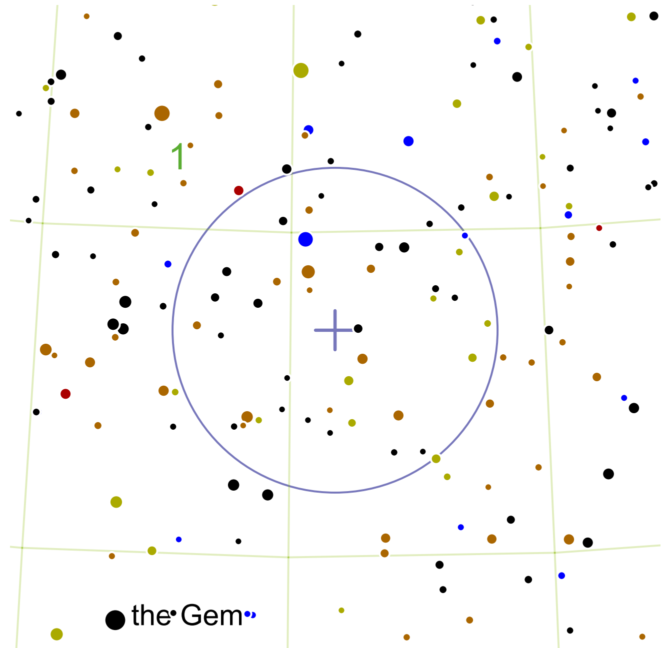
NGC 2281 is a magnitude 5.4 open cluster. Angular size is 15'.

7.1° N from mag.3.64 the Gem.

A bright, concentrated open cluster, with member stars ranging widely in brightness. The double star Psi7 Aurigae is one degree to the north east (magnitudes 5.1 and 10.9; separation 43"; position angle 90°).

Also visible:

(1) UU Aur *(5.1$_m$ carbon star)*



UU Aur

RA: 99.13° | 6h 36.5' — DEC: 38.5° | 38° 30'

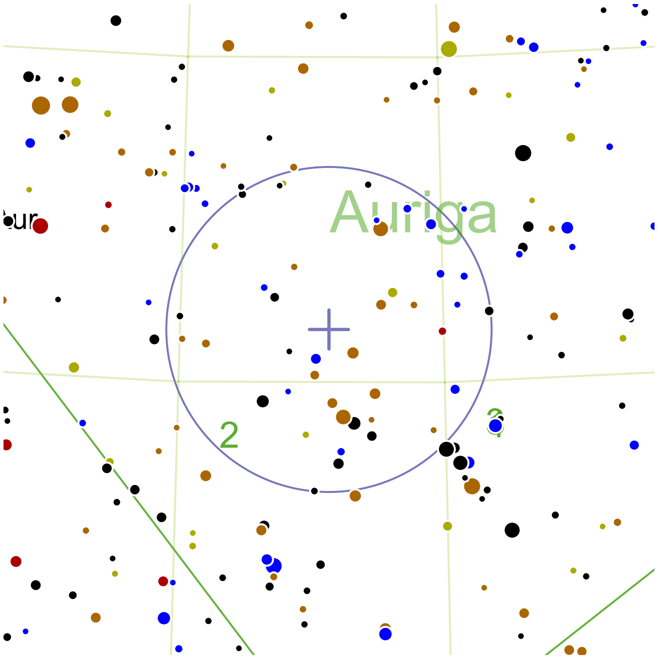
UU Aur (HD 46687) is a magnitude 5.1 carbon star. Magnitude ranges from 7.0 to 5.1 (Δ mag. 1.9) with a period of 235d.

On a line between Capella and Pollux, slightly closer to Capella.

UU Aurigae is an interesting star, being a variable star, a carbon star and a double star. With a color index of 2.78 and spectral class of C5II, the star is intensely red. It has a moderate brightness range of just over two magnitudes but even at its faintest it remains bright enough to show in small telescopes. It has a faint magnitude 11.8 companion separated by 117" at position angle 223°.

Also visible:

(1) NGC 2281 *(5.4$_m$ open cluster)*



M38

RA: 82.18° | 5h 28.69' — DEC: 35.83° | 35° 50'

M38 (NGC 1912) is a magnitude 7.4 open cluster. Angular size is 21'.

6.3° W from mag.2.71 the Aur.

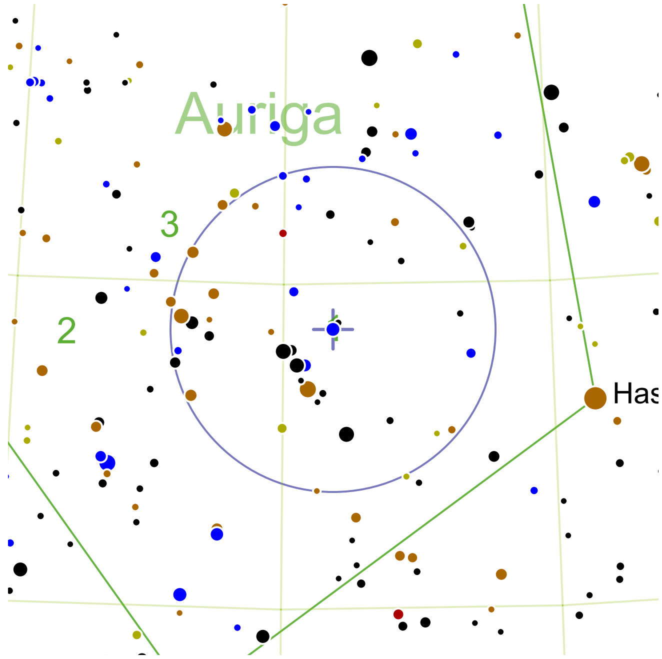
Discovered by Giovanni Batista Hodierna before 1654, this 250 million year old cluster is 3,480 light-years from Earth. It is my personal favorite of all the wonderful Auriga clusters.

Also visible:

(1) C31 *(6.0$_m$ bright nebula)*

(2) M36 *(6.3$_m$ open cluster)*

(3) AE Aur *(5.78$_m$ variable star)*



AE Aur

RA: 79.08° | 5h 16.3' — DEC: 34.31° | 34° 19'

AE Aur (HD 4078) is a magnitude 5.78 variable star. Magnitude ranges from 6.08 to 5.78 (Δ mag. 0.3).

4.1° NEE from mag.2.9 Hassaleh.

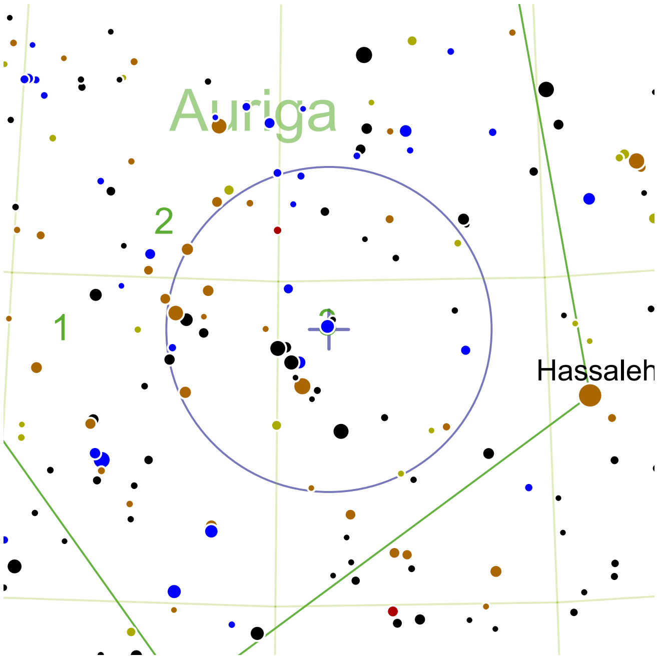
This eruptive blue variable star lights the appropriately named Flaming Star Nebula (Caldwell 31). The magnitude range of 0.3 is hardly to be seen, but magnitude 5.9 HIP 25471 is two degrees to the east, marking the midpoint of this star's brightness range.

Also visible:

(1) C31 *(6.0$_m$ bright nebula)*

(2) M36 *(6.3$_m$ open cluster)*

(3) M38 *(7.4$_m$ open cluster)*



C31

RA: 79.05° | 5h 16.19' — DEC: 34.27° | 34° 16'

C31 (Flaming Star Nebula, IC 405) is a magnitude 6.0 bright nebula. Angular size is 30x19'.

4.1° NEE from mag.2.9 Hassaleh.

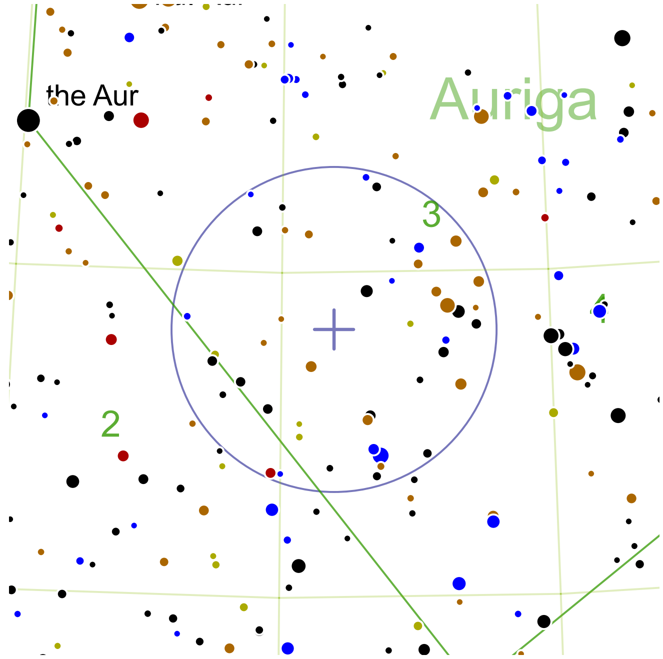
The Flaming Star nebula is dominated by its eponymous stellar component which is surrounded a by a whorling halo of glowing gas and dust. The central star, AE Aurigae, originates from Orion's Belt.

Also visible:

(1) M36 *(6.3$_m$ open cluster)*

(2) M38 *(7.4$_m$ open cluster)*

(3) AE Aur *(5.78$_m$ variable star)*



M36

RA: 84.03° | 5h 36.1' — DEC: 34.13° | 34° 8'

M36 (NGC 1960) is a magnitude 6.3 open cluster. Angular size is 12'.

5.6° SWW from mag.2.71 the Aur.

This bright open cluster is a more distant analog of the more famous Pleiades. It can be aged at around 22 million years based on the stars which have not yet consumed their lithium supplies. In a small telescope, the cluster is quite sparse as only ten stars are brighter than tenth magnitude.

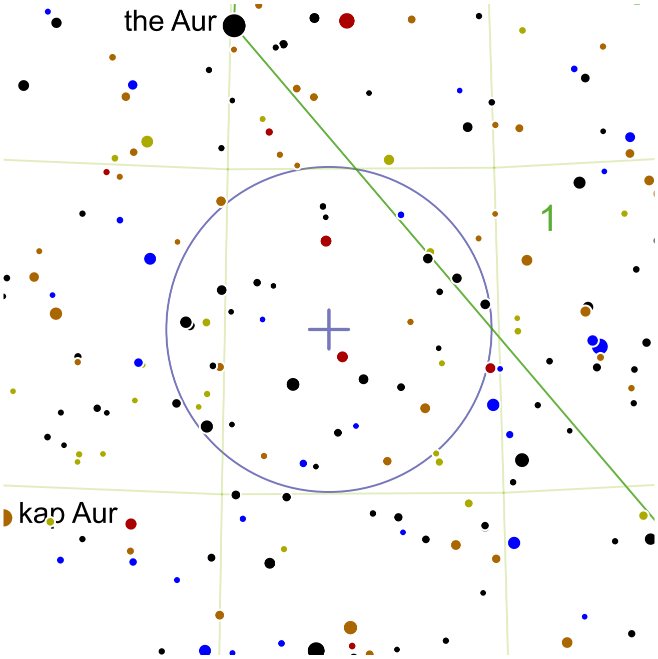
Also visible:

(1) C31 *(6.0$_m$ bright nebula)*

(2) M37 *(6.2$_m$ open cluster)*

(3) M38 *(7.4$_m$ open cluster)*

(4) AE Aur *(5.78$_m$ variable star)*



M37

RA: 88.1° | 5h 52.39' — DEC: 32.55° | 32° 33'

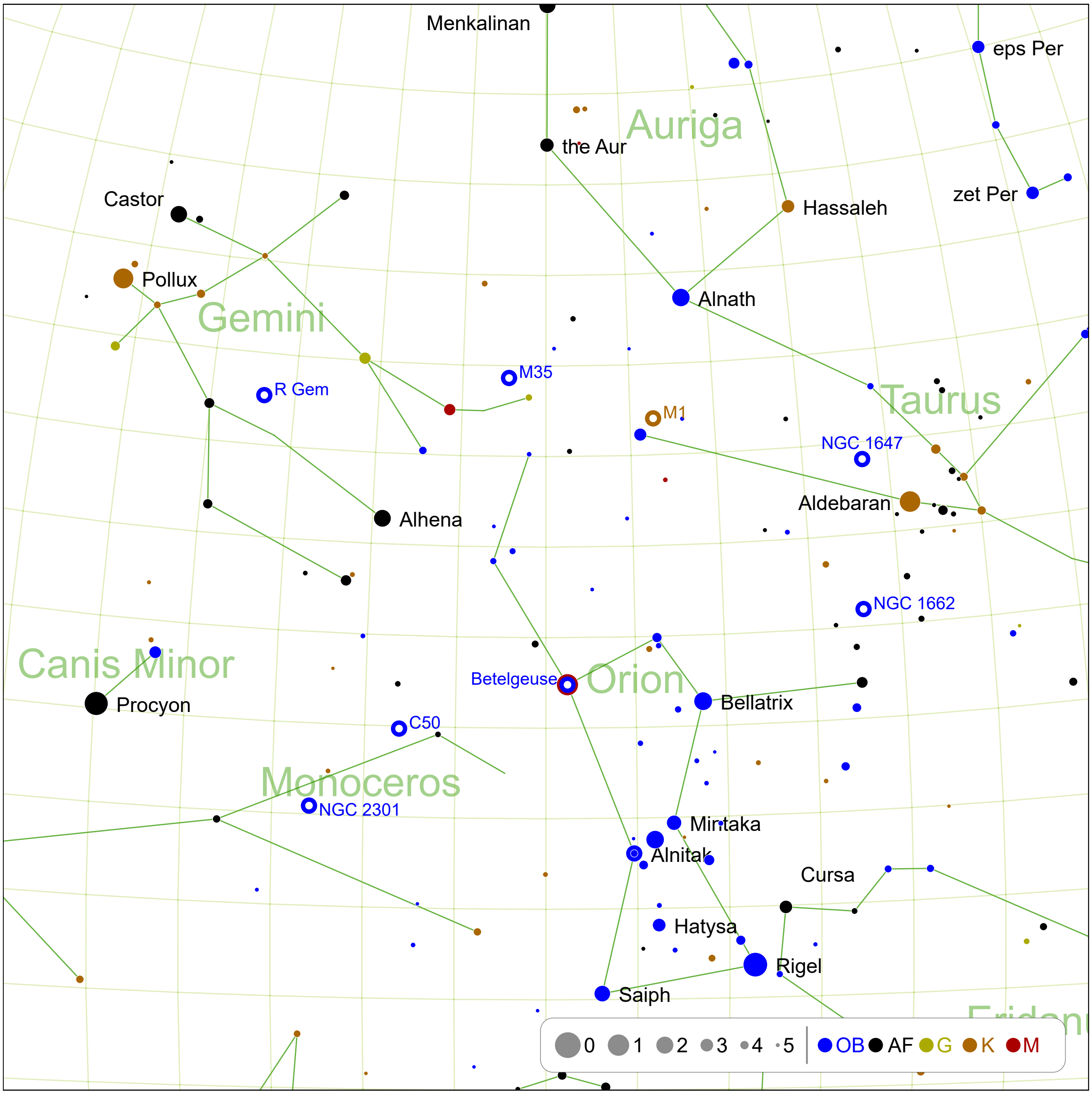
M37 (NGC 2099) is a magnitude 6.2 open cluster. Angular size is 24'.

4.8° SSW from mag.2.71 the Aur.

The brightest of the renowned Auriga open clusters, this cluster has 150 stars that can be visible to a small telescope from a dark site. It is at least 347 million years old, far older than M36. In total it has at least 500 member stars with the collective mass of 1,500 Suns.

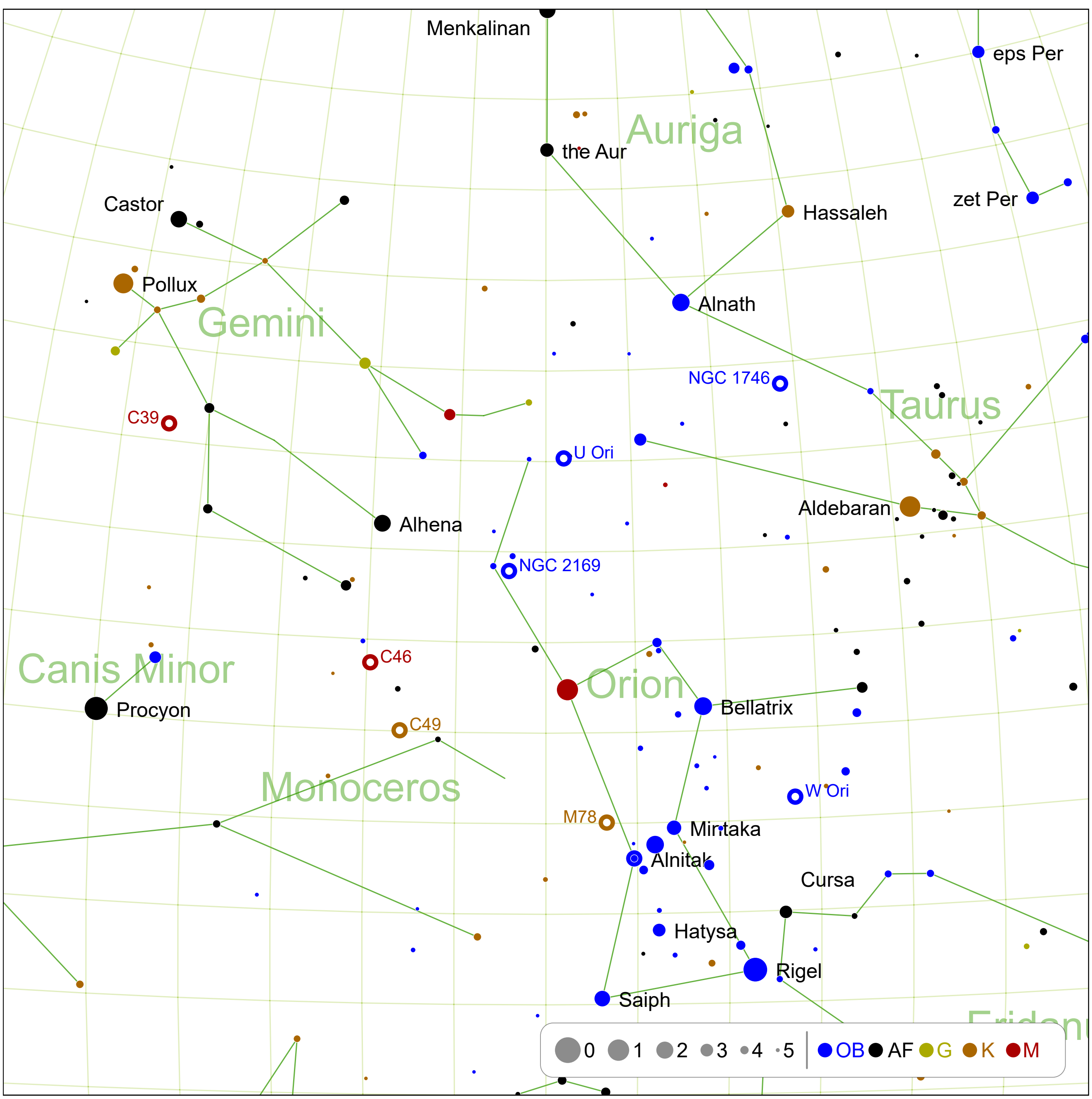
Also visible:
(1) M36 *(6.3$_m$ open cluster)*

December: 15° North (1)



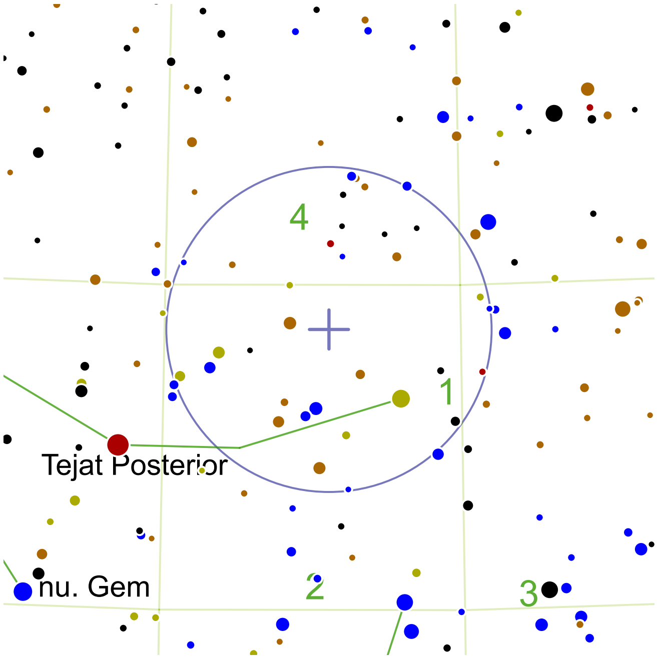
M35: page 113 | R Gem: page 113 | M1: page 114 | NGC 1647: page 114
NGC 1662: page 115 | Betelgeuse: page 115 | C50: page 116 | NGC 2301: page 116

December: 15° North (2)



NGC 1746: page 117 C39: page 117 U Ori: page 118 NGC 2169: page 118

C46: page 119 C49: page 119 W Ori: page 120 M78: page 120



M35

RA: 92.23° | 6h 8.89' — DEC: 24.33° | 24° 20'

M35 (NGC 2168) is a magnitude 5.3 open cluster. Angular size is 28'.

3.6° NWW from mag.3.19 Tejat Posterior.

This large cluster spanning half a degree is a fine sight at lower magnification in a telescope; given the delicacy of its stars it is best viewed on darker nights. It has a mass of 1,600 Suns. Less than a degree to the southwest is a smaller but denser open cluster, NGC 2158 (magnitude 8.6). Because of its compact form, NGC 2158 was initially misclassified as a globular cluster.

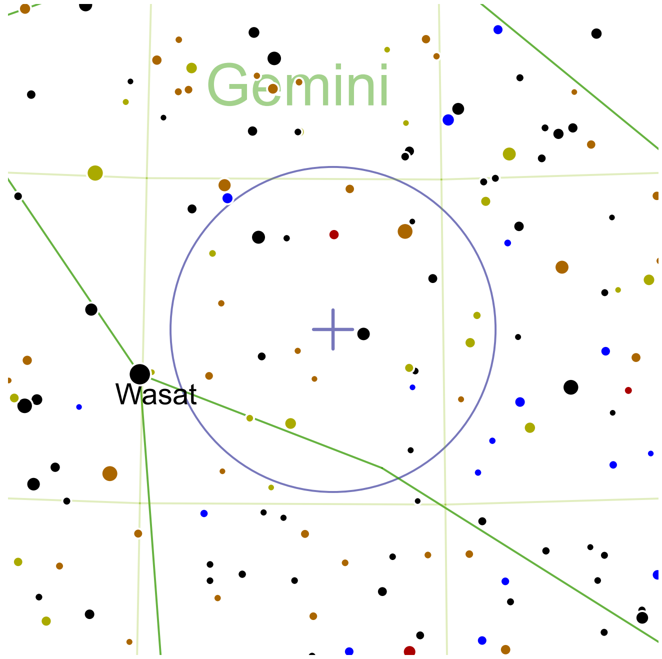
Also visible:

(1) NGC 2129 *(6.7$_m$ open cluster)*

(2) NGC 2175 *(6.8$_m$ open cluster)*

(3) U Ori *(4.8$_m$ variable star)*

(4) TU Gem *(7.5$_m$ carbon star)*



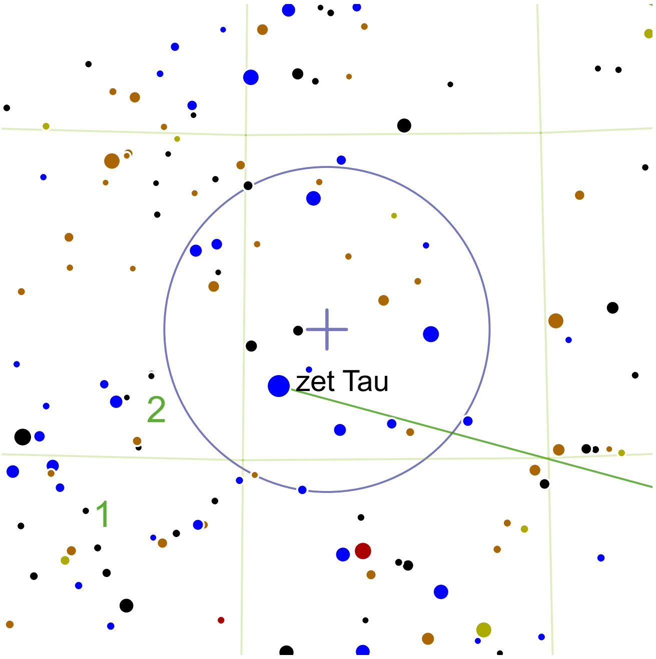
R Gem

RA: 106.84° | 7h 7.35' — DEC: 22.7° | 22° 42'

R Gem (HD 053791) is a magnitude 6.0 variable star. Magnitude ranges from 14.0 to 6.0 (Δ mag. 8.0) with a period of 370d.

3.0° NWW from mag.3.51 Wasat.

This fairly red star is a technetium star, indicating its spectrum is enriched with this radioactive element. Technetium has a half-life of 4.2 million years, which means the element was formed by nucleosynthesis in the star. Specifically heavy elements like technetium are formed by slow neutron capture (the s-process) in the boundary between shells of fusing hydrogen and helium.



M1

RA: 83.63° | 5h 34.5' — DEC: 22.02° | 22° 1'

M1 (Crab Nebula, NGC 1952) is a magnitude 8.4 supernova remnant. Angular size is 6x4'.

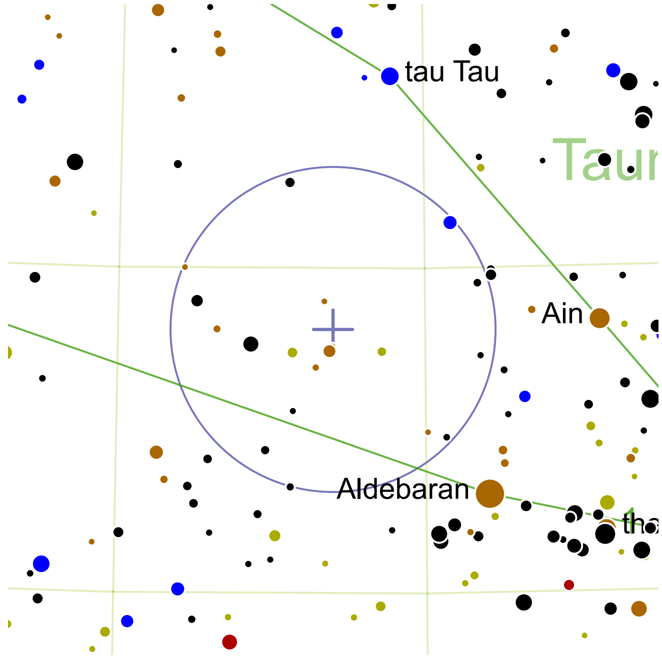
1.1° NW from mag.3.0 zet Tau.

A bright and compact supernova remnant. The star exploded in 1054. When Charles Messier rediscovered the object he initially mistook it for Halley's Comet. To avoid future errors, he decided to create his famous catalog of fuzzy patches that were not comets, and Messier 1 was naturally the first entry.

Also visible:

(1) SU Tau *(9.1$_m$ variable star)*

(2) Y Tau *(7.1$_m$ carbon star)*



NGC 1647

RA: 71.5° | 4h 46.0' — DEC: 19.07° | 19° 4'

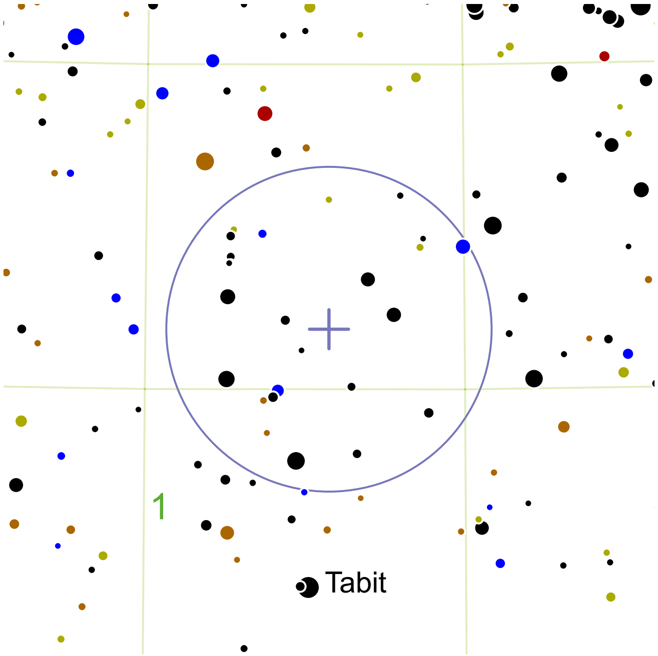
NGC 1647 is a magnitude 6.4 open cluster. Angular size is 45'.

3.4° NE from mag.1.06 Aldebaran.

150 million years old and 1,800 light-years from Earth, this cluster contains about 90 stars.

Also visible:

(1) C41 *(1.0$_m$ open cluster)*



NGC 1662

RA: 72.13° | 4h 48.5' — DEC: 10.93° | 10° 56'

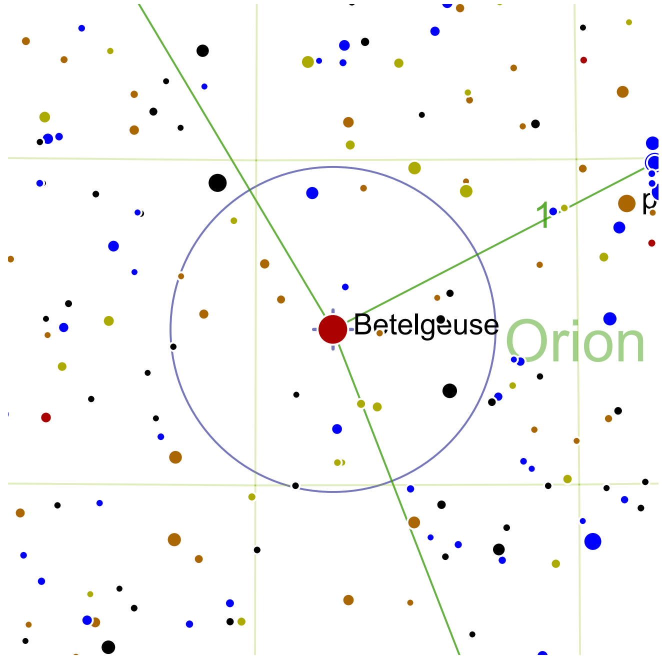
NGC 1662 is a magnitude 6.4 open cluster. Angular size is 20'.

3.9° N from mag.3.31 Tabit.

Located midway between Bellatrix and Aldebaran, this loose cluster is about 1,425 light-years from Earth.

Also visible:

(1) R Ori *(9.05$_m$ variable star)*



Betelgeuse

RA: 88.8° | 5h 55.19' — DEC: 7.4° | 7° 24'

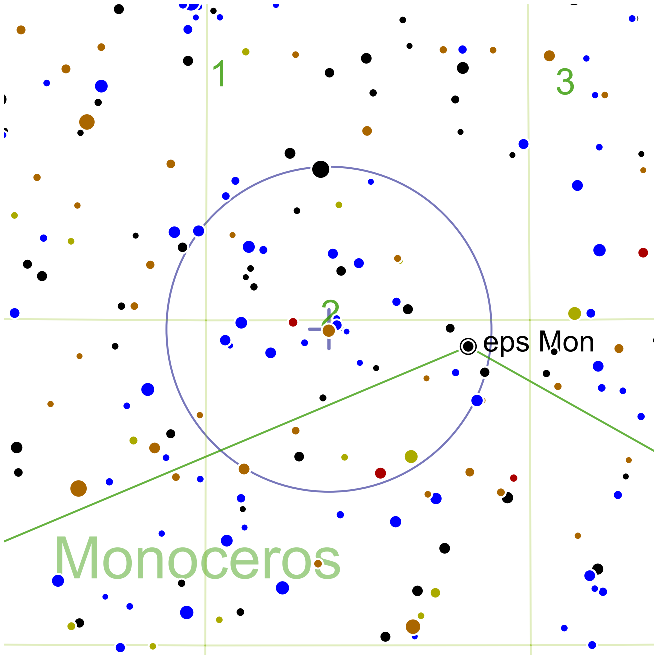
Betelgeuse (HD 39801) is a magnitude 0.4 carbon star. Magnitude ranges from 1.3 to 0.4 (Δ mag. 0.9).

0.0° SWW from mag.0.92 Betelgeuse.

While some sources list Betelgeuse as a carbon star, it does not appear to have more carbon than oxygen in its outer layers, a pre-requisite for true carbon star. It is moderately red with a B-V color index of only 1.52, but its high apparent magnitude makes the color more vivid. Betelgeuse is variable and at its dimmest is equivalent to Bellatrix, and at its brightest it slightly outshines Rigel.

Also visible:

(1) NGC 2022 *(11.5$_m$ planetary nebula)*



C50

RA: 98.1° | 6h 32.39' — DEC: 4.87° | 4° 52'

C50 (Rosette Nebula, NGC 2244) is a magnitude 4.8 open cluster. Angular size is 24'.

Two and a half finder circles east and slightly south of Betelgeuse.

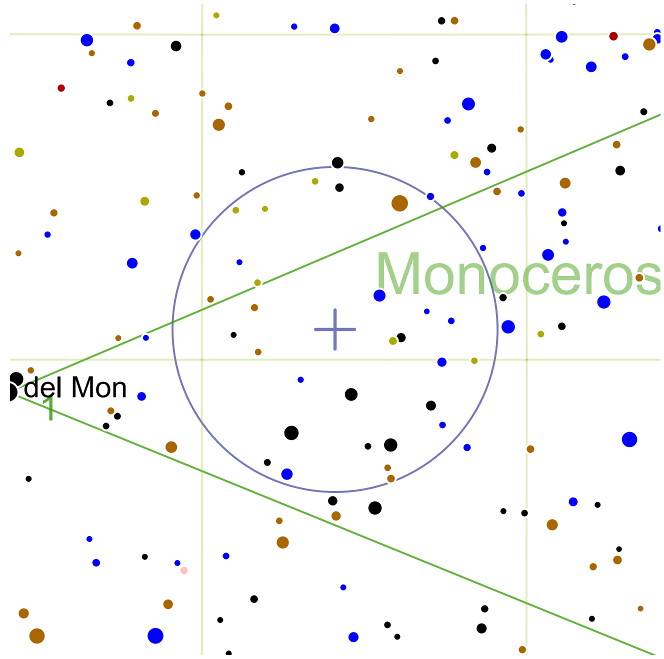
This extremely young star cluster has not drifted away from it's surrounding nebulosity (Caldwell 49), and it still possesses several brilliant but short-lived O type stars. The brightest member of the cluster is HD 46223, a vast star with 50 times the mass of the sun and 400,000 times the luminosity.

Also visible:

(1) C46 *(10.0$_m$ bright nebula)*

(2) C49 *(9.0$_m$ bright nebula)*

(3) GK Ori *(9.5$_m$ carbon star)*



NGC 2301

RA: 102.95° | 6h 51.8' — DEC: 0.47° | 0° 28'

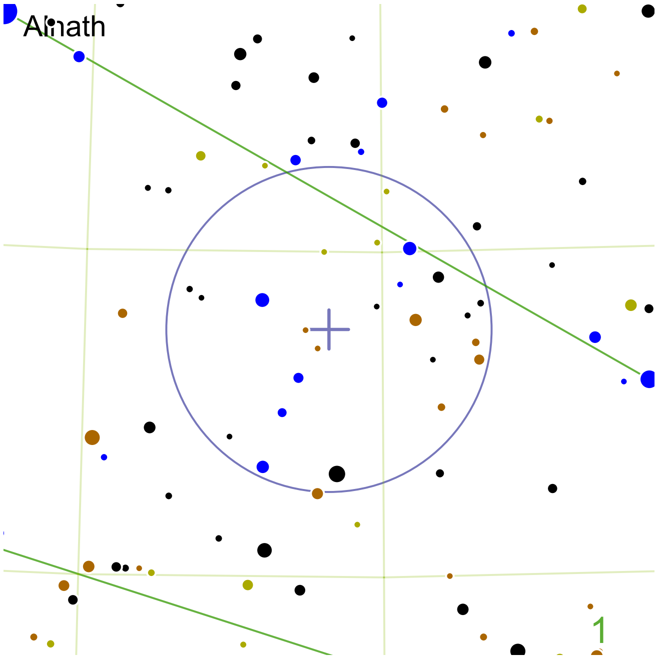
NGC 2301 is a magnitude 6.0 open cluster. Angular size is 12'.

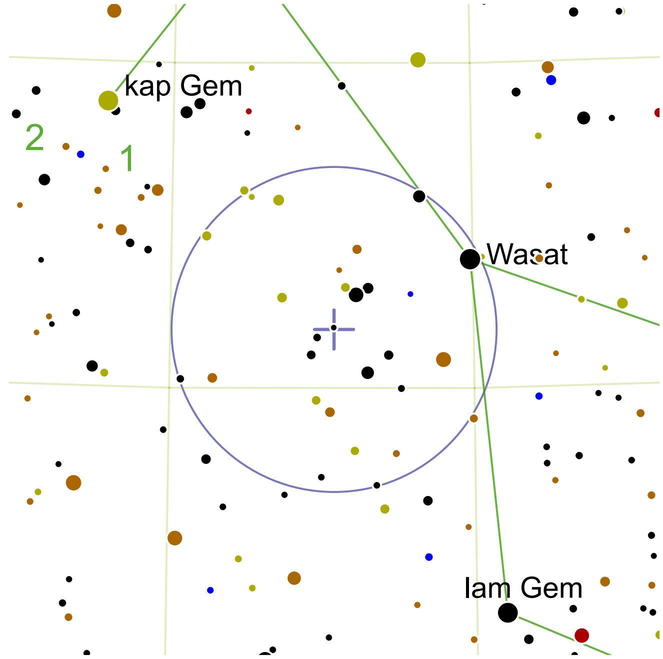
11.7° SW from mag.3.09 Gomeisa.

This bright and rich open cluster is 165 million years old and is 2,840 light-years from Earth.

Also visible:

(1) NGC 2346 *(10.5$_m$ planetary nebula)*





NGC 1746

RA: 75.9° | 5h 3.6' — DEC: 23.82° | 23° 49'

NGC 1746 is a magnitude 6.0 open cluster. Angular size is 42'.

Travel from the Pleiades to Aldebaran, turn right, and travel an equal distance further.

Originally thought to be a poor and relatively scattered open cluster, more recent studies suggest this object is an asterism, merely a chance alignment of unrelated stars.

Also visible:

(1) NGC 1647 *(6.4$_m$ open cluster)*

C39

RA: 112.3° | 7h 29.19' — DEC: 20.92° | 20° 55'

C39 (Eskimo Nebula, NGC 2392) is a magnitude 9.9 planetary nebula. Angular size is 0.8'.

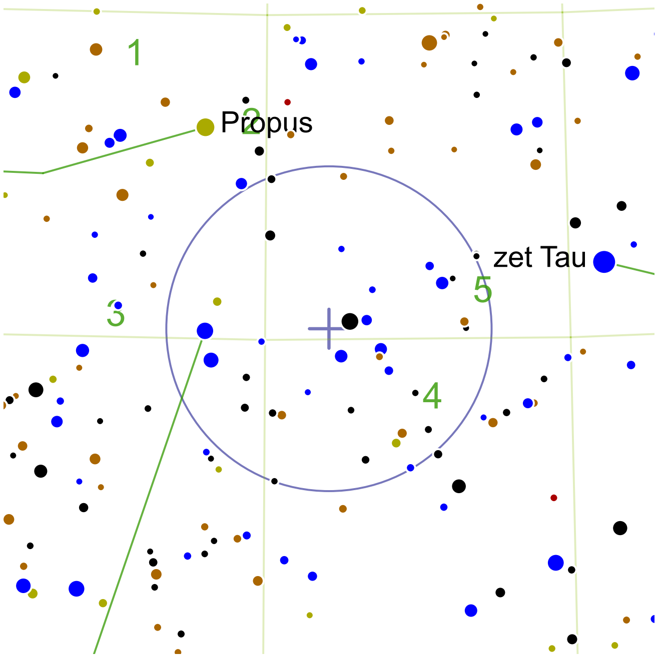
2.3° SEE from mag.3.51 Wasat.

The Clown Face Nebula lies in an interesting field in the finderscope. Double star Delta Geminorum (mag. 3.5, separation 5.6") is on the north-western edge of the finder view, while the small but concentrated open cluster NGC 2420 (mag. 8.3) is on the eastern edge.

Also visible:

(1) S Gem *(8.0$_m$ variable star)*

(2) T Gem *(8.0$_m$ variable star)*



U Ori

RA: 88.95° | 5h 55.81' — DEC: 20.18° | 20° 11'

U Ori (HD 039816) is a magnitude 4.8 variable star. Magnitude ranges from 13.0 to 4.8 (Δ mag. 8.2) with a period of 368d.

Just less than halfway from Betelgeuse to Theta Aurigae.

A good example of a long-period variable, being an easy unaided eye object at its brightest (assuming the skies are unpolluted), while disappearing entirely from view in small to medium telescopes at its dimmest.

Also visible:

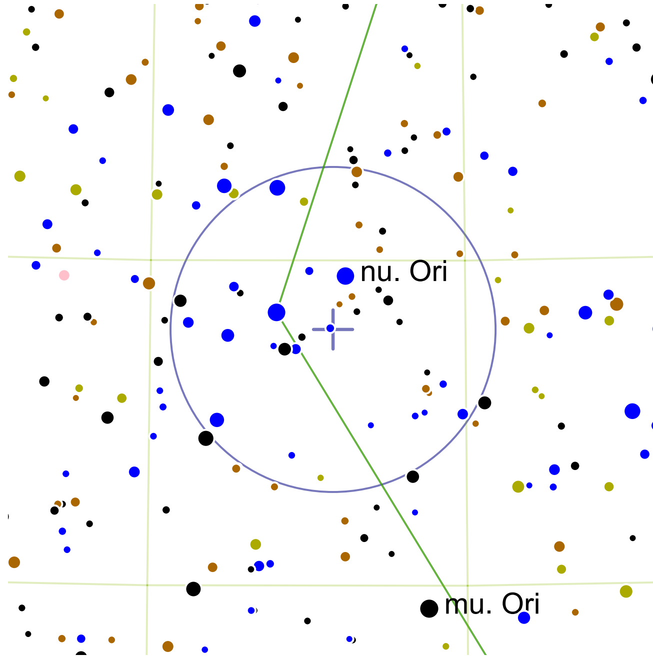
(1) M35 *(5.3$_m$ open cluster)*

(2) NGC 2129 *(6.7$_m$ open cluster)*

(3) NGC 2175 *(6.8$_m$ open cluster)*

(4) SU Tau *(9.1$_m$ variable star)*

(5) Y Tau *(7.1$_m$ carbon star)*



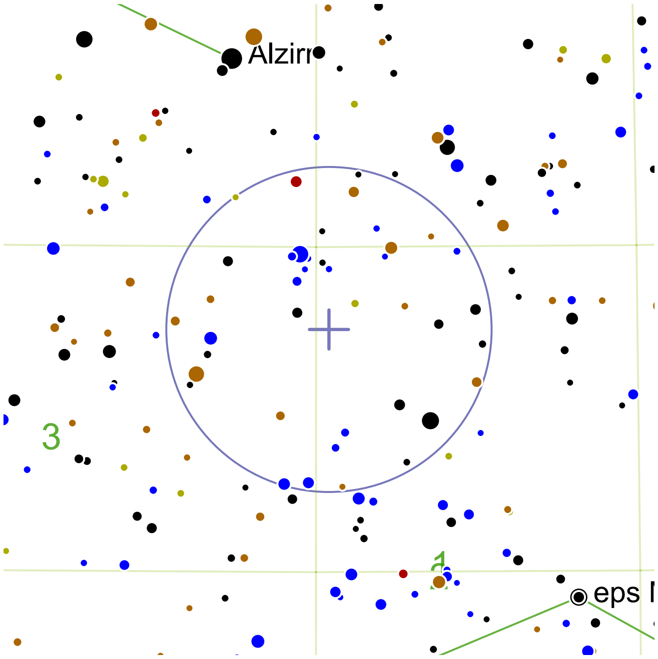
NGC 2169

RA: 92.1° | 6h 8.39' — DEC: 13.95° | 13° 57'

NGC 2169 is a magnitude 5.9 open cluster. Angular size is 7'.

Halfway between Betelgeuse and Tejat in Gemini.

Known as the "37 Cluster" as the brightest stars of the cluster form these numerals, the stars also form the letters "XY" in smaller telescopes that reveal fewer stars.



C46

RA: 99.8° | 6h 39.19' — DEC: 8.73° | 8° 44'

C46 (Hubble's Variable Nebula, NGC 2261) is a magnitude 10.0 bright nebula. Angular size is 2x1'.

4.4° SSW from mag.3.4 Alzirr.

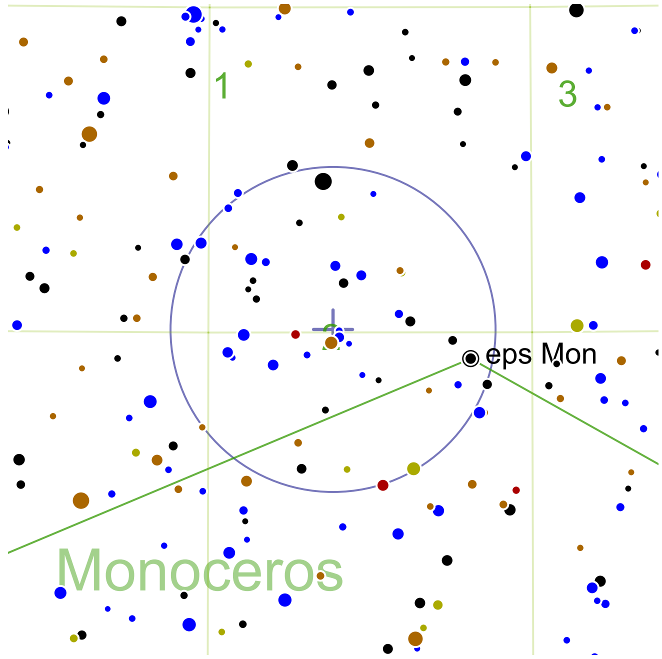
Small dust clouds drifting close to the variable star R Monocerotis cast vastly larger and highly mobile shadows on the more distant reflection nebula. The appearance can accordingly change significantly in a period of weeks, leading to the name of Hubble's Variable Nebula. As a reflection nebula, this object is sensitive to light pollution and particularly the blue cast of moonlight.

Also visible:

(1) C49 *(9.0$_m$ bright nebula)*

(2) C50 *(4.8$_m$ open cluster)*

(3) BG Mon *(9.2$_m$ carbon star)*



C49

RA: 98.08° | 6h 32.3' — DEC: 5.05° | 5° 3'

C49 (NGC 2237-9) is a magnitude 9.0 bright nebula. Angular size is 80x60'.

Two and a half finder circles east and slightly south of Betelgeuse.

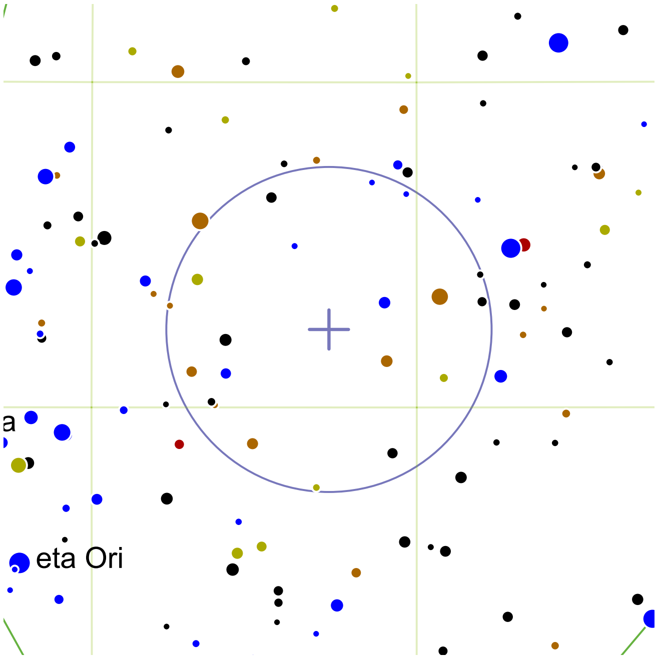
This large nebula can be viewed with binoculars from a dark site. While diffuse nebulae can be a challenge in light-polluted surroundings, the location of Caldwell 49 is marked by the closely associated star cluster Caldwell 50.

Also visible:

(1) C46 *(10.0$_m$ bright nebula)*

(2) C50 *(4.8$_m$ open cluster)*

(3) GK Ori *(9.5$_m$ carbon star)*



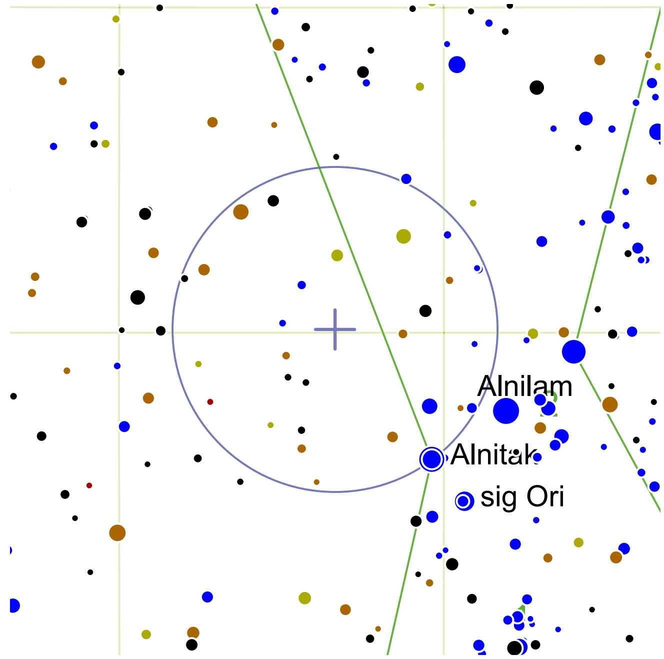
W Ori

RA: 76.35° | 5h 5.39' — DEC: 1.2° | 1° 12'

W Ori (HD 32736) is a magnitude 6.5 carbon star. Magnitude ranges from 10.0 to 6.5 (Δ mag. 3.5) with a period of 210d.

W Orionis forms a kite shape with Bellatrix, Mintaka and Rigel.

The unusual spectrum of this carbon star was first noted in the 1860s and is now classified as a C5,4 carbon star. W Orionis is exceptionally red with a B-V color index of 3.34.



M78

RA: 86.68° | 5h 46.69' — DEC: 0.05° | 0° 3'

M78 (NGC 2068) is a magnitude 8.3 diffuse nebula. Angular size is 8x6'.

Follow Orion's Belt from Mintaka to Alnitak, then turn right and continue an equal distance.

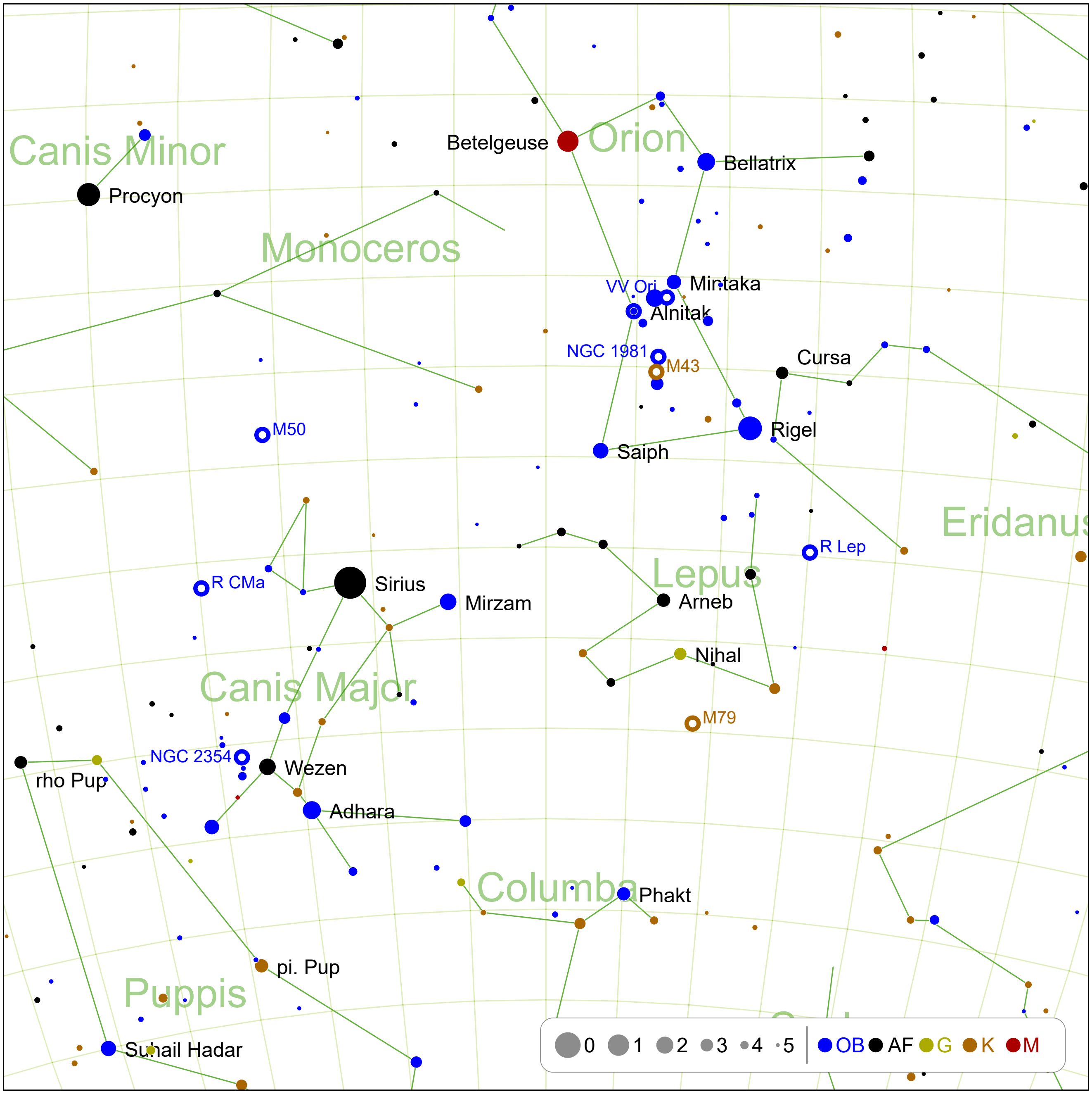
This complex and confusing reflection nebula hides a young star cluster in its dust clouds. The cluster is however detectable in infrared wavelengths.

Also visible:

(1) NGC 1981 *(4.6$_m$ open cluster)*

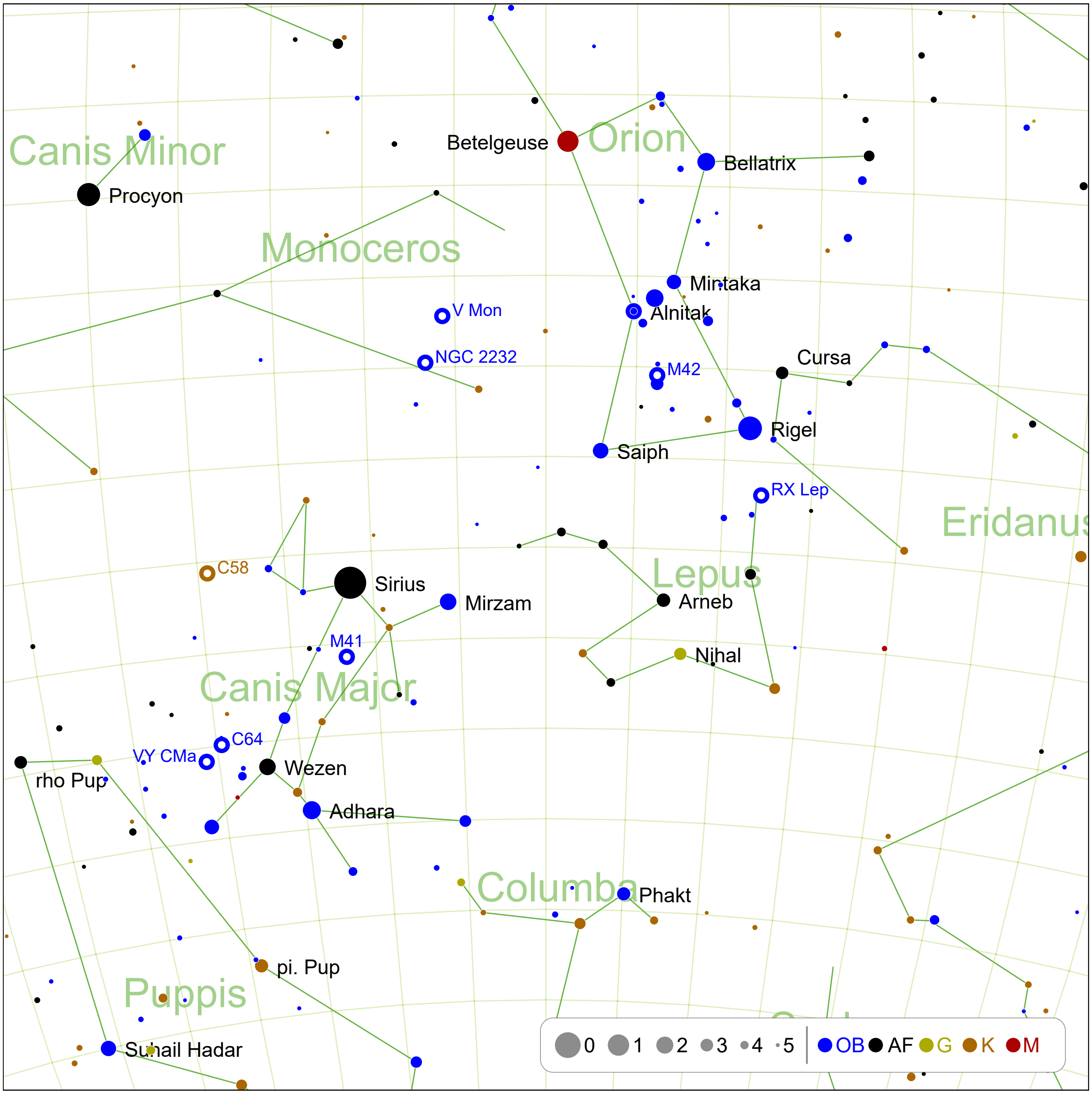
(2) VV Ori *(5.31$_m$ variable star)*

December: -15° South (1)

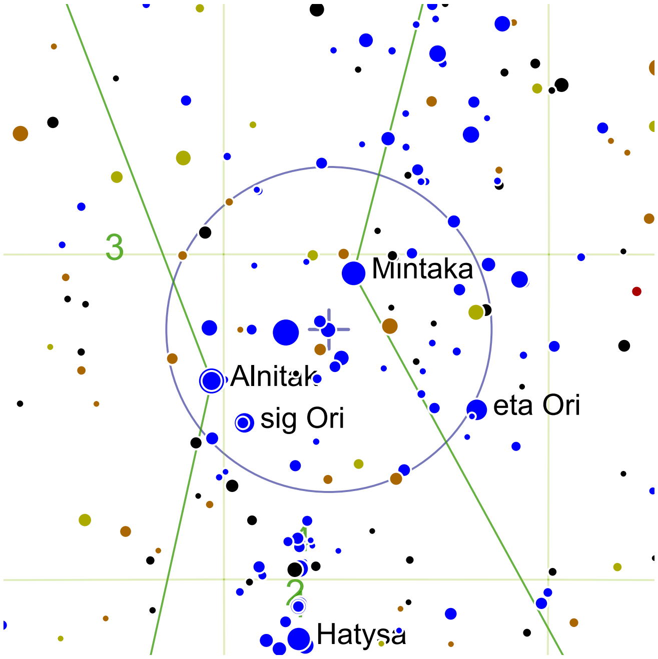


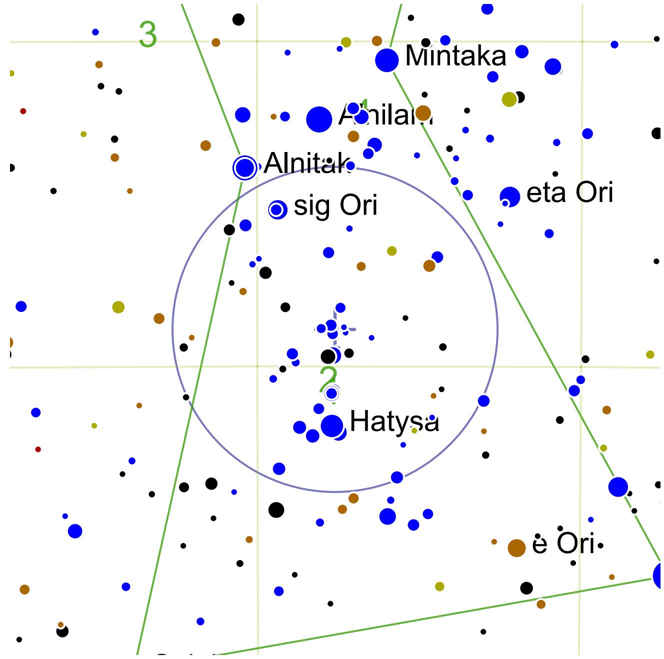
VV Ori: page 123 NGC 1981: page 123 M43: page 124 M50: page 124
R Lep: page 125 R CMa: page 125 M79: page 126 NGC 2354: page 126

December: -15° South (2)



V Mon: page 127	NGC 2232: page 127	M42: page 128	RX Lep: page 128
C58: page 129	M41: page 129	C64: page 130	VY CMa: page 130





VV Ori

RA: 83.38° | 5h 33.52' — DEC: -1.16° | -1° 8'

VV Ori (HD 036695) is a magnitude 5.31 variable star. Magnitude ranges from 5.66 to 5.31 (Δ mag. 0.4) with a period of 1.48538d.

0.6° W from mag.1.75 Alnilam.

This eclipsing binary has a very slight magnitude variation, but half a degree to the SSE is the magnitude 5.30 star SAO 132234 (HD 36591), marking the brightest point of VV Ori's light curve. Conveniently SAO 132234 and VV Ori are the same color making comparison more easy. SAO 132234 is also a tight double with a magnitude 9.8 companion (separation 1.96", position angle 355°).

Also visible:

(1) M42 *(4.0$_m$ diffuse nebula)*

(2) M43 *(9.0$_m$ diffuse nebula)*

(3) M78 *(8.3$_m$ diffuse nebula)*

(4) NGC 1981 *(4.6$_m$ open cluster)*

NGC 1981

RA: 83.8° | 5h 35.19' — DEC: -4.43° | -4° 25'

NGC 1981 is a magnitude 4.6 open cluster. Angular size is 25'.

1.4° N from mag.2.87 Hatysa.

This lively scattering of bright stars is often overlooked as it shares the eyepiece view with the Great Orion Nebula. Take a moment next time you admire the great nebula to look a degree north and acknowledge this open cluster too. In between these two objects is the much more elusive Running Man emission-reflection nebula.

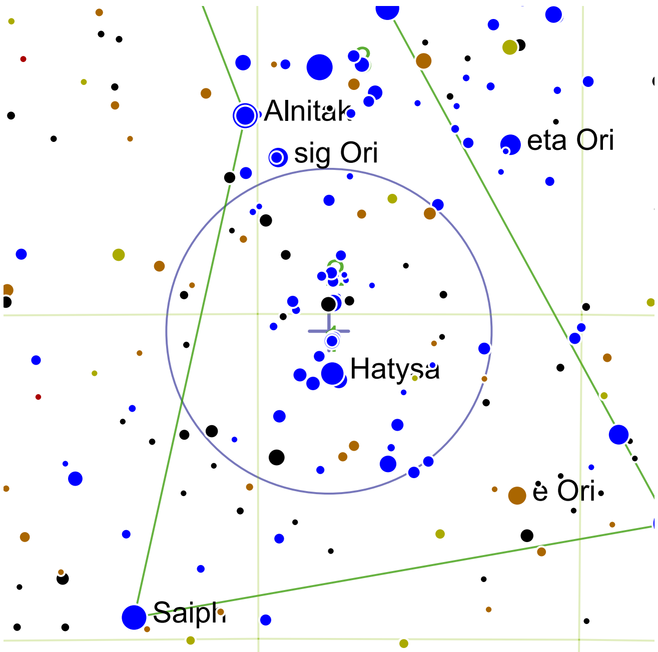
Also visible:

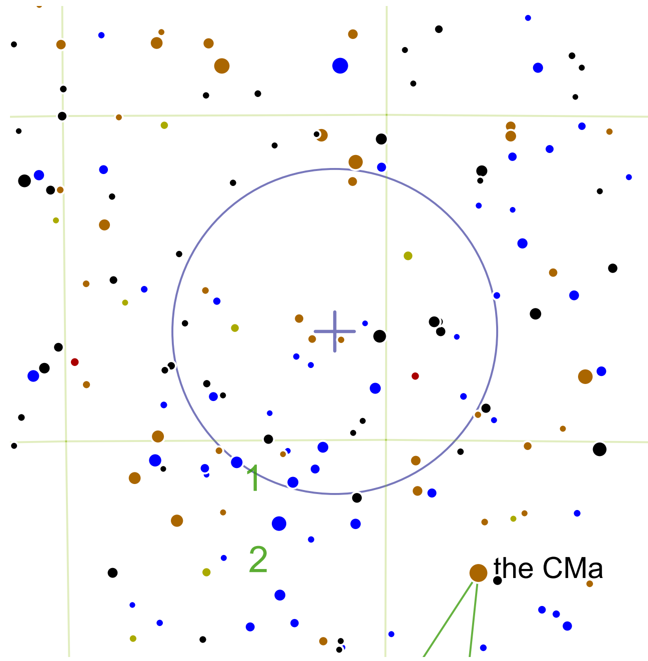
(1) M42 *(4.0$_m$ diffuse nebula)*

(2) M43 *(9.0$_m$ diffuse nebula)*

(3) M78 *(8.3$_m$ diffuse nebula)*

(4) VV Ori *(5.31$_m$ variable star)*





M43

RA: 83.9° | 5h 35.6' — DEC: -5.27° | -5° 15'

M43 (De Mairan's Nebula, NGC 1982) is a magnitude 9.0 diffuse nebula. Angular size is 20x15'.

0.6° N from mag.2.87 Hatysa.

Unless you knew it was cataloged separately as M43 by Charles Messier, you would simply consider M43 to be part of M42, merely separated by a dust lane - and you would be correct. Beyond M43 is the much more challenging Running Man Nebula (cataloged as three nebulae by William Herschel: NGC 1973, NGC 1975 and NGC 1977).

Also visible:

(1) M42 *(4.0_m diffuse nebula)*

(2) NGC 1981 *(4.6_m open cluster)*

(3) VV Ori *(5.31_m variable star)*

M50

RA: 105.8° | 7h 3.19' — DEC: -8.33° | -8° 19'

M50 (NGC 2323) is a magnitude 6.3 open cluster. Angular size is 16'.

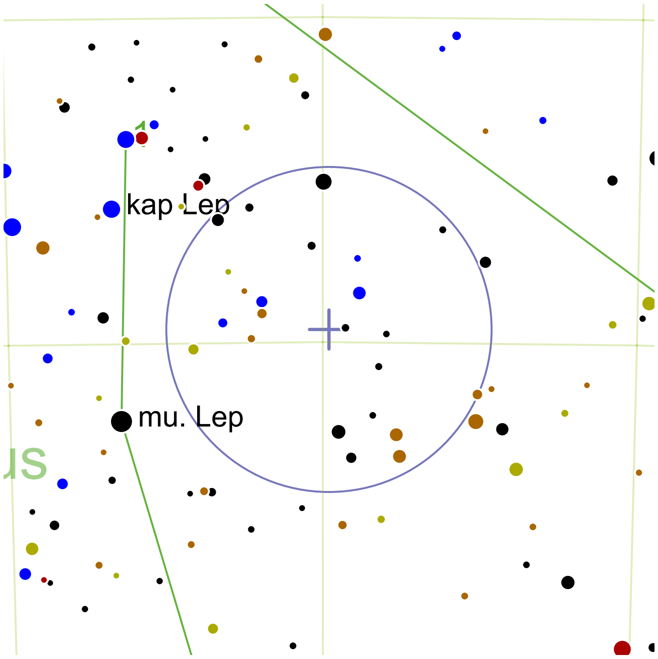
One third of the distance from Sirius to Procyon.

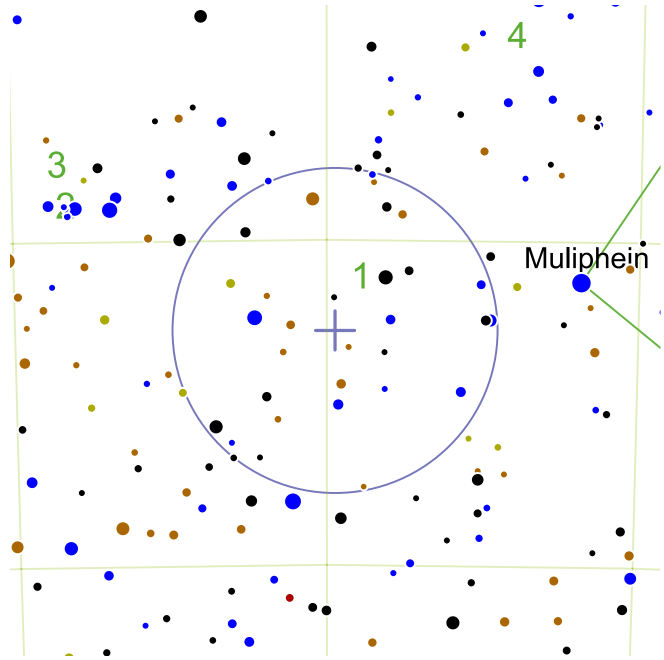
Discovered on G D Cassini on or before 1711, the small cluster (285 solar masses) is just detectable by the naked eye in very dark conditions. It is quite compact with a core radius of just under 6 light-years. It is quite young at 140 million years.

Also visible:

(1) NGC 2343 *(6.7_m open cluster)*

(2) W CMa *(7.0_m carbon star)*





R Lep

RA: 74.9° | 4h 59.6' — DEC: -14.81° | -14° 47'

R Lep (HD 031996) is a magnitude 5.5 variable star. Magnitude ranges from 11.7 to 5.5 (Δ mag. 6.2) with a period of 427d.

Draw a line from Mintaka through Rigel and continue it for almost an equal length.

Better known as Hind's Crimson Star, this deeply red carbon star (B-V index of 2.71) is over 6,000 times brighter than the Sun. Like many carbon stars, R Lep is redder when it is fainter, meaning its deeper reds are better accessible by larger telescopes. When he discovered R Lep in 1845, Hind reported that it resembled "a drop of blood on a black field."

Also visible:

(1) RX Lep *(5.0_m variable star)*

R CMa

RA: 109.87° | 7h 19.46' — DEC: -16.4° | -16° 23'

R CMa (HD 57167) is a magnitude 5.7 variable star. Magnitude ranges from 6.34 to 5.7 (Δ mag. 0.6) with a period of 1.13594d.

Forms an equilateral triangle with Adhara and Mirzam.

This eclipsing binary star is a degree SSE of Caldwell 58.

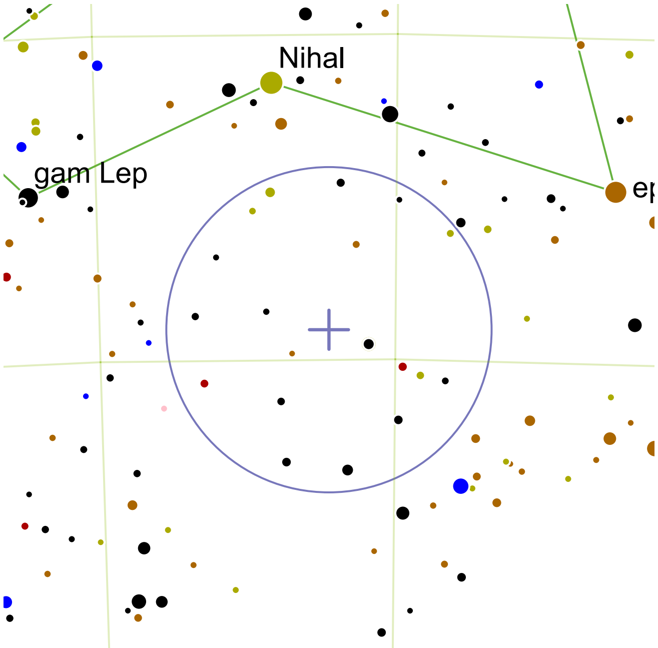
Also visible:

(1) C58 *(7.2_m open cluster)*

(2) M47 *(5.2_m open cluster)*

(3) NGC 2423 *(6.7_m open cluster)*

(4) W CMa *(7.0_m carbon star)*



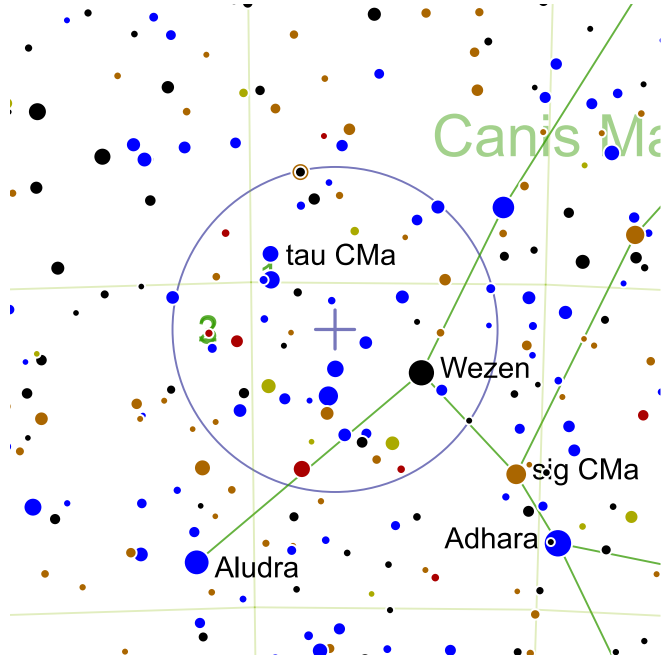
M79

RA: 81.13° | 5h 24.5' — DEC: -24.55° | -24° 32'

M79 (NGC 1904) is a magnitude 7.7 globular cluster. Angular size is 9'.

Draw a line from Arneb through Mihal in Lepus, and extend the line an equal distance.

This globular cluster is believed to be extragalactic, belonging not to the Milky way but to the Canis Major Dwarf Galaxy which, if it exists, is an elliptical concentration of a billion stars in the direction of Canis Major. Aside from its globular clusters (M79, NGC 1851, NGC 2298 and NGC 2808) this putative, highly disrupted galaxy is undetectable by amateur instruments.



NGC 2354

RA: 108.58° | 7h 14.3' — DEC: -25.73° | -25° 43'

NGC 2354 is a magnitude 6.5 open cluster. Angular size is 20'.

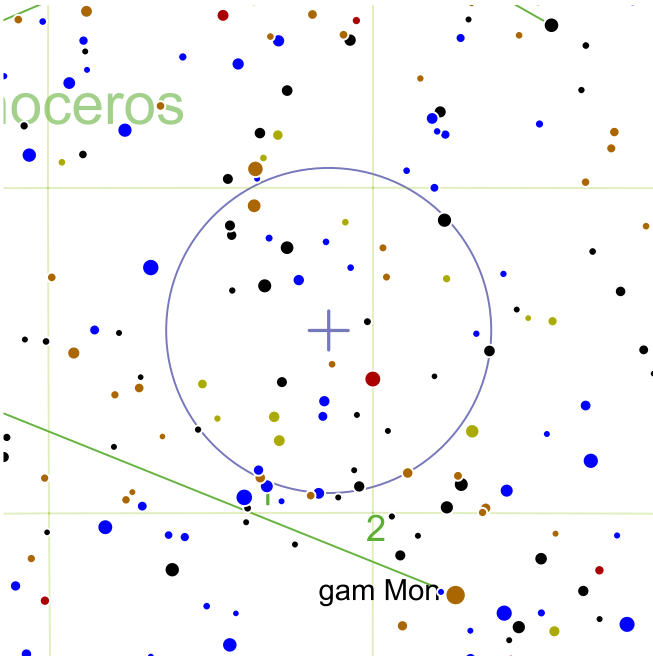
1.0° N from mag.3.83 ome CMa.

Also visible:

(1) C64 *(4.1$_m$ open cluster)*

(2) VY CMa *(6.5$_m$ variable star)*

(3) VY CMa *(8.8$_m$ carbon star)*



V Mon

RA: 95.68° | 6h 22.72' — DEC: -2.2° | -2° 11'

V Mon (HD 044639) is a magnitude 6.0 variable star. Magnitude ranges from 13.9 to 6.0 (Δ mag. 7.9) with a period of 341d.

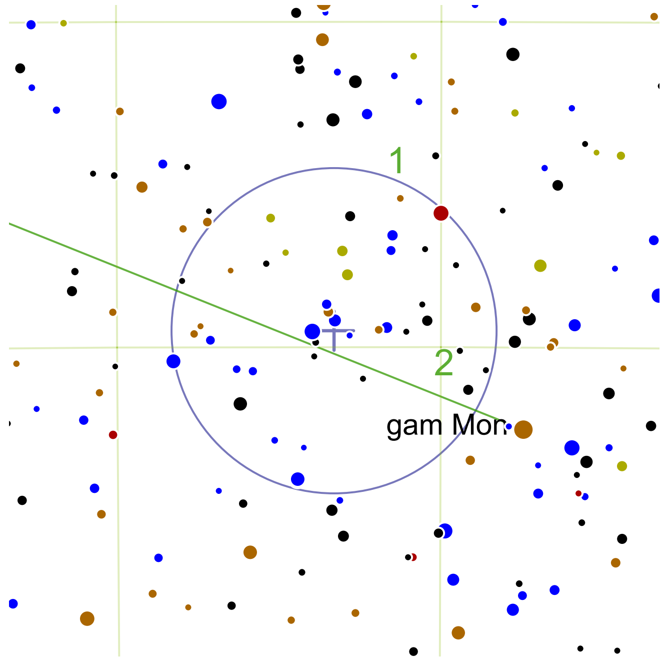
10.4° E from mag.2.05 Alnitak.

This orange long-period variable is roughly 1,388 light-years from Earth.

Also visible:

(1) NGC 2232 *(3.9$_m$ open cluster)*

(2) KS Mon *(8.5$_m$ carbon star)*



NGC 2232

RA: 96.65° | 6h 26.6' — DEC: -4.75° | -4° 44'

NGC 2232 is a magnitude 3.9 open cluster. Angular size is 30'.

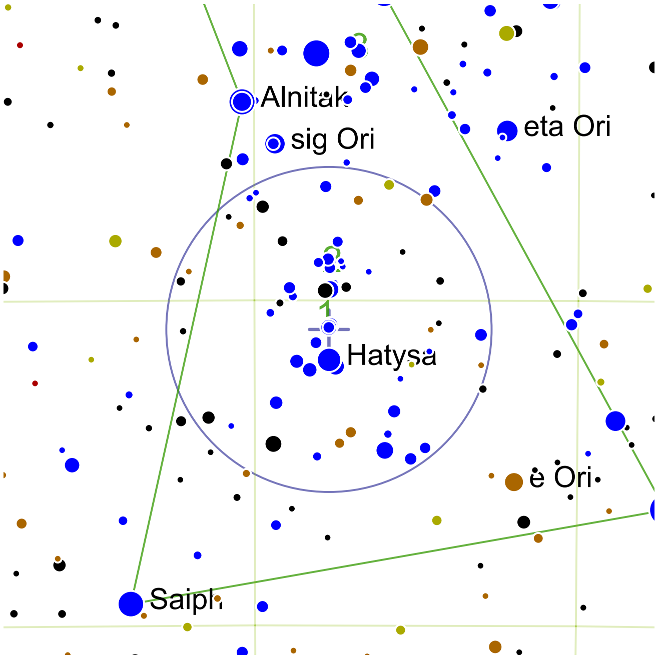
10.8° NEE from mag.2.2 Saiph.

At a distance of 1,060 light-years, this bright grouping is one of the closest open clusters to Earth. It is estimated to be roughly 31 million years old.

Also visible:

(1) V Mon *(6.0$_m$ variable star)*

(2) KS Mon *(8.5$_m$ carbon star)*



M42

RA: 83.85° | 5h 35.39' — DEC: -5.45° | -5° 26'

M42 (Great Nebula in Orion, NGC 1976) is a magnitude 4.0 diffuse nebula. Angular size is 85x60'.

0.4° N from mag.2.87 Hatysa.

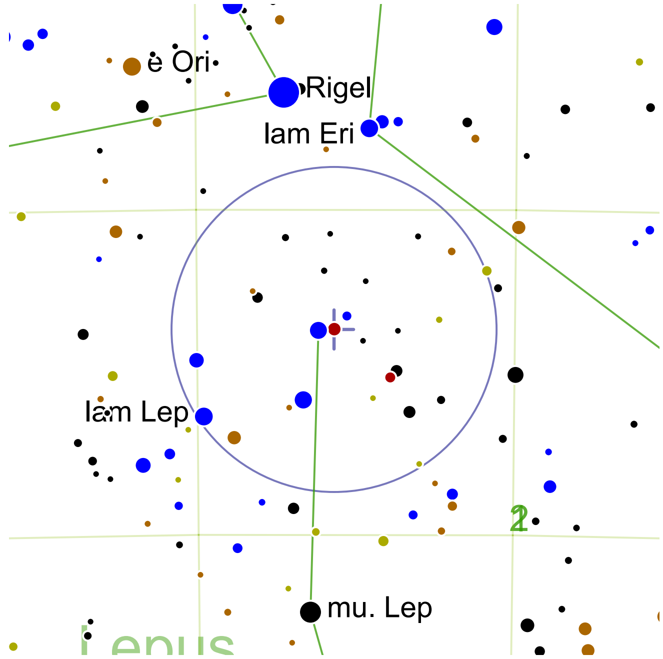
An infallible nebula, visible with the naked eye even from very light-polluted locations. This is the closest star forming region to Earth at a distance of around 1,344 light-years. At its heart is the Trapezium star cluster. The nebula spans 24 light-years and has a mass of 2,000 Suns.

Also visible:

(1) M43 *(9.0_m diffuse nebula)*

(2) NGC 1981 *(4.6_m open cluster)*

(3) VV Ori *(5.31_m variable star)*



RX Lep

RA: 77.85° | 5h 11.38' — DEC: -11.85° | -11° 50'

RX Lep (HD 033664) is a magnitude 5.0 variable star. Magnitude ranges from 7.4 to 5.0 (Δ mag. 2.4) with a period of 60d.

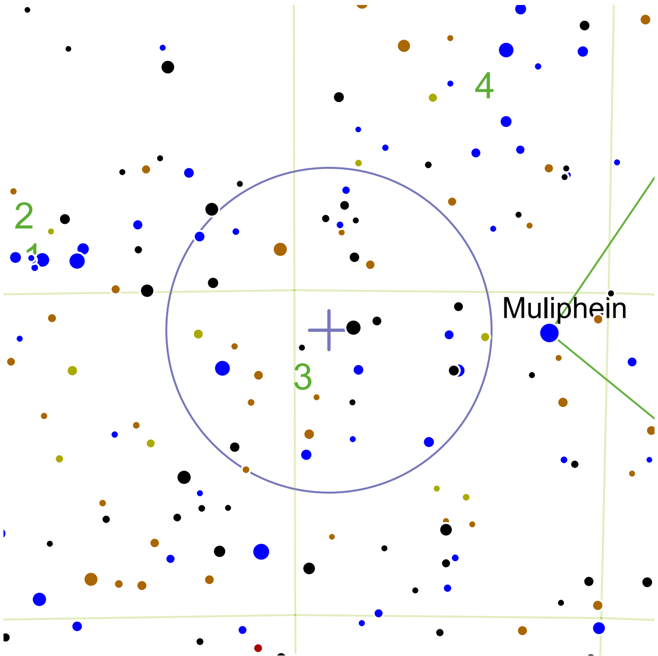
Travel from Saiph to Rigel and turn right, travel a further distance equal to Orion's Belt.

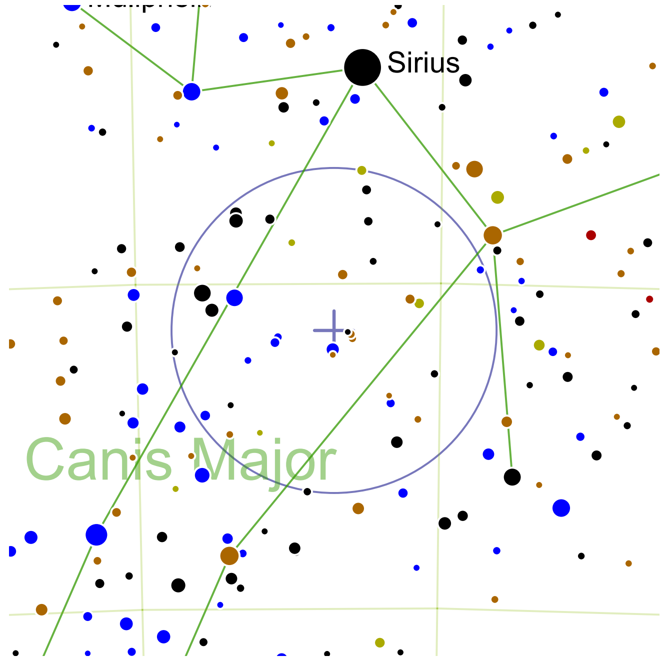
This pulsating variable star offers a moderate magnitude range over a relatively compressed period. 2.5° to the southeast, magnitude 5.45 SAO 150304 (HD 34538) marks the brighter end of RX Lep's range. The fainter end is marked by magnitude 7.55 SAO 150215 (HD 33755), one degree to the north of RX Lep.

Also visible:

(1) R Lep *(5.5_m variable star)*

(2) R Lep *(5.9_m carbon star)*





C58

RA: 109.45° | 7h 17.8' — DEC: -15.62° | -15° 36'

C58 (Caroline's Cluster, NGC 2360) is a magnitude 7.2 open cluster. Angular size is 13'.

7.9° E from mag.-1.58 Sirius.

Discovered by Caroline Herschel in 1783, she described this object as a "beautiful cluster of pretty compressed stars near 1/2 degree in diameter". The cluster has a diameter of 15 light-years and is aged at 2.2 million years. Given the age, the cluster has a few short-lived bright blue stars. The "blue stragglers" are actually older, smaller stars that absorbed mass from a companion star, becoming bright and blue in consequence.

Also visible:

(1) M47 *(5.2$_m$ open cluster)*

(2) NGC 2423 *(6.7$_m$ open cluster)*

(3) R CMa *(5.7$_m$ variable star)*

(4) W CMa *(7.0$_m$ carbon star)*

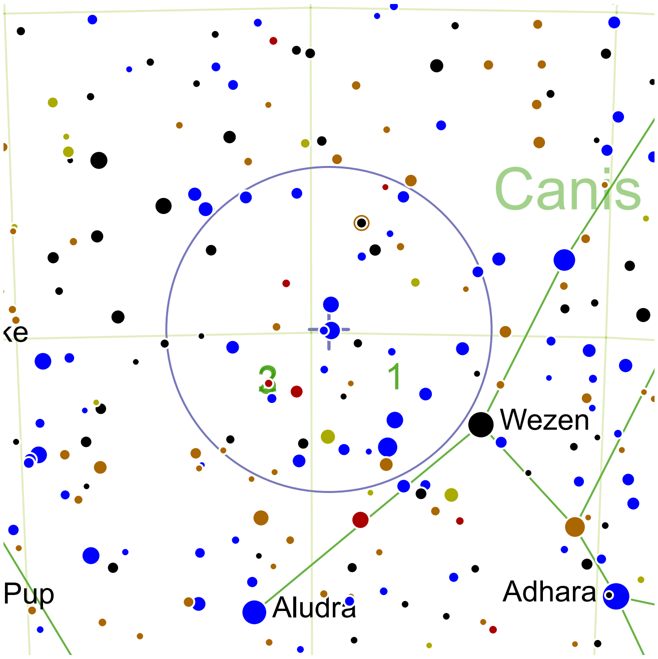
M41

RA: 101.75° | 6h 47.0' — DEC: -20.73° | -20° 43'

M41 (NGC 2287) is a magnitude 4.6 open cluster. Angular size is 38'.

4.0° S from mag.-1.58 Sirius.

Possibly known in ancient times, this very bright open cluster is graced with a number of prominent red stars. It is approximately 190 million years old and is 2,300 light-years from Earth.



C64

RA: 109.7° | 7h 18.8' — DEC: -24.95° | -24° 56'

C64 (Pirate's Jewels Cluster, NGC 2362) is a magnitude 4.1 open cluster. Angular size is 8'.

2.0° NNE from mag.3.83 ome CMa.

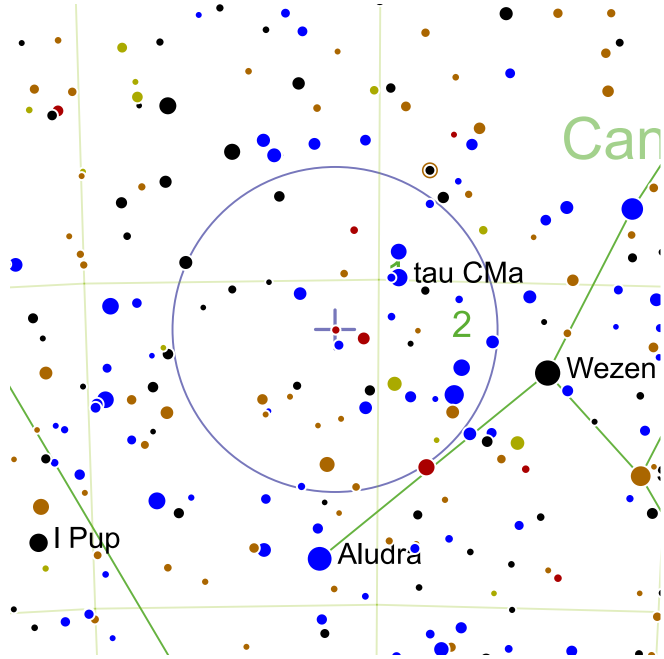
Discovered in 1654, this beautiful and bright cluster is only 4.5 million years old with a collective size of around 500 solar masses.

Also visible:

(1) NGC 2354 *(6.5_m open cluster)*

(2) VY CMa *(6.5_m variable star)*

(3) VY CMa *(8.8_m carbon star)*



VY CMa

RA: 110.74° | 7h 22.97' — DEC: -25.77° | -25° 45'

VY CMa (HD 58061) is a magnitude 6.5 variable star. Magnitude ranges from 9.6 to 6.5 (Δ mag. 3.1).

2.0° NEE from mag.3.83 ome CMa.

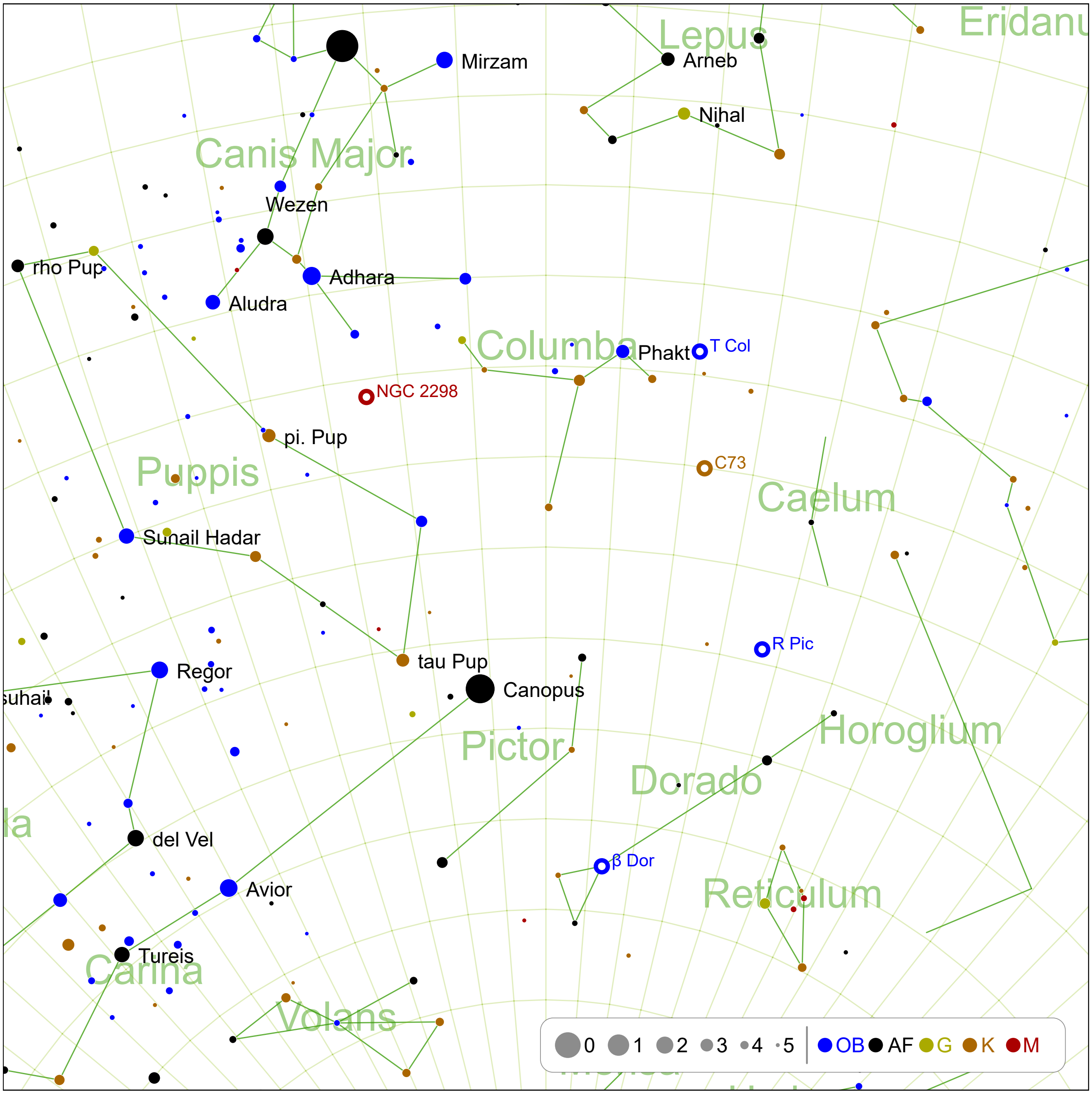
Distinguished by a relatively long period, this red pulsating variable star is roughly 1,832 light years from Earth.

Also visible:

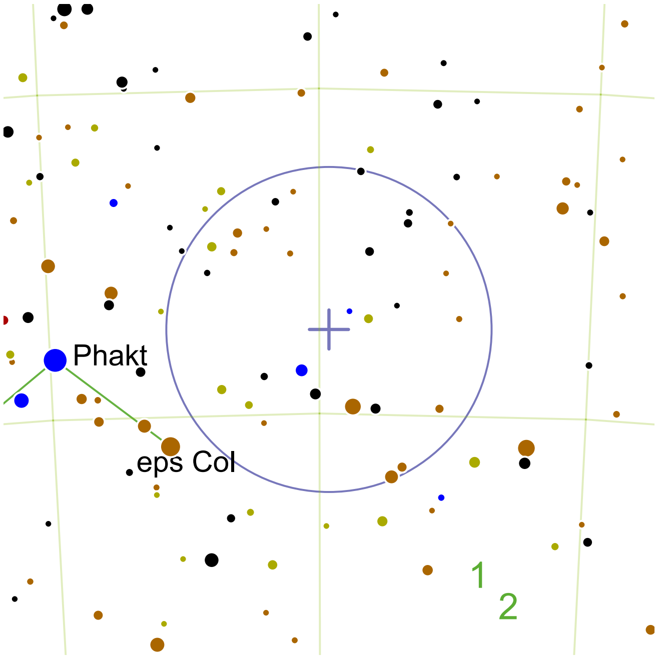
(1) C64 *(4.1_m open cluster)*

(2) NGC 2354 *(6.5_m open cluster)*

December: -45° South



T Col: page 132 NGC 2298: page 132 C73: page 133 R Pic: page 133
β Dor: page 134



T Col

RA: 79.82° | 5h 19.28' — DEC: -33.71° | -33° 41'

T Col (HD 34897) is a magnitude 6.6 variable star. Magnitude ranges from 12.7 to 6.6 (Δ mag. 6.1) with a period of 226d.

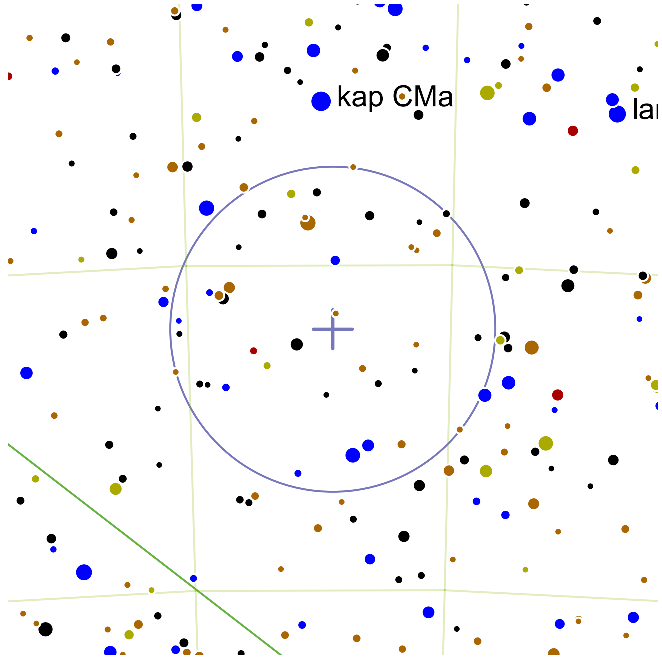
3.0° NW from mag.3.92 eps Col.

This orange-red pulsating variable star is roughly 2.038 light-years from Earth.

Also visible:

(1) NGC 1808 *(10.74$_m$ barred spiral galaxy)*

(2) NGC 1792 *(10.87$_m$ barred spiral galaxy)*



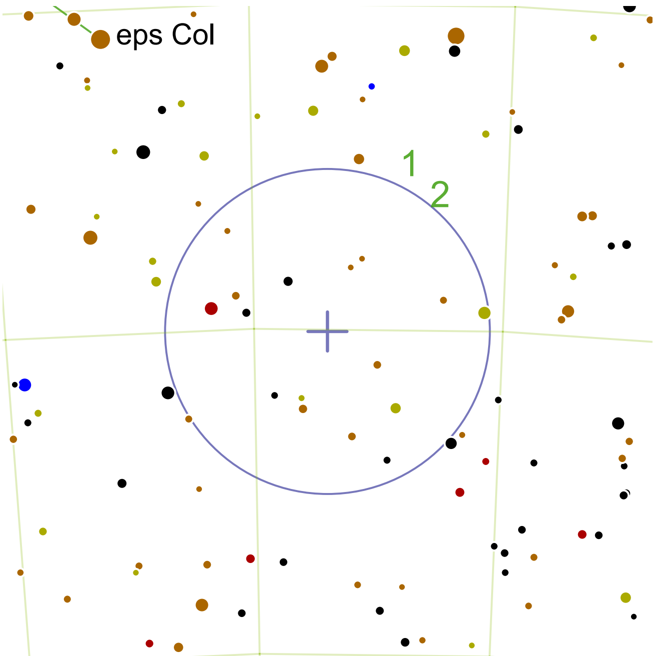
NGC 2298

RA: 102.25° | 6h 48.98' — DEC: -36.01° | -36° 0'

NGC 2298 (NGC) is a magnitude 9.29 globular cluster. Angular size is 5'.

3.5° S from mag.3.78 kap CMa.

This globular cluster lies 34,900 light-years from Earth, and is believed to originate from the Canis Major Dwarf galaxy. The cluster shows signs of disruption by the gravitational effects of the Milky way, an exhibits a tidal tail.



C73

RA: 78.53° | 5h 14.1' — DEC: -40.05° | -40° 2'

C73 (NGC 1851) is a magnitude 7.3 globular cluster. Angular size is 11'.

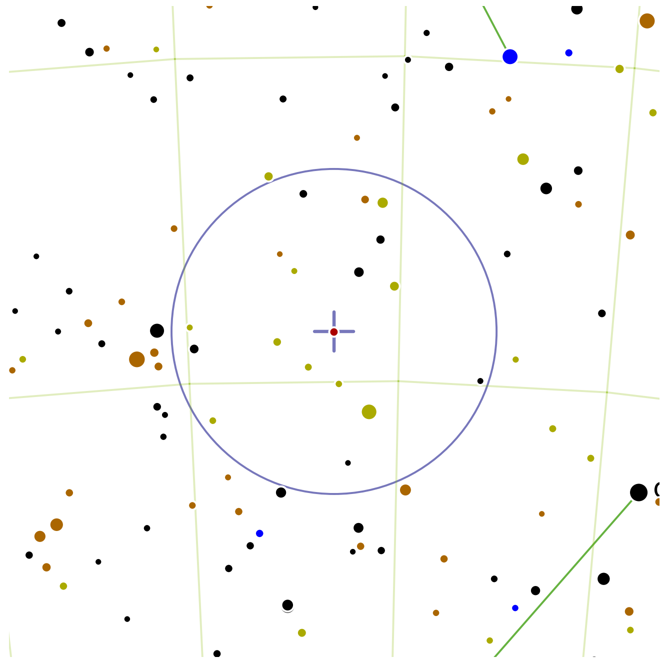
5.6° SW from mag.3.92 eps Col.

This bright globular cluster is interesting as it contain populations of stars with different ages, whereas globular clusters are usually composed exclusively of ancient stars.

Also visible:

(1) NGC 1808 *(10.74$_m$ barred spiral galaxy)*

(2) NGC 1792 *(10.87$_m$ barred spiral galaxy)*



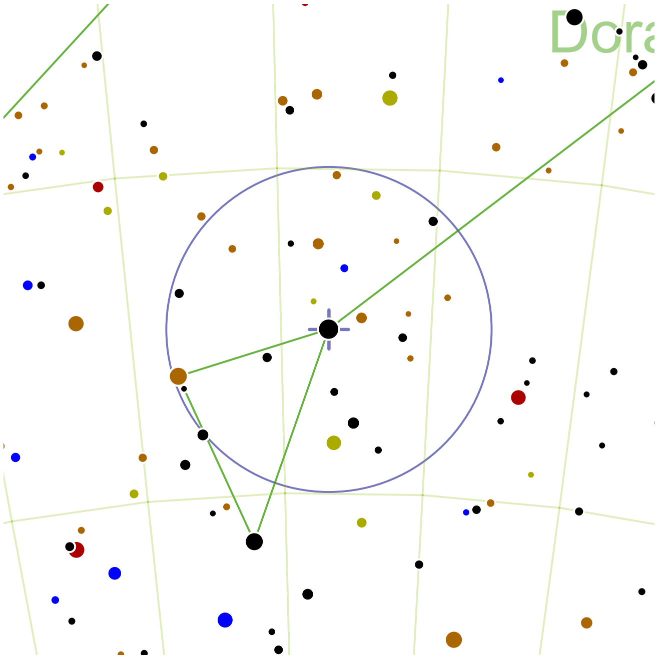
R Pic

RA: 71.54° | 4h 46.15' — DEC: -49.25° | -49° 14'

R Pic (HD 030551) is a magnitude 6.35 variable star. Magnitude ranges from 10.1 to 6.35 (Δ mag. 3.8) with a period of 171d.

6.0° NNE from mag.3.47 alf Dor.

Nearby SAO 217006 (HD 30850) lies half a degree to the southeast; with magnitude 7.45 it marks the midpoint of the brightness range of R Pic.



β Dor

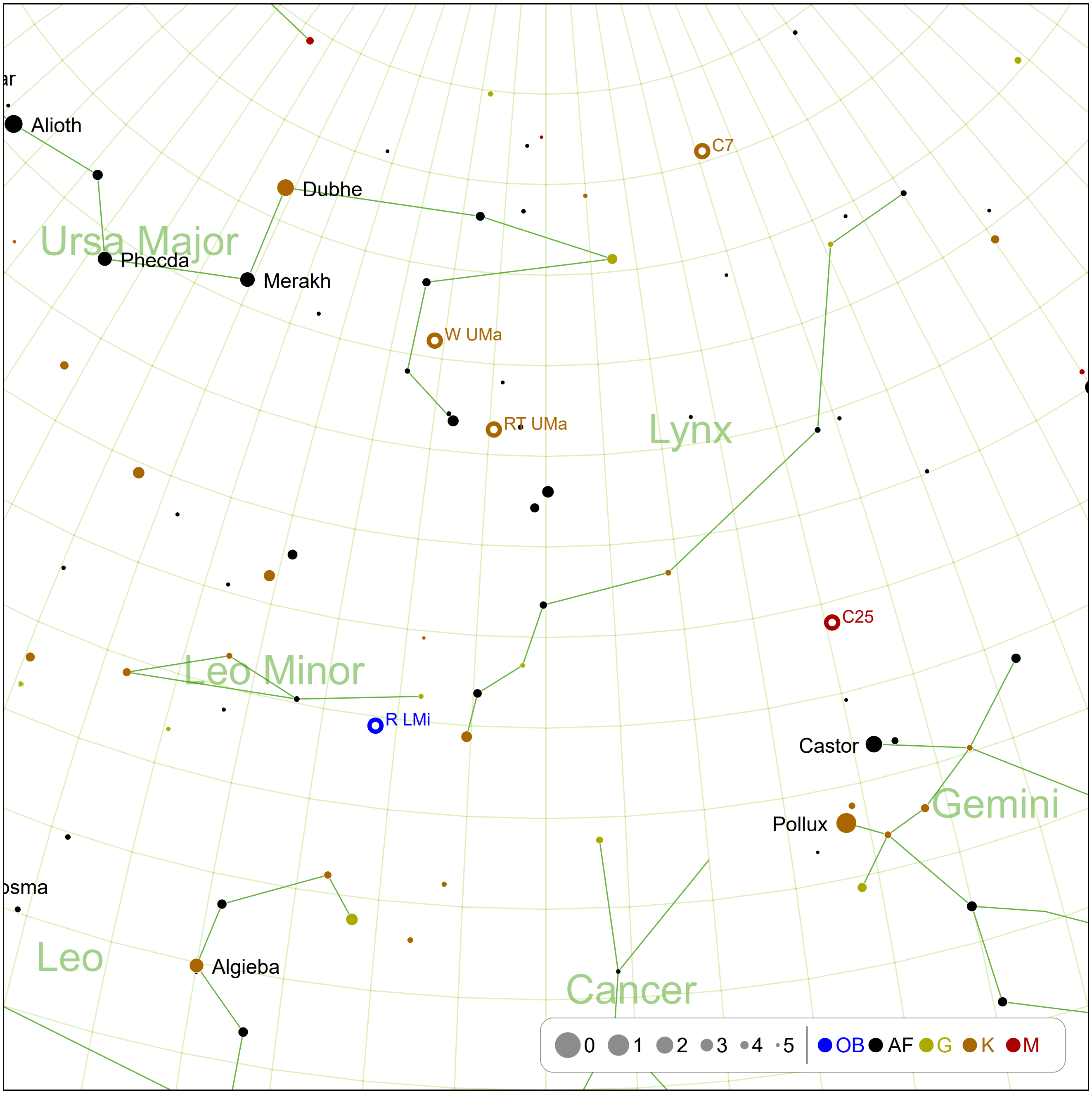
RA: 83.41° | 5h 33.62' — DEC: -62.49° | -62° 28'

β Dor (HD 037350) is a magnitude 3.46 variable star. Magnitude ranges from 4.08 to 3.46 (Δ mag. 0.6) with a period of 9.8426d.

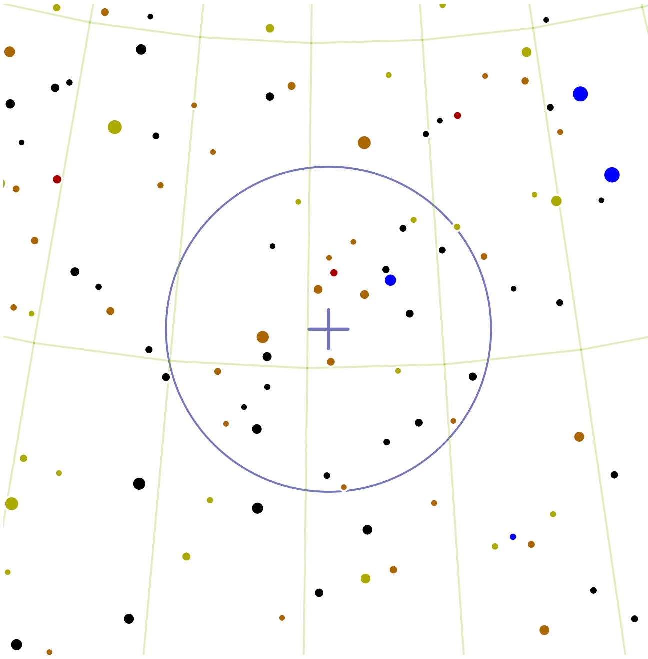
β Dor i a prminent star ten degrees SW of Canopus.

At its faintest, β Dor is the same brightness as δ Dor which lies three degrees to the south.

February: 45° North



C7: page 136 W UMa: page 136 RT UMa: page 137 C25: page 137
R LMi: page 138



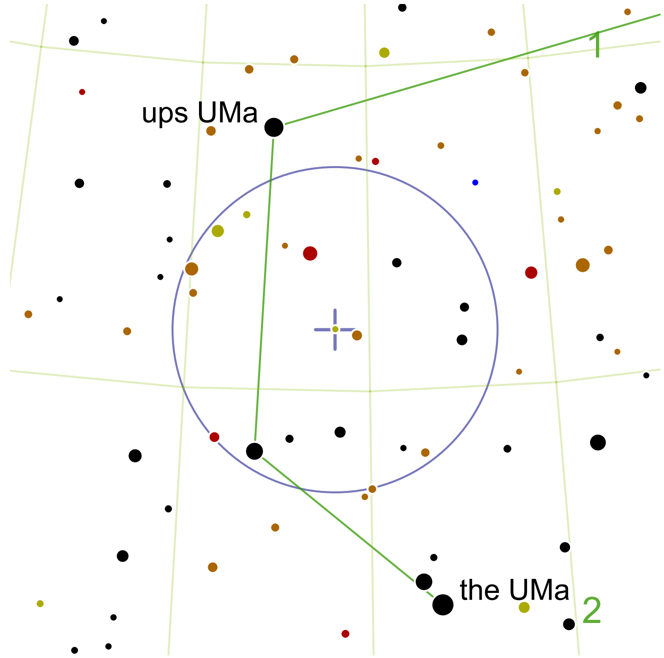
C7

RA: 114.23° | 7h 36.89' — DEC: 65.6° | 65° 36'

C7 (NGC 2403) is a magnitude 8.9 spiral galaxy. Angular size is 22x12'.

7.7° NW from mag.3.47 omi UMa.

A bright, obliquely oriented spiral galaxy.



W UMa

RA: 145.94° | 9h 43.75' — DEC: 55.95° | 55° 57'

W UMa (HD 083950) is a magnitude 7.75 variable star. Magnitude ranges from 8.48 to 7.75 (Δ mag. 0.7) with a period of 0.3336d.

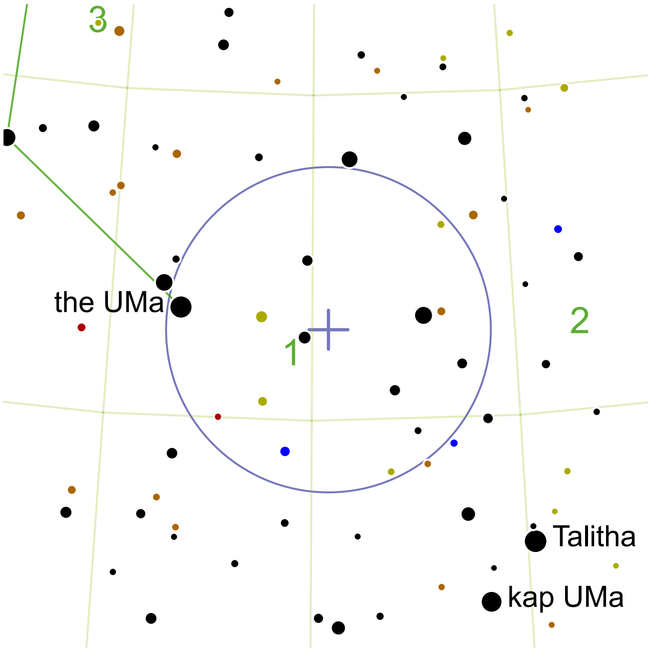
3.2° SSW from mag.3.89 ups UMa.

This star is the prototype of the W Ursae Majoris class of variables. These stars are contact binaries of spectral types F, G, or K. The two distorted stars exchange gas through a connecting "neck". The close pair are eclipsing over a very short period, so the moderate light curve can be observed in a period of hours. W UMa is surrounded by three stars of approximately mag. 9.0, which can be used as a reference for the minima.

Also visible:

(1) NGC 2768 *(10.84$_m$ elliptical galaxy)*

(2) RT UMa *(8.6$_m$ carbon star)*



RT UMa

RA: 139.6° | 9h 18.39' — DEC: 51.4° | 51° 24'

RT UMa (TYC 3431-229-1) is a magnitude 8.6 carbon star. Magnitude ranges from 9.6 to 8.6 (Δ mag. 1.0).

2.2° W from mag.3.26 the UMa.

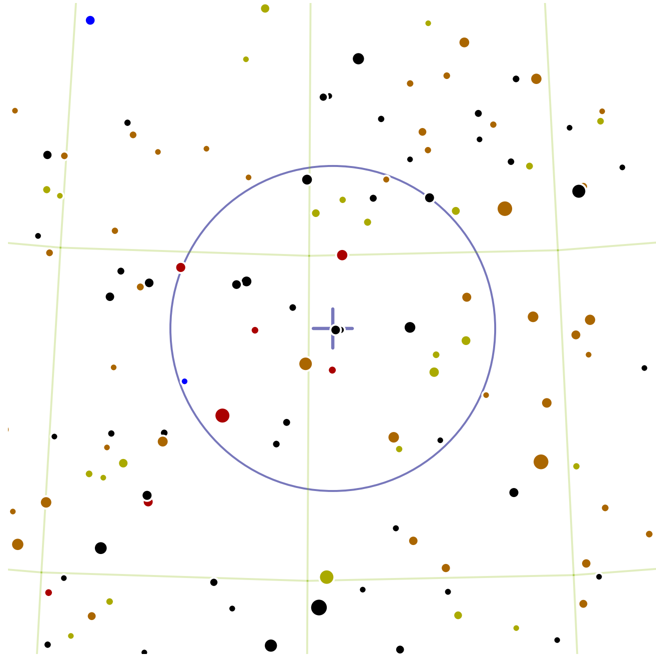
This carbon star is deeply red with a B-V color index of 3.5. The spectral class is C4+,4.

Also visible:

(1) NGC 2841 *(10.09$_m$ barred spiral galaxy)*

(2) NGC 2681 *(11.09$_m$ barred spiral galaxy)*

(3) W UMa *(7.75$_m$ variable star)*



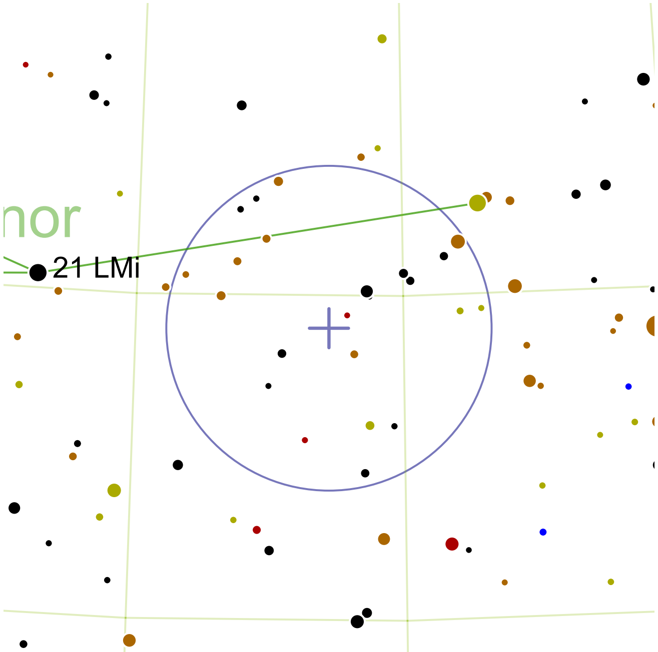
C25

RA: 114.53° | 7h 38.1' — DEC: 38.88° | 38° 53'

C25 (Intergalactic Wanderer, NGC 2419) is a magnitude 10.4 globular cluster. Angular size is 6'.

Due north of Castor, roughly twice the distance between Castor and Pollux.

A very distant globular cluster, more distant than the Magellanic Clouds, this object may not have formed with the Milky Way, and may instead be a visitor from afar. Because of the extreme distance of the cluster, individual stars cannot be resolved with moderately-sized telescopes.



R LMi

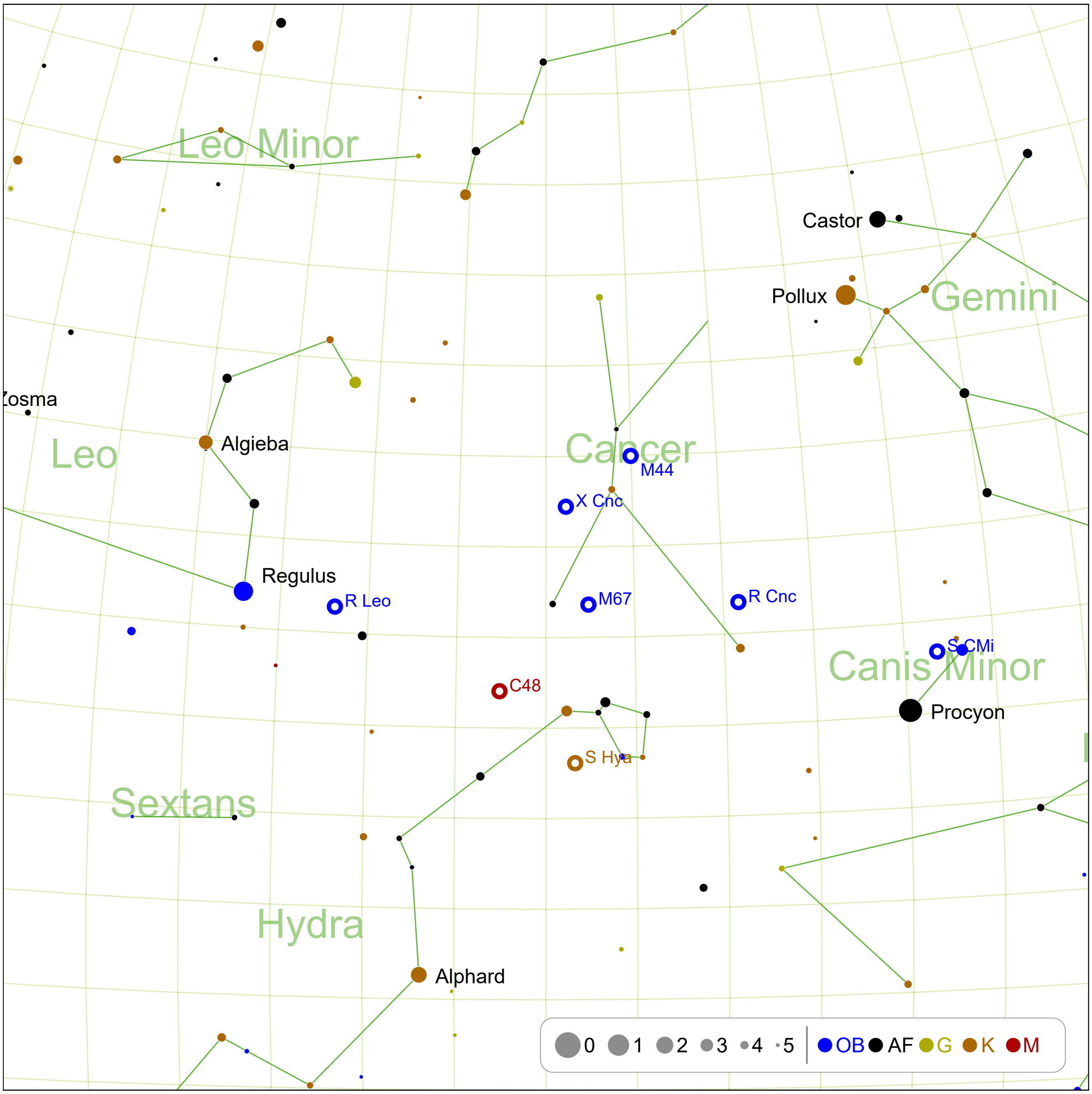
RA: 146.39° | 9h 45.57' — DEC: 34.51° | 34° 31'

R LMi (HD 084346) is a magnitude 6.3 variable star. Magnitude ranges from 13.2 to 6.3 (Δ mag. 6.9) with a period of 372d.

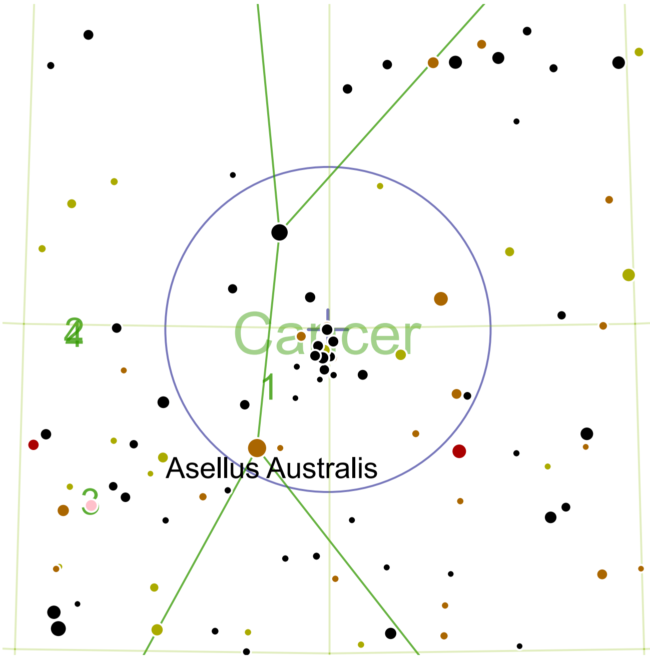
5.0° E from mag.3.3 alf Lyn.

This orange variable at its brightest rivals nearby magnitude 6.10 13 LMi, while at its faintest it disappears from view in small and moderate telescopes.

February: 15° North



M44: page 140 | X Cnc: page 140 | R Cnc: page 141 | M67: page 141
R Leo: page 142 | S CMi: page 142 | C48: page 143 | S Hya: page 143



M44

RA: 130.03° | 8h 40.1' — DEC: 19.98° | 19° 59'

M44 (Beehive Cluster, NGC 2632) is a magnitude 3.7 open cluster. Angular size is 95'.

12.1° NNE from mag.3.76 Altarf.

Truly spectacular from a dark site, this large open cluster has around 1,000 member stars and has a mass of around 600 Suns. Only 2% of the stars in the cluster are bright A-type stars, and there are only five giant stars.

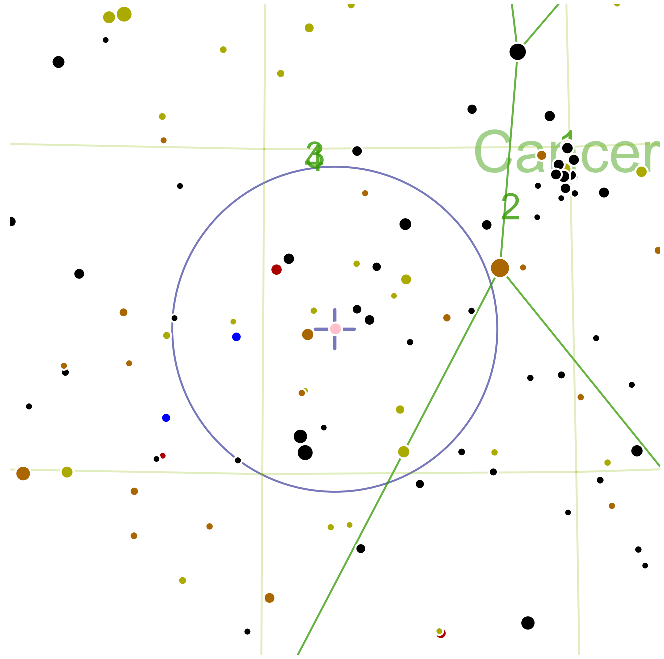
Also visible:

(1) S Cnc *(8.29_m variable star)*

(2) T Cnc *(7.6_m variable star)*

(3) X Cnc *(5.6_m variable star)*

(4) T Cnc *(7.8_m carbon star)*



X Cnc

RA: 133.85° | 8h 55.38' — DEC: 17.23° | 17° 14'

X Cnc (HD 76221) is a magnitude 5.6 variable star. Magnitude ranges from 7.5 to 5.6 (Δ mag. 1.9) with a period of 195d.

Halfway between Regulus of Leo and Wasat in Gemini.

One of the brightest carbon stars in the sky, X Cnc has a B-V color index 2.96 so it is markedly red, and is still reasonably bright at its minimum, at which point it exhibits its deepest red. 4,600 times brighter than the Sun, X Cnc is 2,900 light-years from Earth.

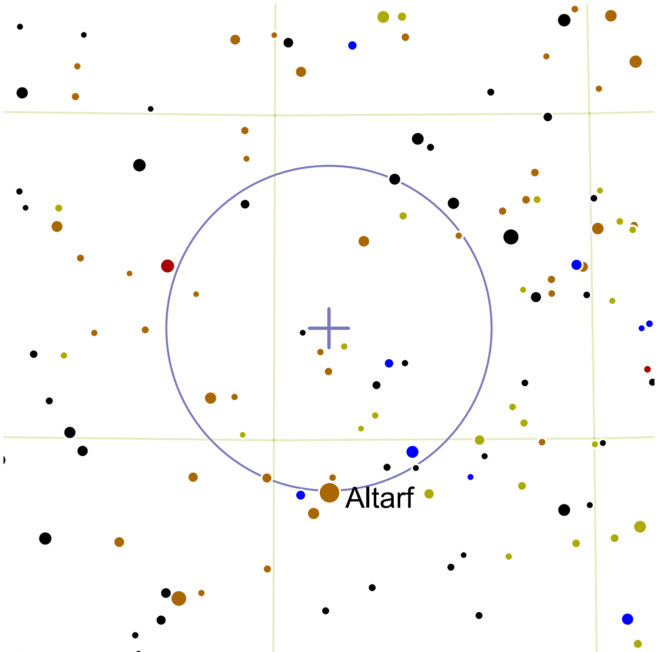
Also visible:

(1) M44 *(3.7_m open cluster)*

(2) S Cnc *(8.29_m variable star)*

(3) T Cnc *(7.6_m variable star)*

(4) T Cnc *(7.8_m carbon star)*



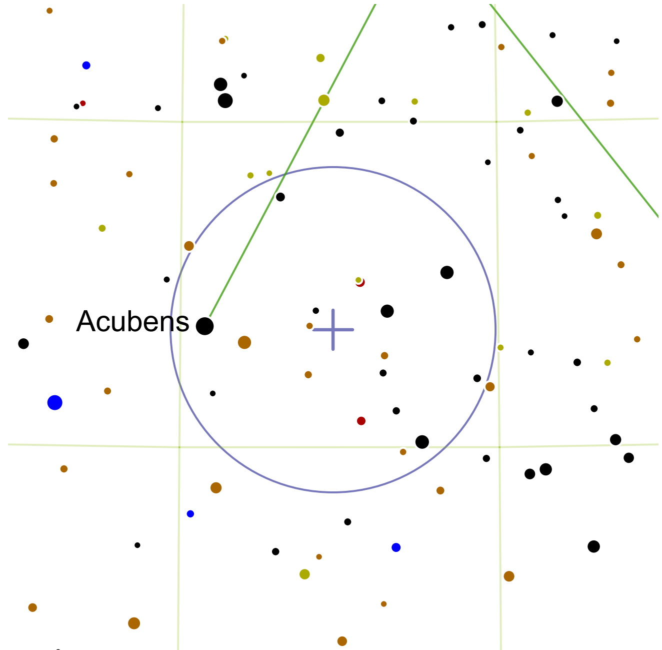
R Cnc

RA: 124.14° | 8h 16.56' — DEC: 11.73° | 11° 44'

R Cnc (HD 69243) is a magnitude 6.07 variable star. Magnitude ranges from 11.8 to 6.07 (Δ mag. 5.7) with a period of 362d.

2.5° N from mag.3.76 Altarf.

R Cnc is a Mira-type variable 830 light-years from Earth.



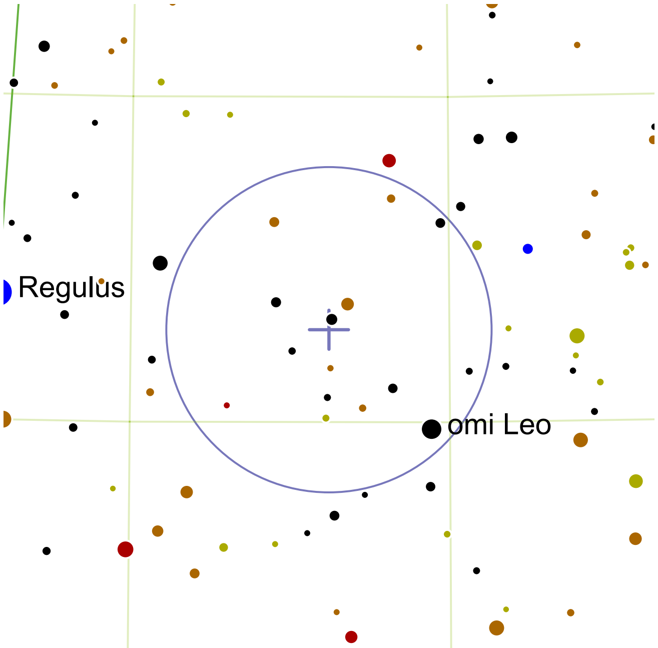
M67

RA: 132.6° | 8h 50.39' — DEC: 11.82° | 11° 49'

M67 (NGC 2682) is a magnitude 6.1 open cluster. Angular size is 30'.

5.4° N from mag.3.48 eps Hya.

A truly ancient open cluster (by the standards of open clusters) at three to five billion years age. It has a mass in the region 1000 to 1,500 solar masses, and is rich in stars similar to the Sun. The cluster is a good example of mass segregation, whereby velocity is transferred preferentially to less massive members of the cluster which causes the cluster to lose its lighter members over time.



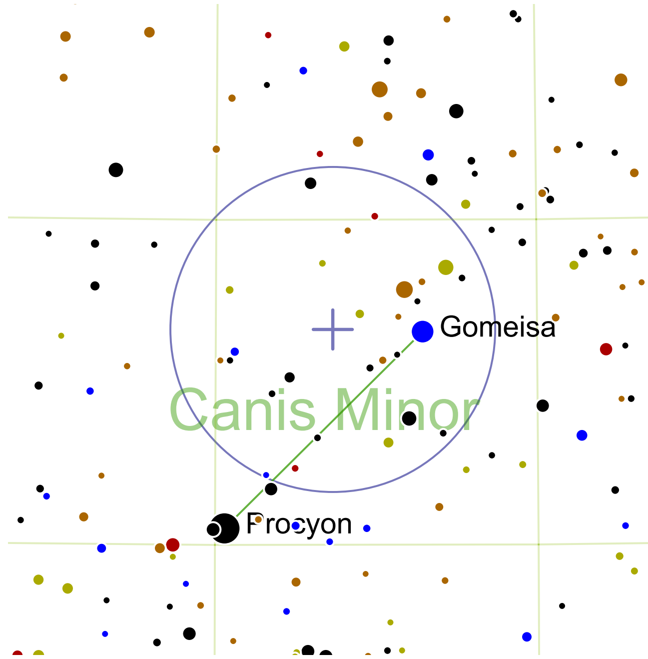
R Leo

RA: 146.89° | 9h 47.55' — DEC: 11.43° | 11° 26'

R Leo (HD 084748) is a magnitude 4.4 variable star. Magnitude ranges from 11.3 to 4.4 (Δ mag. 6.9) with a period of 310d.

Travel from Eta Leonis to Regulus, turn left, and travel an equal distance onward.

A reddish Mira-type variable with a bright maximum and deep minimum.



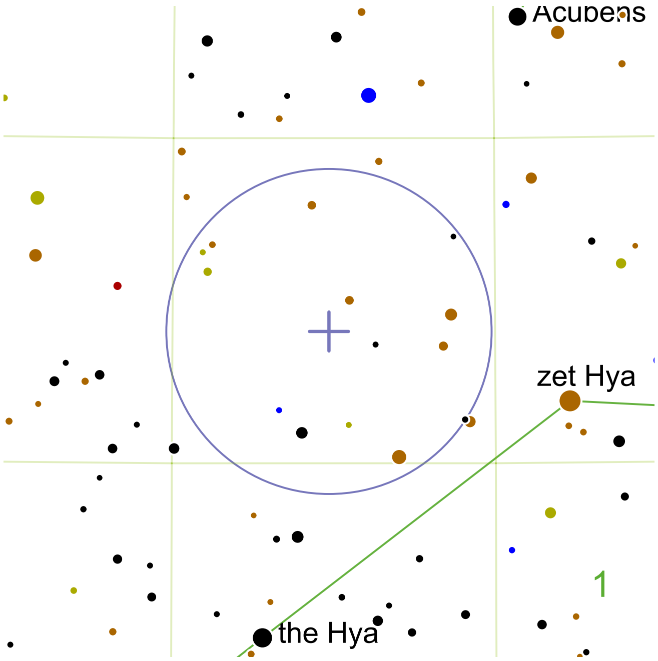
S CMi

RA: 113.18° | 7h 32.71' — DEC: 8.32° | 8° 19'

S CMi (HD 59950) is a magnitude 6.6 variable star. Magnitude ranges from 13.2 to 6.6 (Δ mag. 6.6) with a period of 333d.

1.3° E from mag.3.09 Gomeisa.

A Mira-type variable, S CMi is shedding significant quantities of silicate dust from its outer layers to surrounding space. It is 6,500 times brighter than the Sun.



C48

RA: 137.57° | 9h 10.29' — DEC: 7.03° | 7° 2'

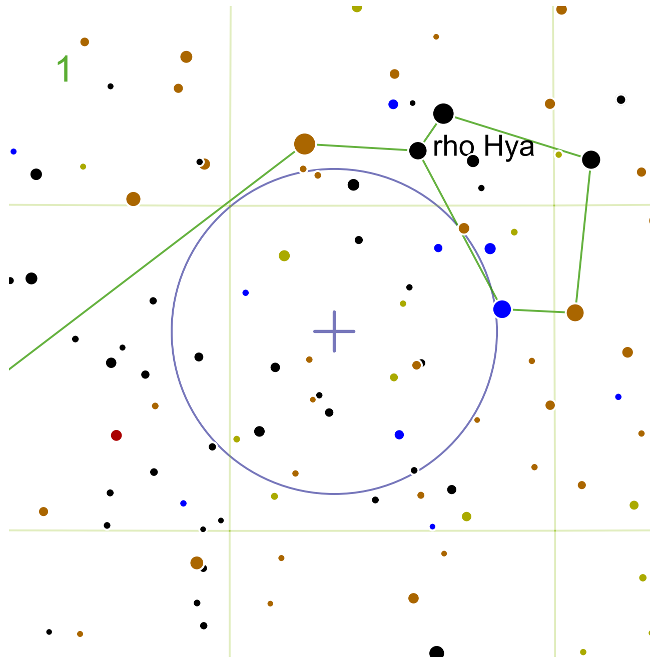
C48 (NGC 2775) is a magnitude 10.3 spiral galaxy. Angular size is 4.5x3'.

Two-fifths of the distance from Regulus to Procyon, slightly south of this line.

Small telescopes can show the large yellow core of the galaxy, but even large telescopes struggle to reveal the surrounding spiral arms.

Also visible:

(1) S Hya *(7.2$_m$ variable star)*



S Hya

RA: 133.39° | 8h 53.56' — DEC: 3.07° | 3° 4'

S Hya (HD 076011) is a magnitude 7.2 variable star. Magnitude ranges from 13.3 to 7.2 (Δ mag. 6.1) with a period of 257d.

One third of the distance from Alphard to Pollux.

This pulsating variable star is roughly 2,700 light-years from Earth.

Also visible:

(1) C48 *(10.3$_m$ spiral galaxy)*

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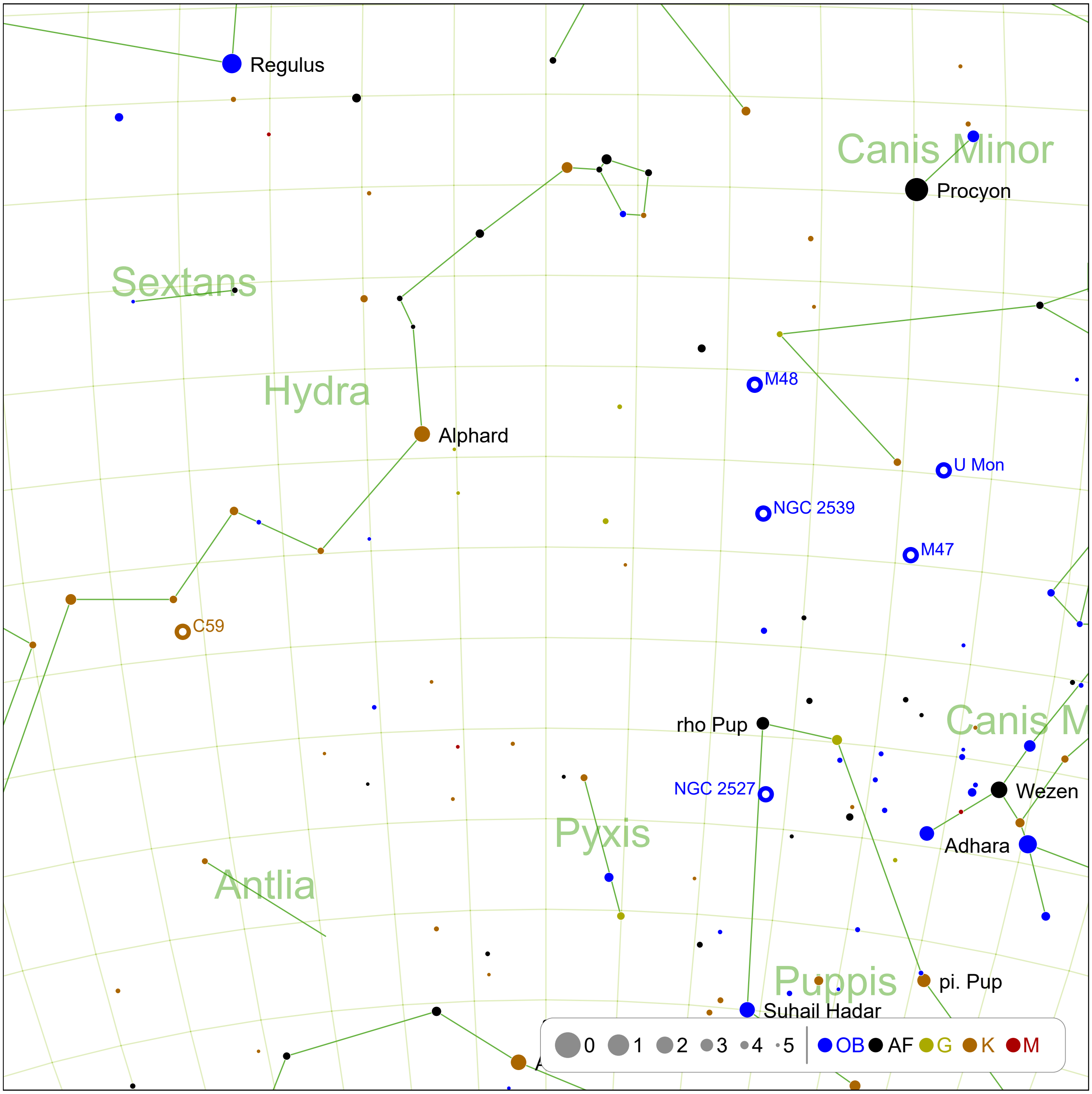
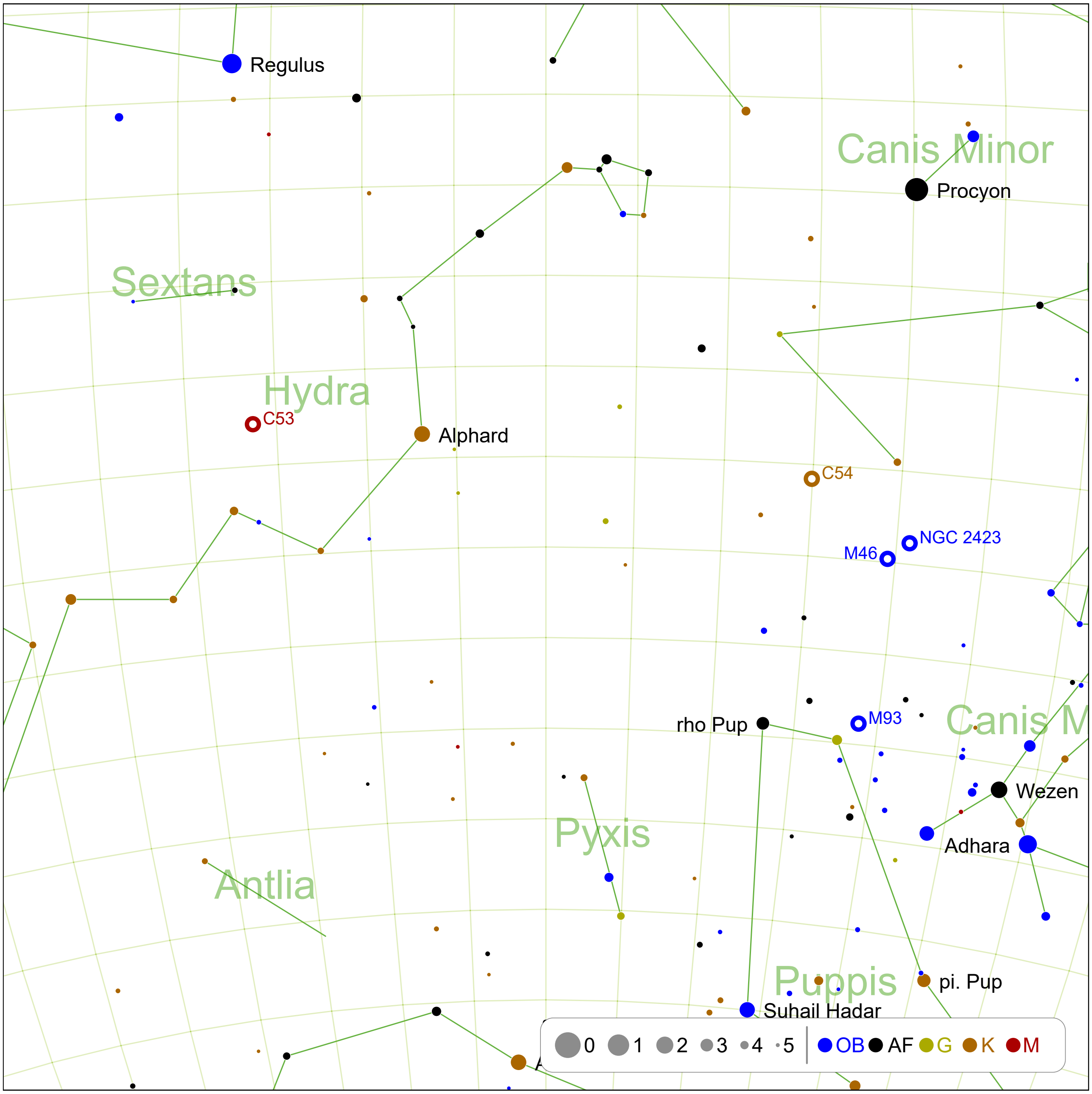
February: -15° South (1)

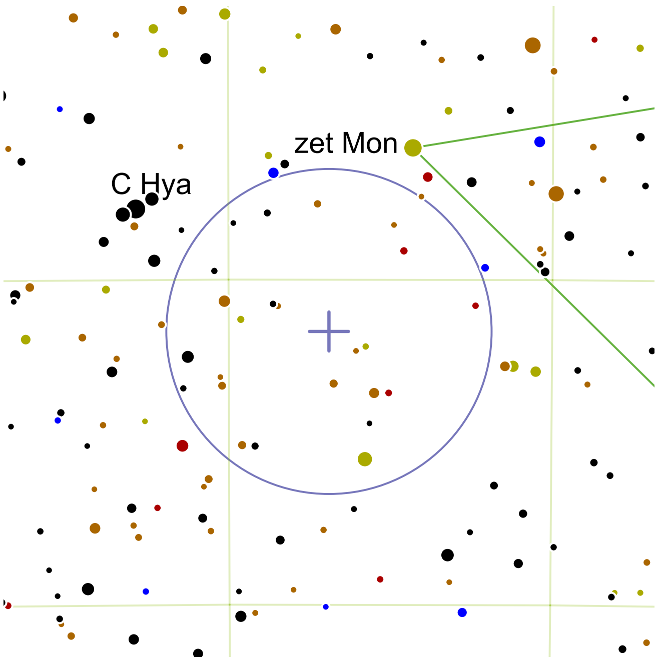


M48: page 147
U Mon: page 147
NGC 2539: page 148
M47: page 148
C59: page 149
NGC 2527: page 149

February: -15° South (2)



C53: page 150 C54: page 150 NGC 2423: page 151 M46: page 151
M93: page 152



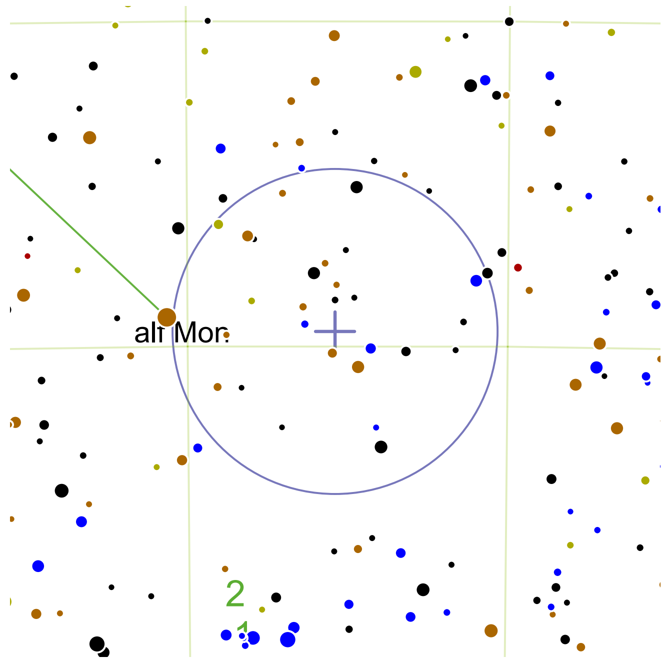
M48

RA: 123.45° | 8h 13.8' — DEC: -5.8° | -5° 47'

M48 (NGC 2548) is a magnitude 5.5 open cluster. Angular size is 54'.

Pointed to by lines from Mirzam through Sirius and Adhara through Wezen.

This cluster was observed by Charles Messier in 1771, but he recorded a declination that was wrong by five degrees. As such the discovery is often credited to Caroline Herschel in 1783. This massive open cluster (2,300 solar masses) is in the process of fragmenting: it is divided into three distinct lobes with different proper motion. M48 is 2,500 light-years from Earth.



U Mon

RA: 112.7° | 7h 30.79' — DEC: -9.78° | -9° 46'

U Mon (HD 059693) is a magnitude 6.1 variable star. Magnitude ranges from 8.8 to 6.1 (Δ mag. 2.7) with a period of 91.3d.

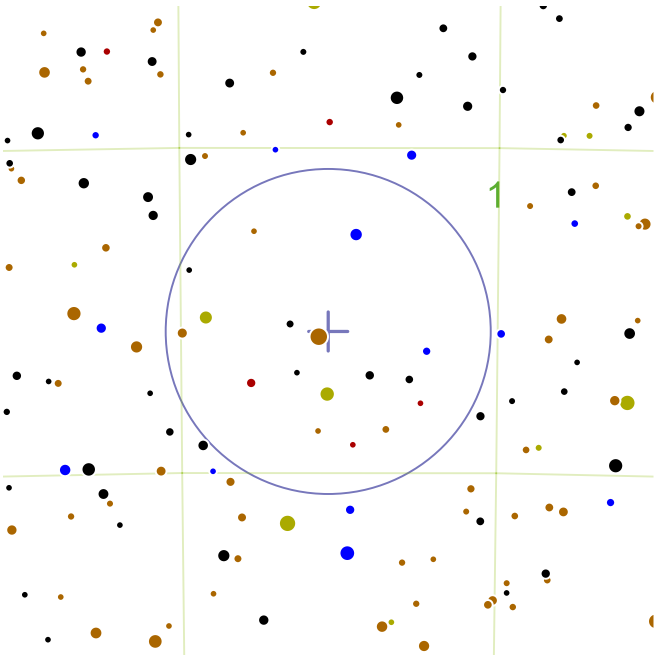
13.0° NEE from mag.-1.58 Sirius.

Located in a bright and colorful field, U Mon is neighbored by SAO 152986 to the south (magnitude 6.6), marking the brighter limit of this star's range. Half a degree to the east is SAO 134821 (magnitude 7.6) which acts as a guide to the middle of U Mon's range.

Also visible:

(1) M47 *(5.2ₘ open cluster)*

(2) NGC 2423 *(6.7ₘ open cluster)*



NGC 2539

RA: 122.68° | 8h 10.69' — DEC: -12.83° | -12° 49'

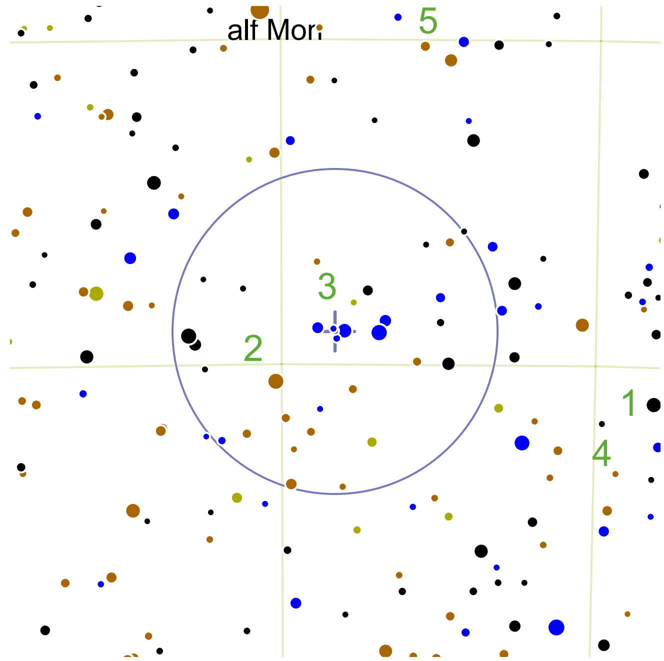
NGC 2539 is a magnitude 6.5 open cluster. Angular size is 22'.

9.6° SSW from mag.3.95 C Hya.

This moderately rich cluster has around 50-100 stars.

Also visible:

(1) C54 *(7.6$_m$ open cluster)*



M47

RA: 114.15° | 7h 36.6' — DEC: -14.5° | -14° 29'

M47 (NGC 2422) is a magnitude 5.2 open cluster. Angular size is 30'.

Forms the sharp tip of a slightly extended isosceles triangle with Sirius and Wezen (the bright star in Canis Major's tail).

This cluster was discovered and rediscovered by Giovanni Battista Hodierna (1654), Charles Messier (1771) and Caroline Herschel. Messier mistakenly transposed the Right Ascension and Declination signs in his work, so for centuries M47 was considered a "lost Messier". M47 is 78 million years old, has the mass of 453 Suns, and spans 30 light years.

Also visible:

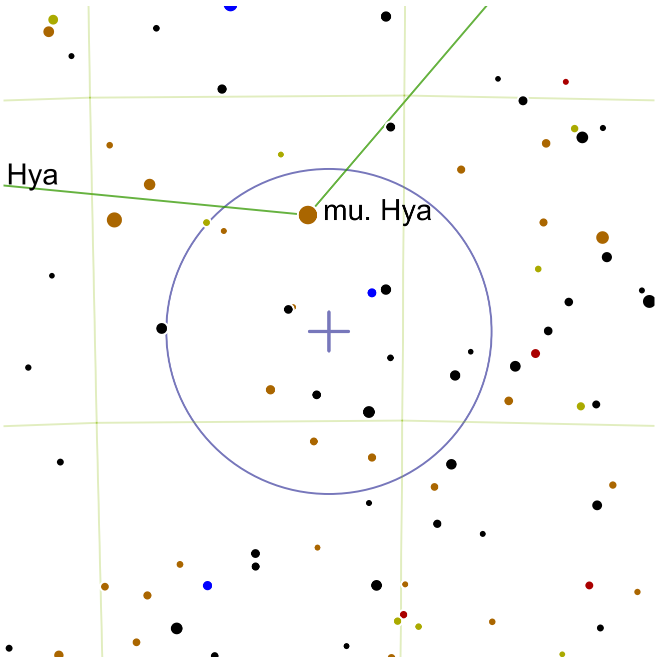
(1) C58 *(7.2$_m$ open cluster)*

(2) M46 *(6.0$_m$ open cluster)*

(3) NGC 2423 *(6.7$_m$ open cluster)*

(4) R CMa *(5.7$_m$ variable star)*

(5) U Mon *(6.1$_m$ variable star)*



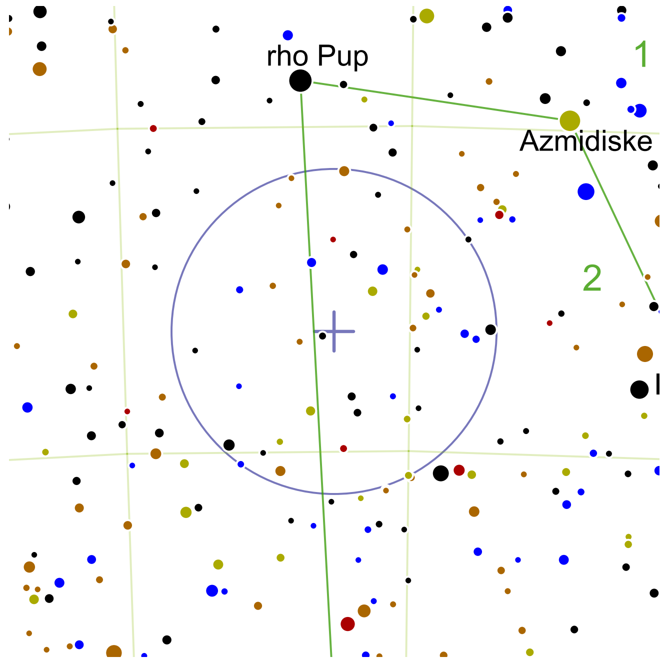
C59

RA: 156.2° | 10h 24.79' — DEC: -18.63° | -18° 37'

C59 (Ghost of Jupiter, NGC 3242) is a magnitude 8.6 planetary nebula. Angular size is 0.4'.

6.4° SWW from mag.3.32 nu. Hya.

A bright planetary nebula with rich structures that be picked out with larger telescopes. The nebula spans 2 light-years, and the inner shell of expelled gas was ejected from the central white dwarf 1,500 years ago.



NGC 2527

RA: 121.33° | 8h 5.3' — DEC: -28.17° | -28° 9'

NGC 2527 is a magnitude 6.5 open cluster. Angular size is 22'.

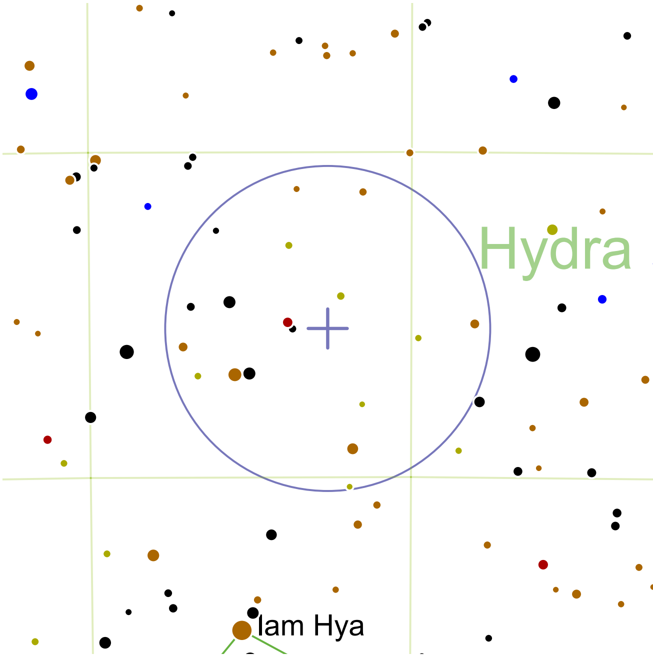
3.8° S from mag.2.88 rho Pup.

A loose scattering of stars, originally discovered by William Herschel on December 9, 1784. His son John rediscovered the cluster in 1837, giving it the duplicate identifier NGC 2520.

Also visible:

(1) M93 *(6.0$_m$ open cluster)*

(2) NGC 2452 *(12.5$_m$ planetary nebula)*



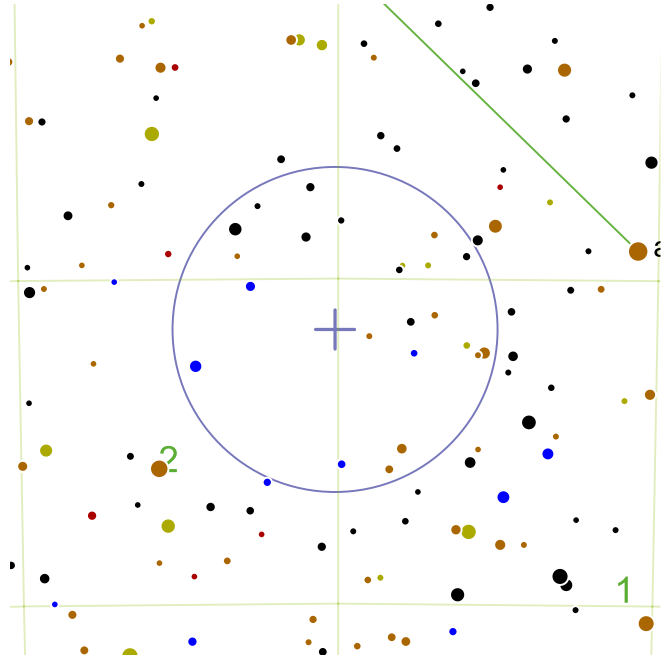
C53

RA: 151.3° | 10h 5.2' — DEC: -7.72° | -7° 42'

C53 (Spindle Galaxy, NGC 3115) is a magnitude 9.1 elliptical galaxy. Angular size is 8x3'.

4.8° NNW from mag.3.83 lam Hya.

This edge-on lenticular galaxy is quite accessible to smaller telescopes, which can reveal the elongated shape and bright core.



C54

RA: 120.05° | 8h 0.19' — DEC: -10.78° | -10° 46'

C54 (NGC 2506) is a magnitude 7.6 open cluster. Angular size is 7'.

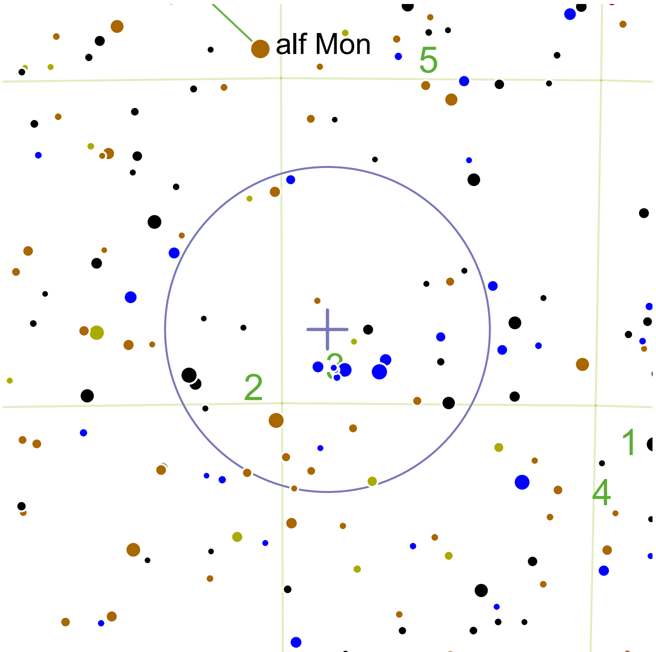
Midway between Alphard and Sirius, bearing slightly toward Procyon.

A fine sight in binoculars and any telescope, the member stars of this cluster are quite faint but numerous. At an age of 1.1 billion years, this is an elderly open cluster.

Also visible:

(1) M46 *(6.0$_m$ open cluster)*

(2) NGC 2539 *(6.5$_m$ open cluster)*



NGC 2423

RA: 114.28° | 7h 37.1' — DEC: -13.87° | -13° 51'

NGC 2423 is a magnitude 6.7 open cluster. Angular size is 19'.

Forms the sharp tip of a slightly extended isosceles triangle with Sirius and Wezen (the bright star in Canis Major's tail).

The finder circle is crowded with interesting objects - Messier 47 is less than a degree to the south, while Messier 46 is nearly two degrees to the southeast. The faint cluster NGC 2414 is two degrees to the southwest. Messier 46 includes the faint planetary nebula NGC 2438.

Also visible:

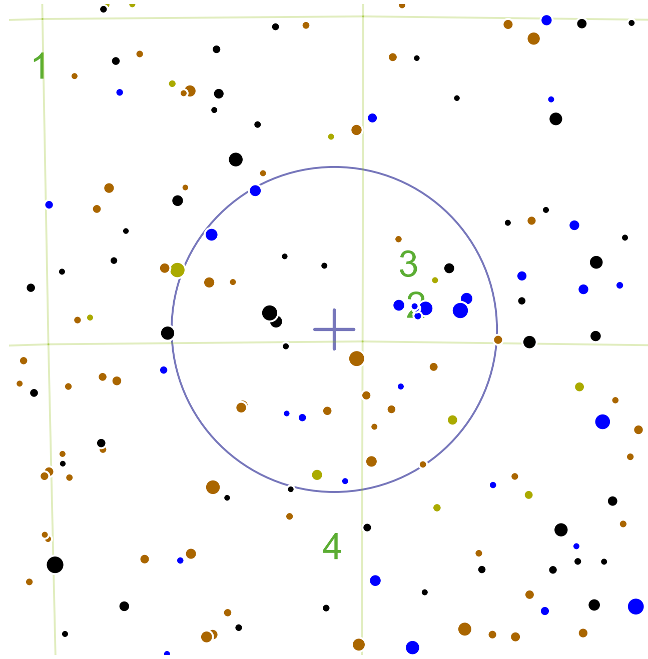
(1) C58 *(7.2$_m$ open cluster)*

(2) M46 *(6.0$_m$ open cluster)*

(3) M47 *(5.2$_m$ open cluster)*

(4) R CMa *(5.7$_m$ variable star)*

(5) U Mon *(6.1$_m$ variable star)*



M46

RA: 115.45° | 7h 41.8' — DEC: -14.82° | -14° 48'

M46 (NGC 2437) is a magnitude 6.0 open cluster. Angular size is 27'.

Forms the sharp tip of a slightly extended isosceles triangle with Sirius and Wezen (the bright star in Canis Major's tail).

A bright, rich and large cluster with a surprise on its northern edge - the planetary nebula NGC 2438 (magnitude 10.8, 1.1' diameter). The cluster has a mass of around 450 Suns and a radius of 37.8 light-years. It is 250 million years old. It forms a "double cluster" with M47, one degree away, but this is a line-of-sight coincidence and the two strikingly different clusters are unrelated.

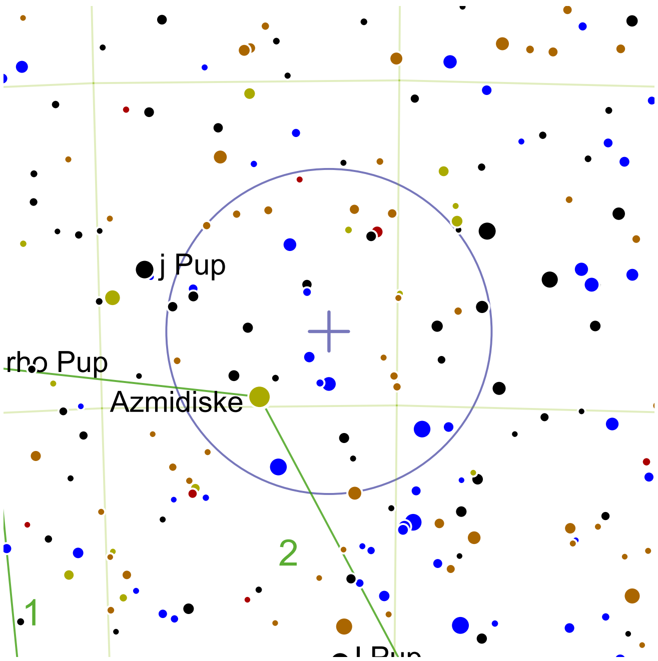
Also visible:

(1) C54 *(7.6$_m$ open cluster)*

(2) M47 *(5.2$_m$ open cluster)*

(3) NGC 2423 *(6.7$_m$ open cluster)*

(4) NGC 2440 *(10.5$_m$ planetary nebula)*



M93

RA: 116.15° | 7h 44.6' — DEC: -23.87° | -23° 51'

M93 (NGC 2447) is a magnitude 6.0 open cluster. Angular size is 22'.

1.4° NW from mag.3.47 Azmidiske.

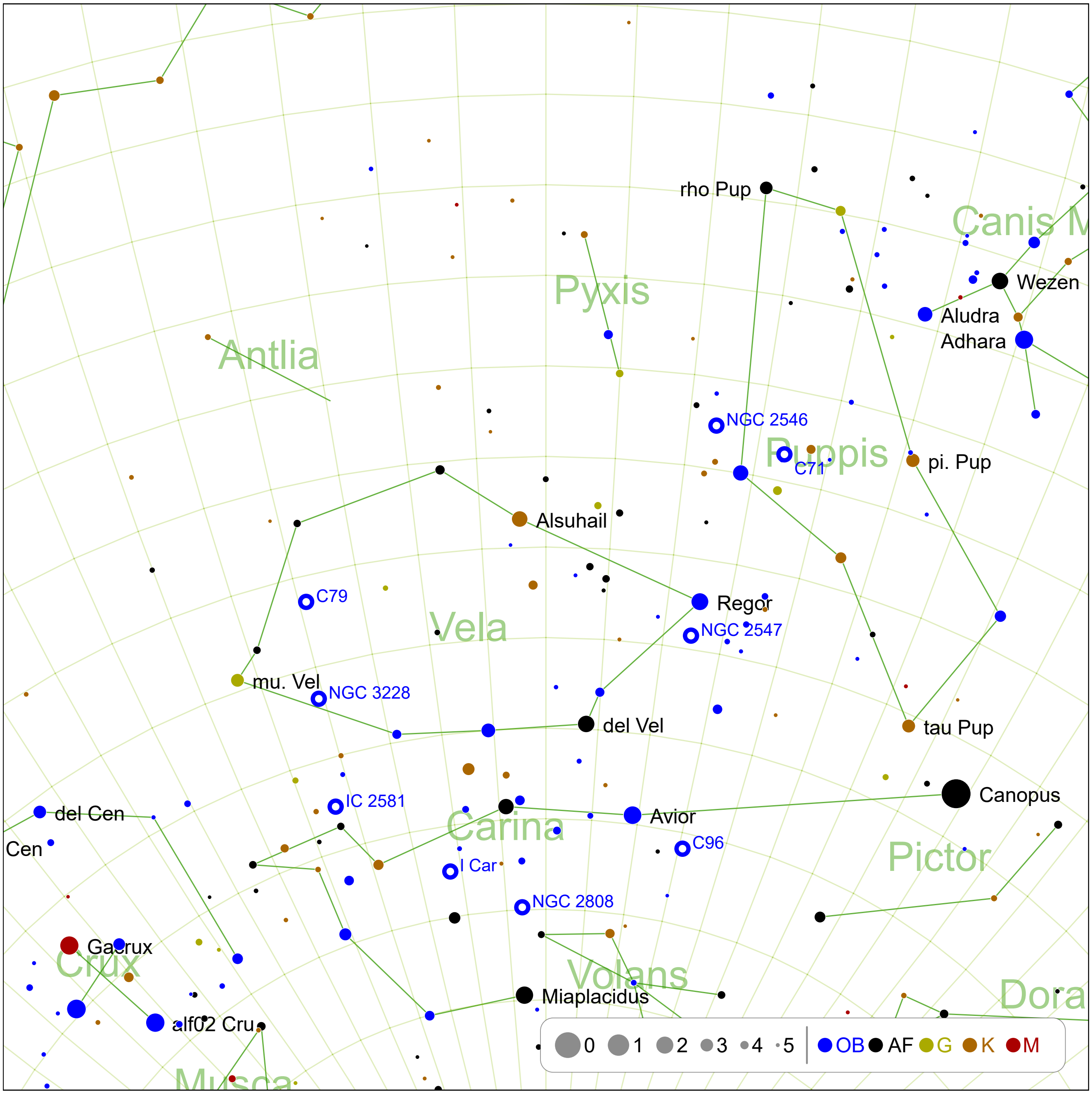
This rich open cluster was discovered by Charles Messier in 1781, and by Caroline Herschel in 1783. In larger telescopes the cluster can resemble a starfish. It is about 390 million years old, and is 3,380 light-years from Earth.

Also visible:

(1) NGC 2527 *(6.5_m open cluster)*

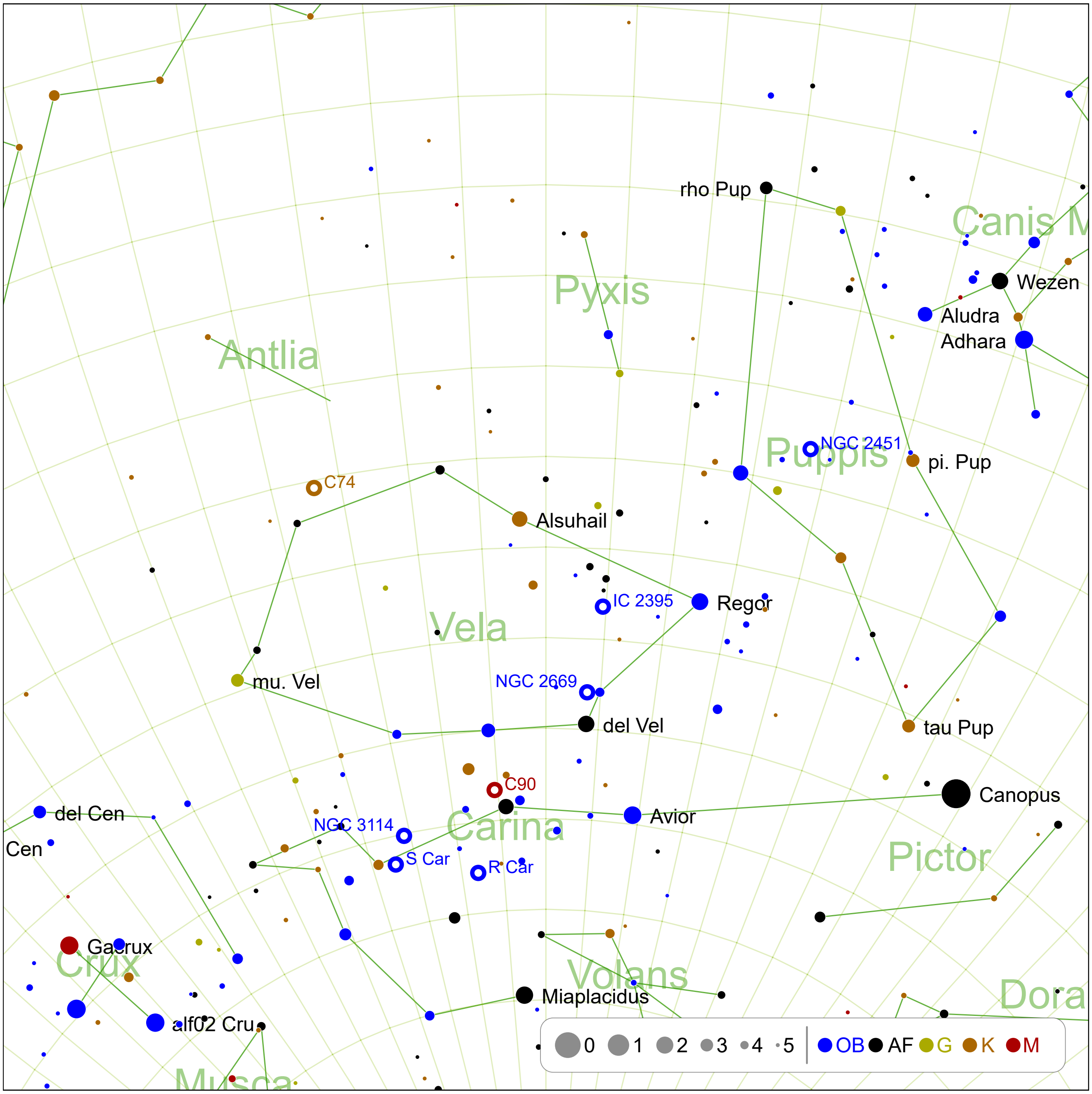
(2) NGC 2452 *(12.5_m planetary nebula)*

February: -45° South (1)

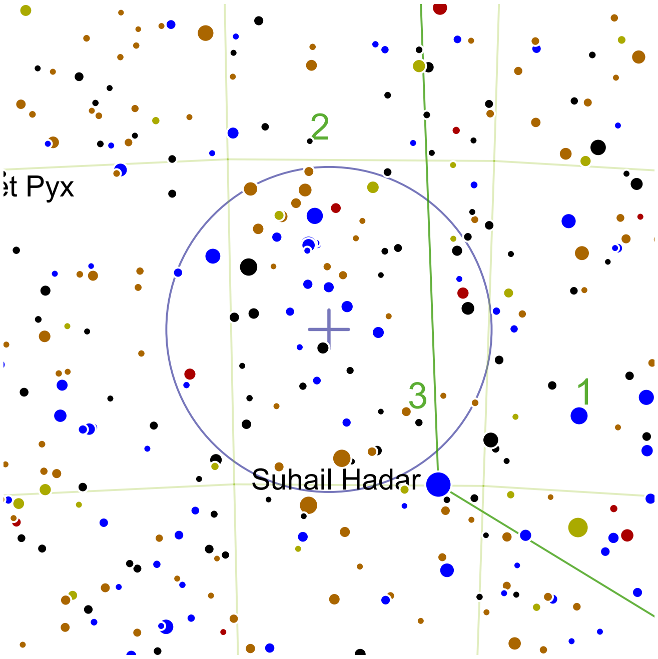


NGC 2546: page 155 | C71: page 155 | C79: page 156 | NGC 2547: page 156
NGC 3228: page 157 | IC 2581: page 157 | C96: page 158 | l Car: page 158
NGC 2808: page 159

February: -45° South (2)



NGC 2451: page 159
C74: page 160
IC 2395: page 160
NGC 2669: page 161
C90: page 161
NGC 3114: page 162
S Car: page 162
R Car: page 163



NGC 2546

RA: 123.1° | 8h 12.39' — DEC: -37.63° | -37° 37'

NGC 2546 is a magnitude 6.3 open cluster. Angular size is 41'.

2.9° NE from mag.2.27 Suhail Hadar.

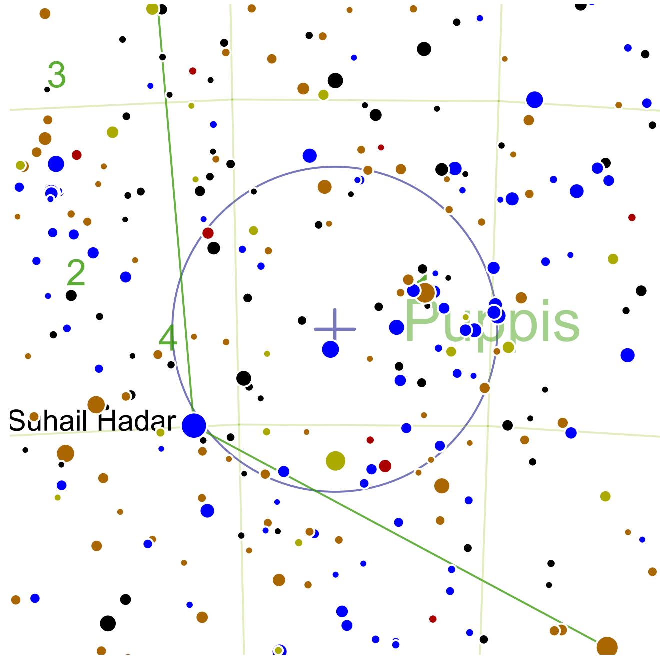
Discovered from South Africa in 1751-1752 by Abbe Lacaille, this sparse open cluster is 3,300 light years from Earth.

Also visible:

(1) C71 *(5.8_m open cluster)*

(2) RS Pup *(6.52_m variable star)*

(3) RT Pup *(8.5_m carbon star)*



C71

RA: 118.08° | 7h 52.3' — DEC: -38.55° | -38° 32'

C71 (NGC 2477) is a magnitude 5.8 open cluster. Angular size is 27'.

1.4° SEE from mag.3.72 c Pup.

This massive and dense open cluster resembles a globular cluster with its spherical shape and numerous stars. The center of Caldwell 71 however lacks the brightness of a true globular cluster. Given its size and great brightness, this is one of the best clusters in the sky.

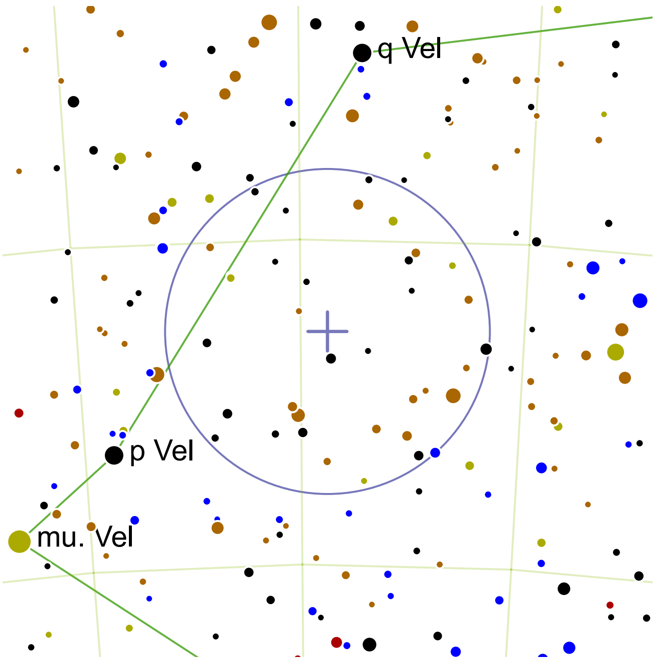
Also visible:

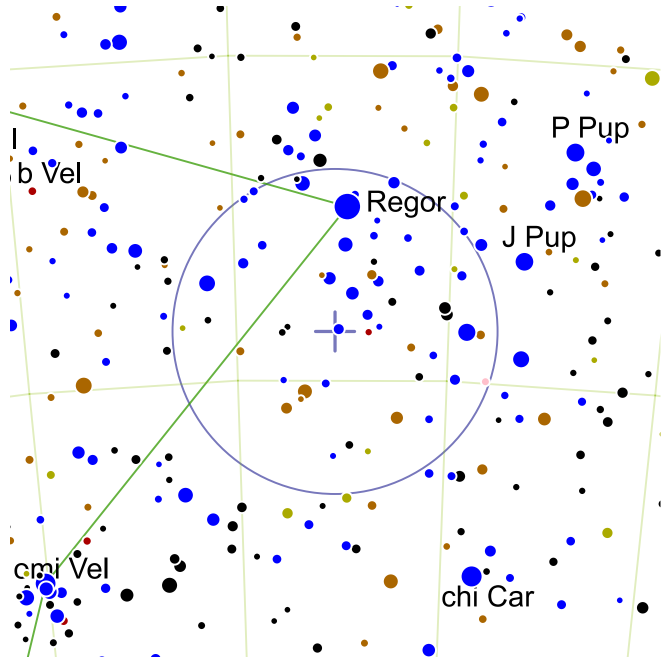
(1) NGC 2451 *(2.8_m open cluster)*

(2) NGC 2546 *(6.3_m open cluster)*

(3) RS Pup *(6.52_m variable star)*

(4) RT Pup *(8.5_m carbon star)*





C79

RA: 154.4° | 10h 17.6' — DEC: -46.42° | -46° 24'

C79 (NGC 3201) is a magnitude 6.7 globular cluster. Angular size is 18'.

5.7° NWW from mag.2.84 mu. Vel.

A brilliant globular cluster and easy binocular target, a small telescope can resolve the member stars well into the relatively diffuse core. Caldwell 79 orbits in the opposite direction to the Milky Way's rotation, suggesting it may be a captured object. Interestingly, stars in this cluster become redder and cooler toward the core of the cluster, an inhomogenous characteristic only shared by Messier 4.

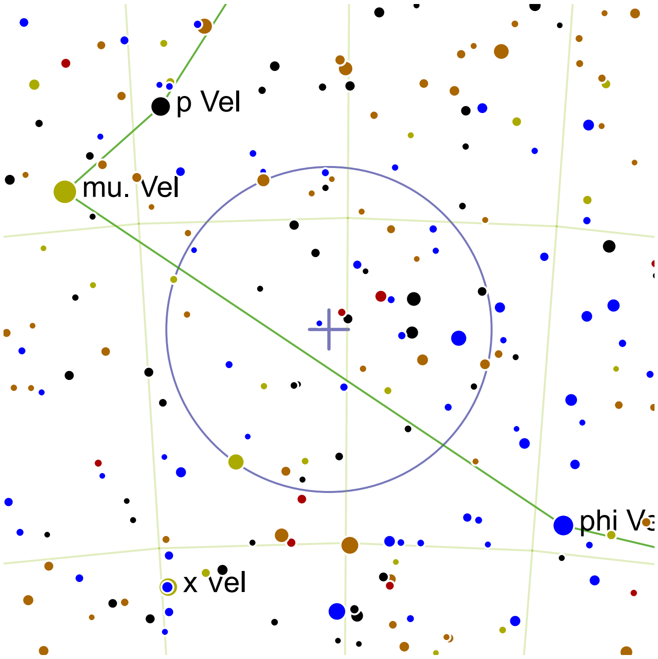
NGC 2547

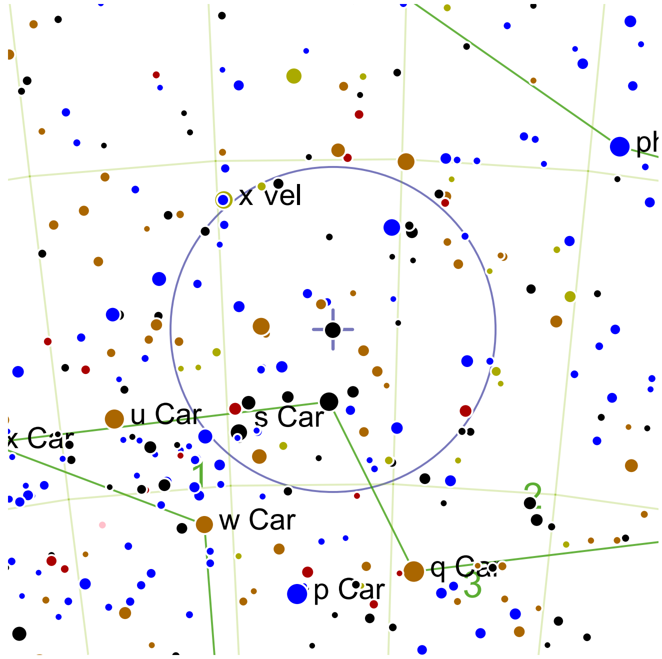
RA: 122.68° | 8h 10.69' — DEC: -49.27° | -49° 15'

NGC 2547 is a magnitude 4.7 open cluster. Angular size is 20'.

1.9° S from mag.1.92 Regor.

This young cluster (less than 30 million years old) possesses multiple stars with excess infrared radiation, strongly suggesting planet-forming discs around these stars. The cluster is only 1,200 light-years distant.





NGC 3228

RA: 155.45° | 10h 21.79' — DEC: -51.72° | -51° 42'

NGC 3228 is a magnitude 6.0 open cluster. Angular size is 18'.

4.5° SWW from mag.2.84 mu. Vel.

This small, bright open cluster is roughly 260 million years old. 53 possible members have been ascribed to this cluster.

IC 2581

RA: 156.85° | 10h 27.39' — DEC: -57.63° | -57° 37'

IC 2581 is a magnitude 4.3 open cluster. Angular size is 8'.

3.6° NWW from mag.3.88 u Car.

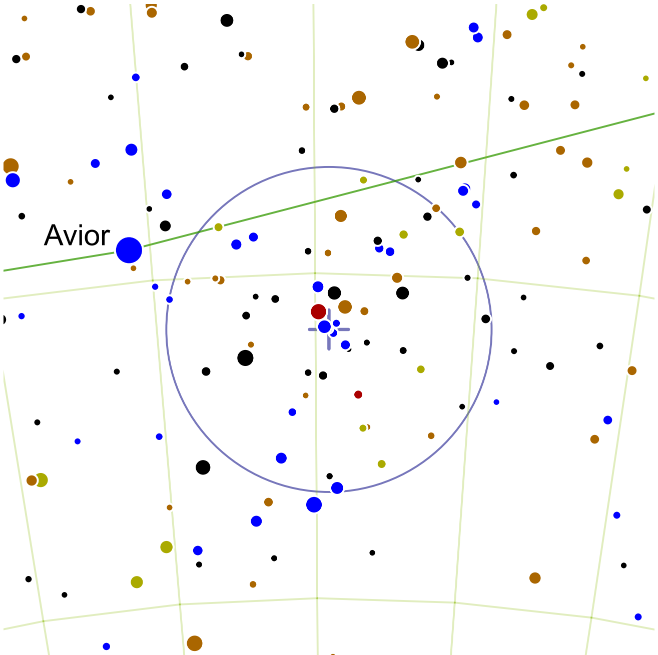
This bright open cluster has about 120 members, dominated by the A7 supergiant HD 90772 near its center.

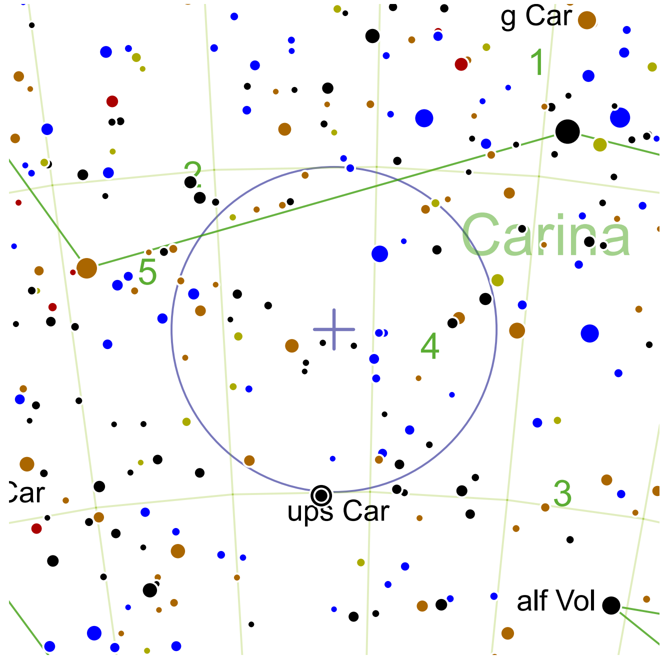
Also visible:

(1) C92 *(6.2$_m$ bright nebula)*

(2) NGC 3114 *(4.2$_m$ open cluster)*

(3) S Car *(4.5$_m$ variable star)*





C96

RA: 119.58° | 7h 58.3' — DEC: -60.87° | -60° 51'

C96 (Southern Beehive, NGC 2516) is a magnitude 3.8 open cluster. Angular size is 30'.

3.3° SWW from mag.1.74 71130.

The Southern Beehive is a broad swarm of stars, easily seen by the naked eye in a dark location. 1,000 light-years from Earth, the cluster has over 100 stars.

l Car

RA: 146.31° | 9h 45.24' — DEC: -62.51° | -62° 29'

l Car (HD 84810) is a magnitude 3.28 variable star. Magnitude ranges from 4.18 to 3.28 (Δ mag. 0.9) with a period of 35.53584d.

2.5° N from mag.3.15 ups Car.

This bright Cepheid variable is best compared with the unaided eye to the other bright stars of Carina.

Also visible:

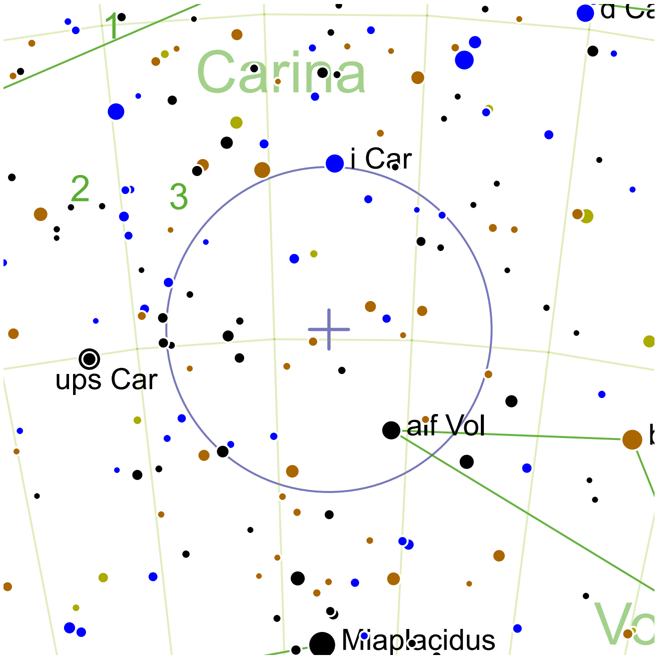
(1) C90 *(9.7$_m$ planetary nebula)*

(2) NGC 3114 *(4.2$_m$ open cluster)*

(3) NGC 2808 *(6.2$_m$ globular cluster)*

(4) R Car *(3.9$_m$ variable star)*

(5) S Car *(4.5$_m$ variable star)*



NGC 2808

RA: 138.01° | 9h 12.04' — DEC: -64.86° | -64° 51'

NGC 2808 (NGC) is a magnitude 6.2 globular cluster. Angular size is 14'.

3.7° W from mag.3.15 ups Car.

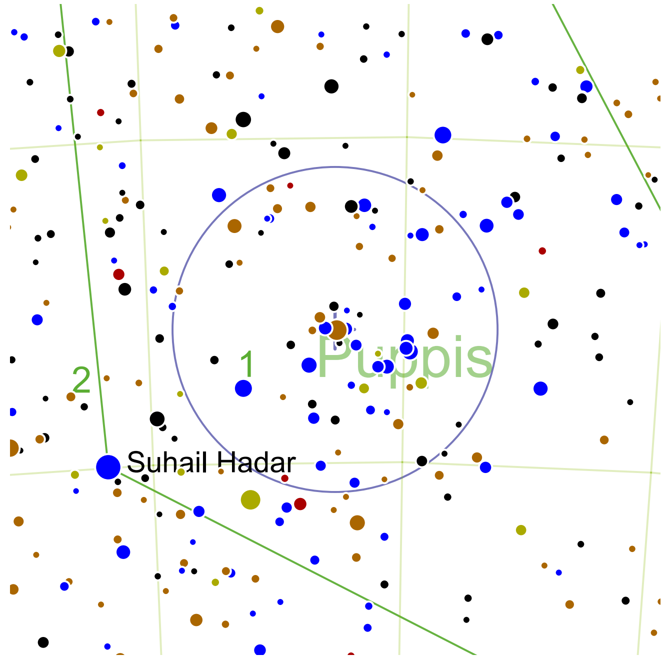
One of the largest globular clusters in the Milky Way, NGC 2808 has over a million stars. Studies suggest that the stars in NGC 2808 formed over a period of 200 million years in three distinct generations.

Also visible:

(1) IC 2501 *(11.0_m planetary nebula)*

(2) l Car *(3.28_m variable star)*

(3) R Car *(3.9_m variable star)*



NGC 2451

RA: 116.35° | 7h 45.39' — DEC: -37.97° | -37° 57'

NGC 2451 is a magnitude 2.8 open cluster. Angular size is 45'.

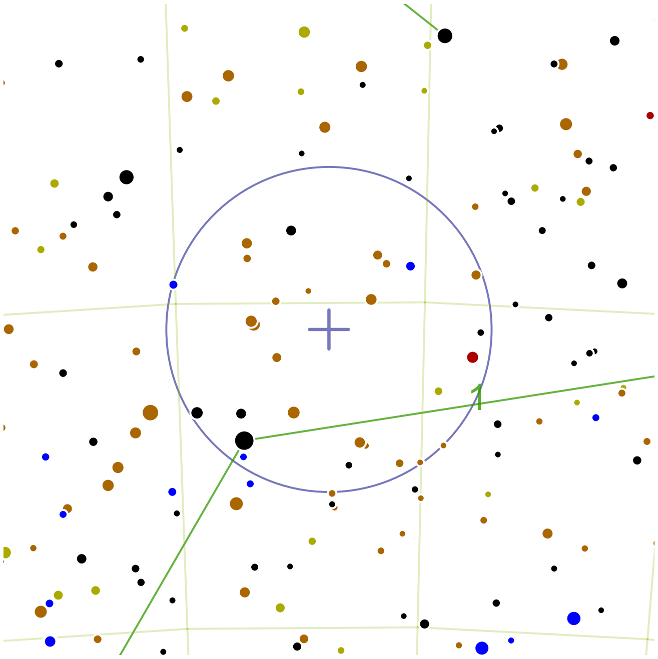
Draw a line from Sirius through Wezen, and extend it slightly more than an equal distance.

Two for one! This bright open cluster is actually two open clusters in the same line of sight - NGC 2451A at 600 light-years, and NGC 2451B at 1,200 light-years.

Also visible:

(1) C71 *(5.8_m open cluster)*

(2) RT Pup *(8.5_m carbon star)*



C74

RA: 151.93° | 10h 7.7' — DEC: -40.43° | -40° 25'

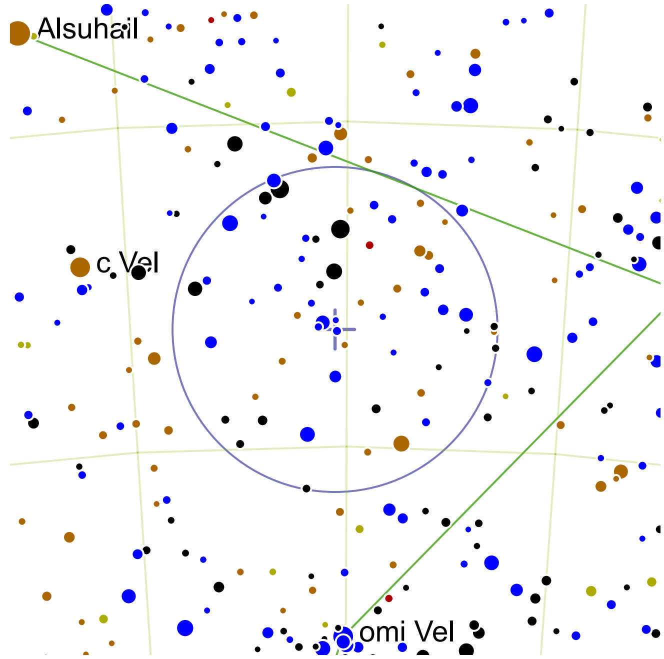
C74 (Eight Burst Nebula, NGC 3132) is a magnitude 8.2 planetary nebula. Angular size is 0.8'.

7.0° E from mag.3.64 psi Vel.

This fainter planetary nebula is only 0.4 light-years wide, so it is relatively young. The tenth magnitude star within the ring of nebulosity is not the source of the gas cloud nor of the ultraviolet light that causes the gas to fluoresce. This honor falls to the sixteenth magnitude companion star nearby.

Also visible:

(1) X Vel *(8.4_m carbon star)*



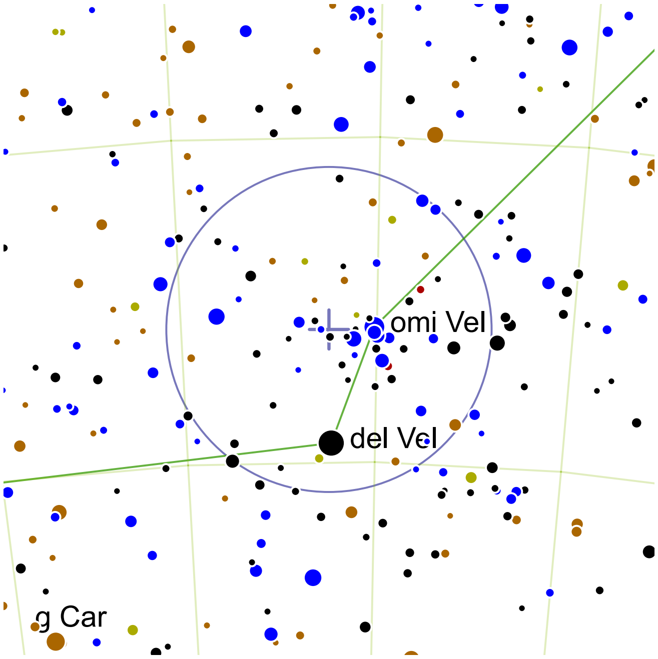
IC 2395

RA: 130.28° | 8h 41.1' — DEC: -48.2° | -48° 11'

IC 2395 is a magnitude 4.6 open cluster. Angular size is 8'.

4.0° SWW from mag.3.69 c Vel.

This open cluster has around 45 members and is under 18 million years old and 2,300 light-years distant. Its brightest member is magnitude 5.5.

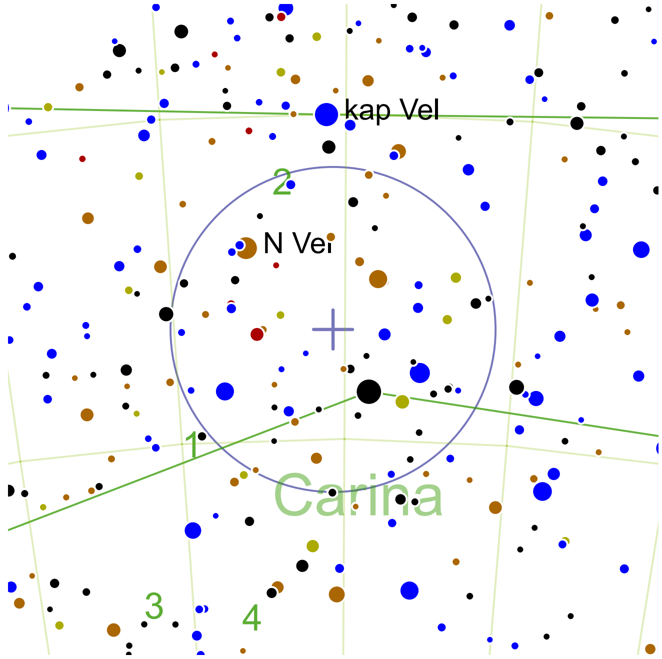


NGC 2669

RA: 131.23° | 8h 44.89' — DEC: -52.97° | -52° 57'

NGC 2669 is a magnitude 6.1 open cluster. Angular size is 12'.

0.6° E from mag.3.68 omi Vel.



C90

RA: 140.35° | 9h 21.39' — DEC: -58.32° | -58° 18'

C90 (NGC 2867) is a magnitude 9.7 planetary nebula. Angular size is 0.2'.

1.1° NNE from mag.2.25 Tureis.

When John Herschel discovered this object on April Fool's Day in 1834, he at first thought he had discovered a new planet, but it was "only" a planetary nebula. Being quite faint and small, Herschel's brief confusion is quite excusable.

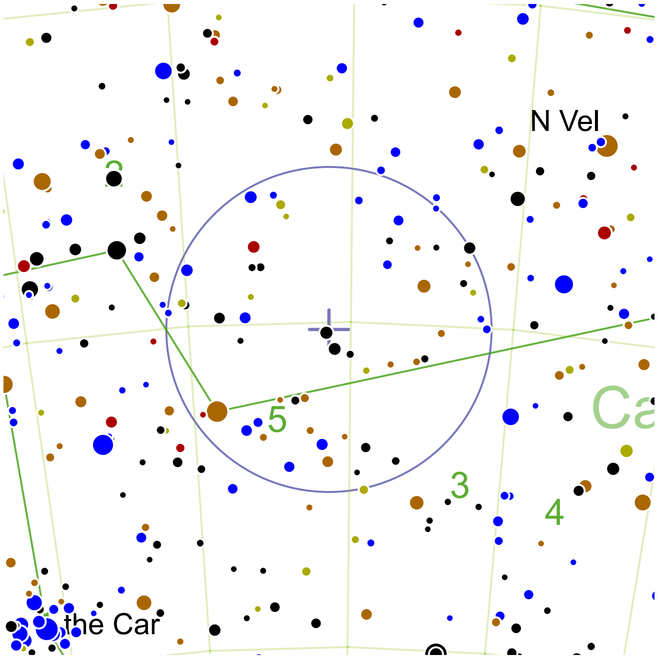
Also visible:

(1) IC 2501 *(11.0$_m$ planetary nebula)*

(2) NGC 2899 *(12.0$_m$ planetary nebula)*

(3) l Car *(3.28$_m$ variable star)*

(4) R Car *(3.9$_m$ variable star)*



NGC 3114

RA: 150.68° | 10h 2.7' — DEC: -60.12° | -60° 6'

NGC 3114 is a magnitude 4.2 open cluster. Angular size is 35'.

2.1° NWW from mag.3.44 q Car.

A sparse open cluster almost lost in a very rich star field.

Also visible:

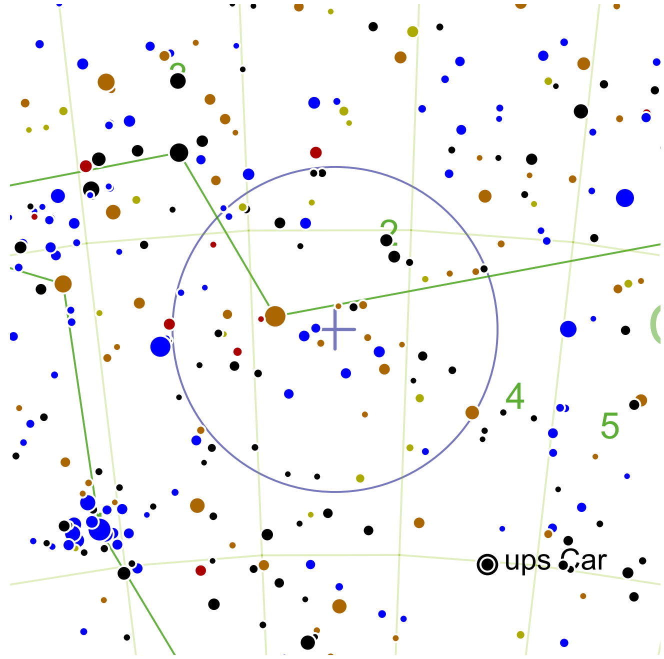
(1) C102 *(1.9$_m$ open cluster)*

(2) IC 2581 *(4.3$_m$ open cluster)*

(3) l Car *(3.28$_m$ variable star)*

(4) R Car *(3.9$_m$ variable star)*

(5) S Car *(4.5$_m$ variable star)*



S Car

RA: 152.34° | 10h 9.36' — DEC: -61.55° | -61° 32'

S Car (HD 88366) is a magnitude 4.5 variable star. Magnitude ranges from 9.9 to 4.5 (Δ mag. 5.4) with a period of 149d.

0.9° SWW from mag.3.44 q Car.

A Mira-type variable, although it is unusually hot for a star of this class and also has an unusually short period.

Also visible:

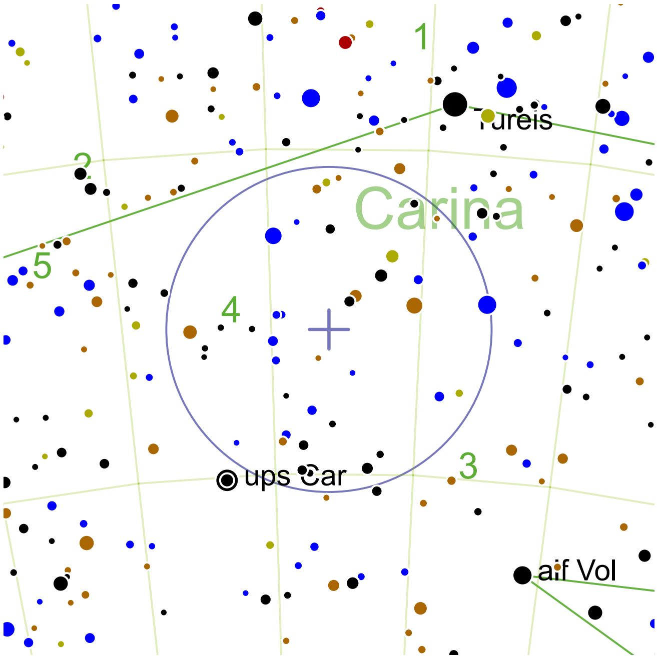
(1) C102 *(1.9$_m$ open cluster)*

(2) NGC 3114 *(4.2$_m$ open cluster)*

(3) IC 2581 *(4.3$_m$ open cluster)*

(4) l Car *(3.28$_m$ variable star)*

(5) R Car *(3.9$_m$ variable star)*



R Car

RA: 143.06° | 9h 32.24' — DEC: -62.79° | -62° 46'

R Car (HD 82901) is a magnitude 3.9 variable star. Magnitude ranges from 10.5 to 3.9 (Δ mag. 6.6) with a period of 309d.

2.7° NW from mag.3.15 ups Car.

A double star where the primary is a Mira-type variable, and the faint secondary (magnitude 11.3) is separated by only 2.1" on a position angle of 132°.

Also visible:

(1) C90 *(9.7$_m$ planetary nebula)*

(2) NGC 3114 *(4.2$_m$ open cluster)*

(3) NGC 2808 *(6.2$_m$ globular cluster)*

(4) l Car *(3.28$_m$ variable star)*

(5) S Car *(4.5$_m$ variable star)*

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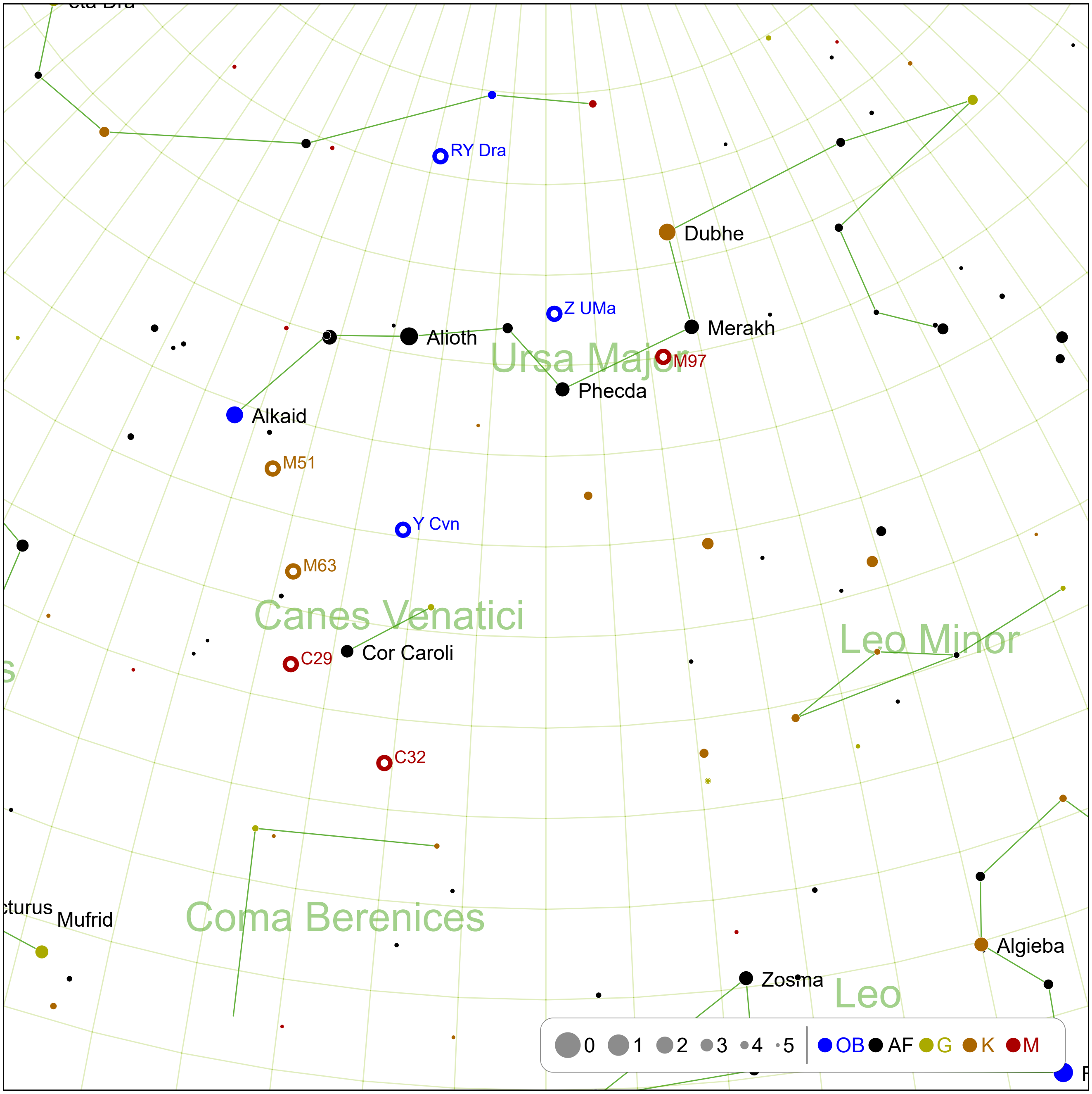
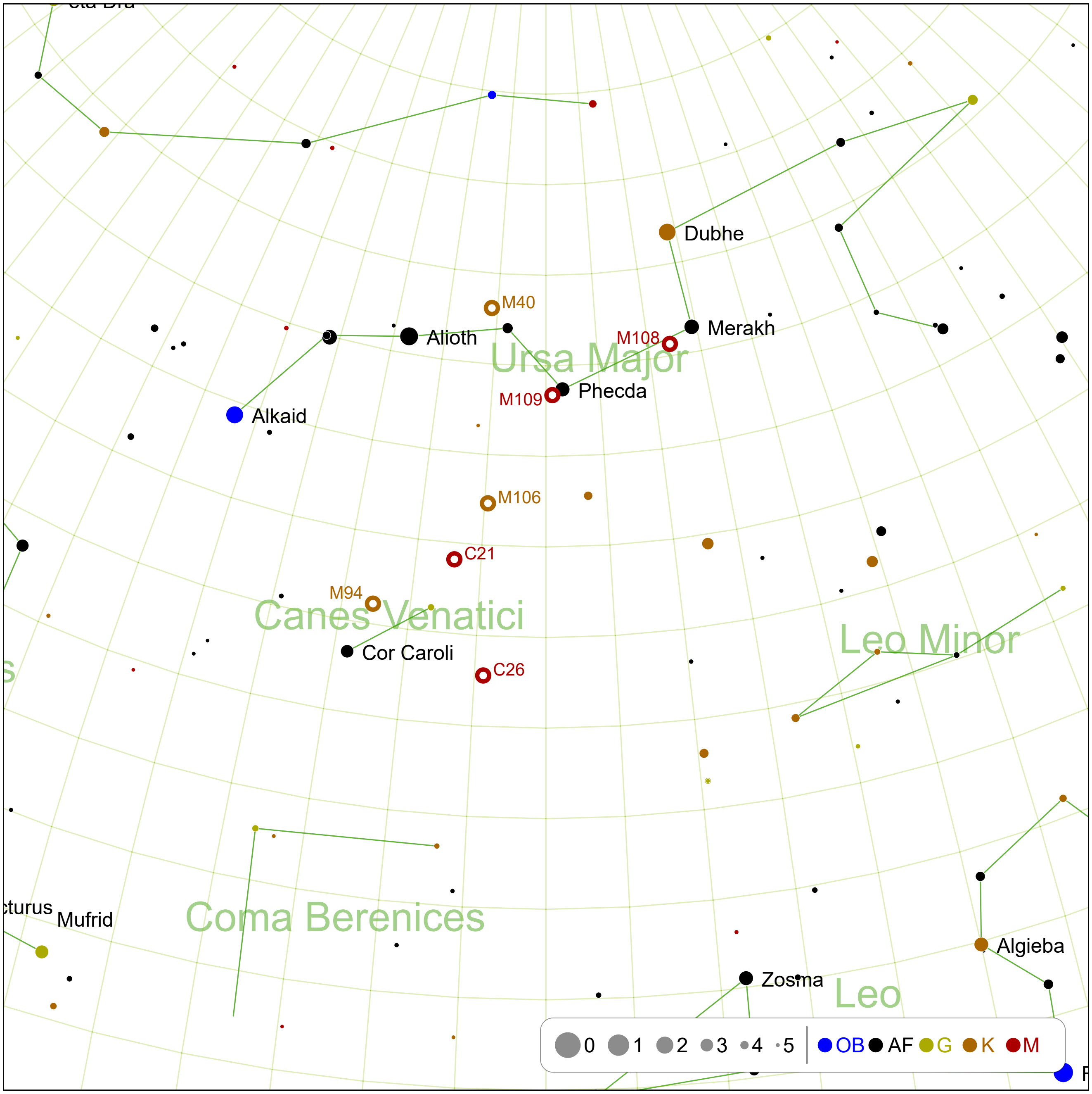
April: 45° North (1)

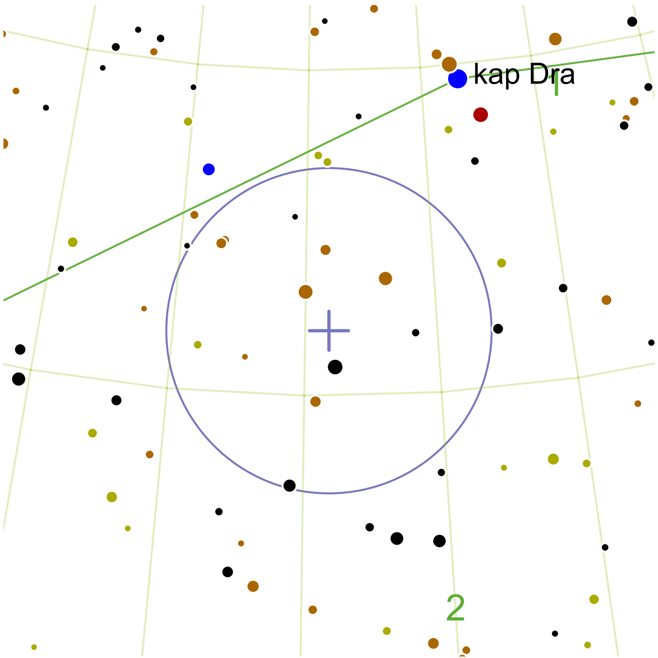


RY Dra: page 167
Z UMa: page 167
M97: page 168
M51: page 168
Y Cvn: page 169
M63: page 169
C29: page 170
C32: page 170

April: 45° North (2)



M40: page 171 | M108: page 171 | M109: page 172 | M106: page 172
C21: page 173 | M94: page 173 | C26: page 174



RY Dra

RA: 194.1° | 12h 56.39' — DEC: 66.0° | 66° 0'

RY Dra (HD 112559) is a magnitude 6.0 carbon star. Magnitude ranges from 8.2 to 6.0 (Δ mag. 2.2) with a period of 170d.

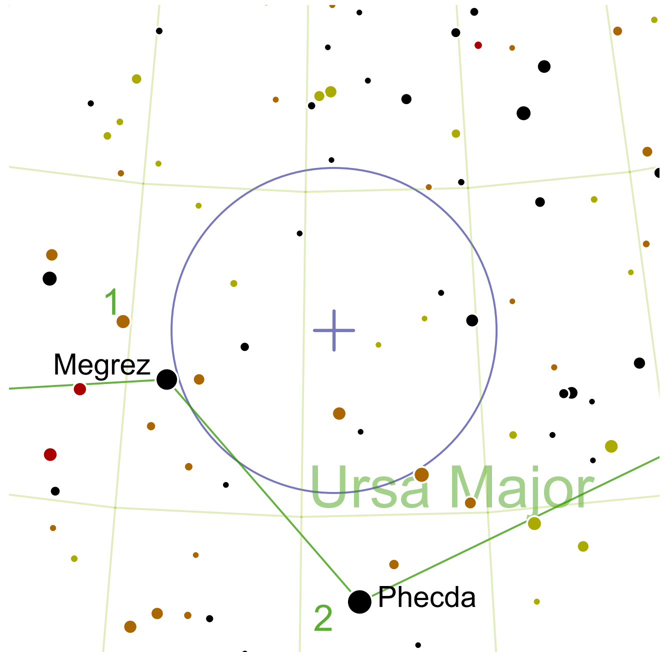
Forms an equilateral triangle with Mizar and Phecda.

An extremely red star with a B-V color index of 3.28, RY Dra is classified as a C-N3III carbon star. It is roughly 1,254 light-years from Earth.

Also visible:

(1) C3 *(9.7$_m$ barred spiral galaxy)*

(2) NGC 4605 *(10.89$_m$ barred spiral galaxy)*



Z UMa

RA: 179.13° | 11h 56.5' — DEC: 57.87° | 57° 52'

Z UMa (HD 103681) is a magnitude 6.2 variable star. Magnitude ranges from 9.4 to 6.2 (Δ mag. 3.2) with a period of 196d.

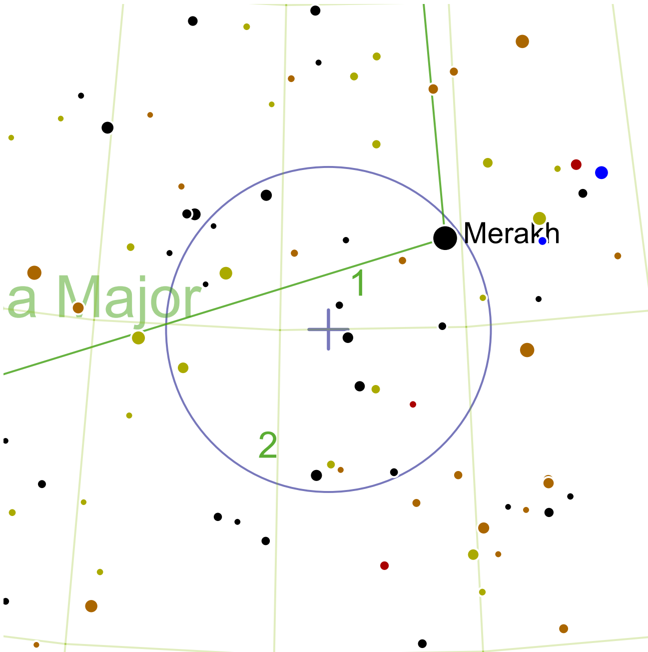
Position Phecda at the southern edge of the finder view; Z UMa is on the northern edge.

This pulsating variable star is roughly 1,059 light-years from Earth.

Also visible:

(1) M40 *(8.4$_m$ double star)*

(2) M109 *(9.8$_m$ barred spiral galaxy)*



M97

RA: 168.7° | 11h 14.79' — DEC: 55.02° | 55° 1'

M97 (Owl Nebula, NGC 3587) is a magnitude 9.9 planetary nebula. Angular size is 3x3.3'.

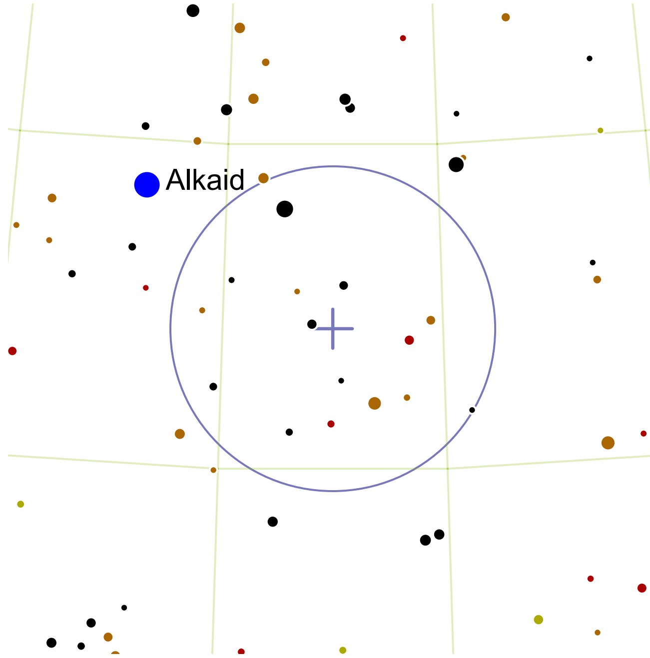
2.2° SE from mag.2.44 Merakh.

This nebula is composed of three concentric shells of gas. This innermost shell is actually barrel-shaped, and inclined at an angle to us, so the two dark "eyes" of this nebula are the open ends of the innermost shell.

Also visible:

(1) M108 *(10.0_m spiral galaxy)*

(2) NGC 3631 *(11.01_m spiral galaxy)*



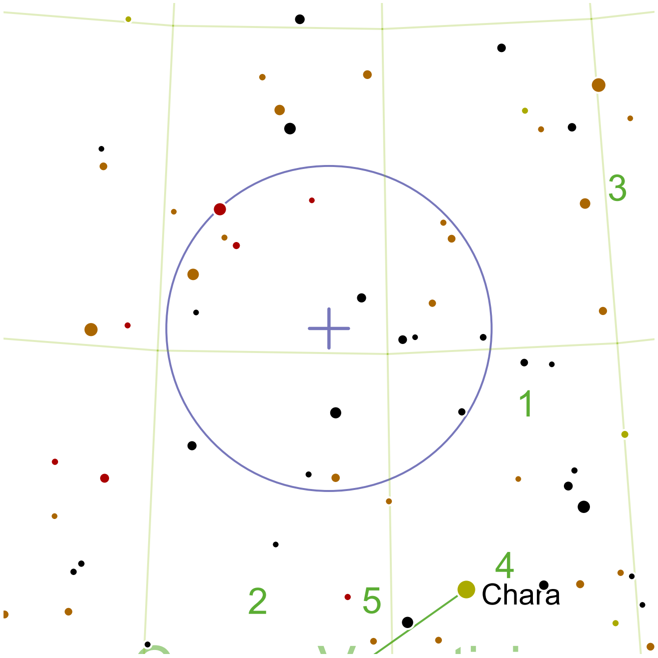
M51

RA: 202.5° | 13h 30.0' — DEC: 47.18° | 47° 11'

M51 (Whirlpool Galaxy, NGC 5194) is a magnitude 8.4 spiral galaxy. Angular size is 11x7'.

A quarter of the way along a line from Alkaid to Cor Caroli.

M51 is a perfect example of an interacting galaxy pair. The main galaxy (NGC 5194) is a face-on spiral galaxy with well defined spiral arms and a bright core, while the companion galaxy is a bright but unclassifiable mass connected to one of the spiral arms by a dust lane. M51 was the first galaxy to be identified as being spiral in structure, by William Parsons in 1845.



Y Cvn

RA: 191.28° | 12h 45.1' — DEC: 45.4° | 45° 24'

Y Cvn (La Superba, HD 110914) is a magnitude 5.0 carbon star. Magnitude ranges from 6.4 to 5.0 (Δ mag. 1.4) with a period of 158d.

Travel from Cor Caroli to Chara in Canes Venaticorum, turn left, and travel an equal distance.

An extremely red carbon star (also known as La Superba) with a B-V color index of 3.0, this star is classified as a C-N5 carbon star. It is only 756 light-years from Earth and its relatively bright minimum magnitude allows better observation of its strong color.

Also visible:

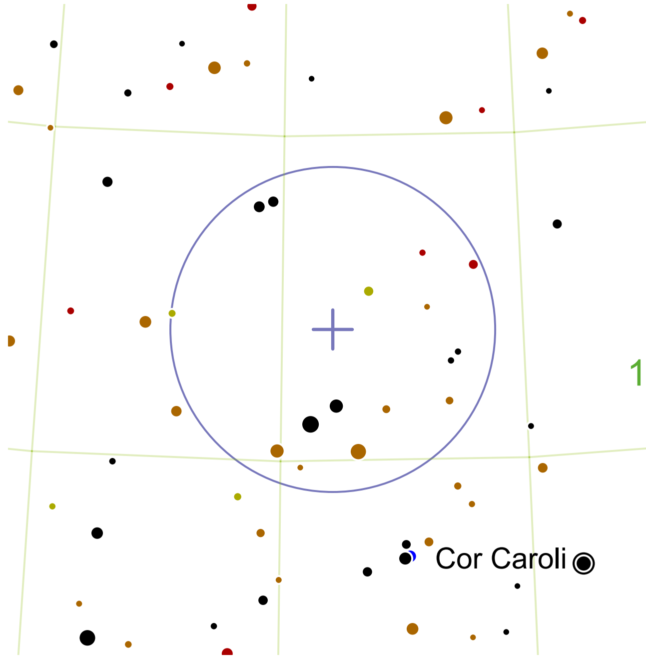
(1) C21 *(9.4_m irregular galaxy)*

(2) M94 *(8.2_m spiral galaxy)*

(3) M106 *(8.4_m spiral galaxy)*

(4) NGC 4490 *(10.22_m barred spiral galaxy)*

(5) NGC 4618 *(11.22_m SBd)*



M63

RA: 198.95° | 13h 15.79' — DEC: 42.03° | 42° 2'

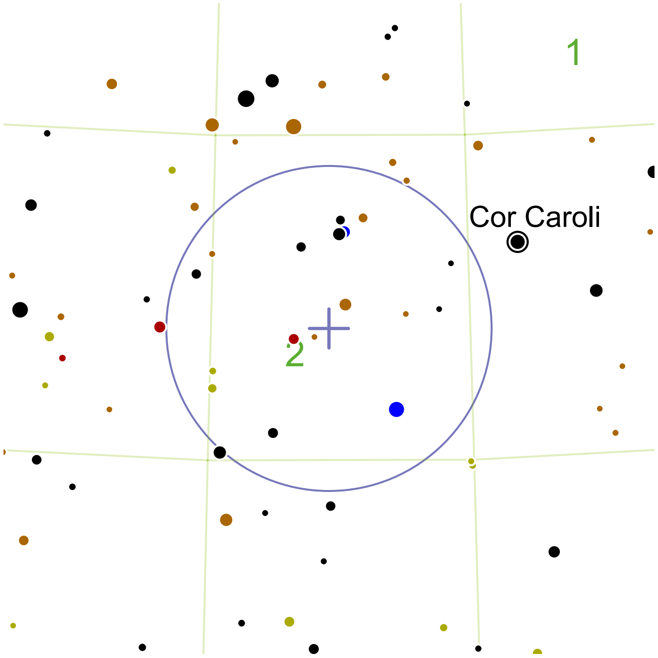
M63 (Sunflower Galaxy, NGC 5055) is a magnitude 8.6 spiral galaxy. Angular size is 10x6'.

Located a third away along a line from Cor Caroli to Alkaid.

This flocculant spiral galaxy is so named because it does not have well-defined spiral arms. This galaxy was discovered in 1779 by Pierre Méchain, and lies 27 million light-years from Earth.

Also visible:

(1) M94 *(8.2_m spiral galaxy)*



C29

RA: 197.73° | 13h 10.89' — DEC: 37.05° | 37° 3'

C29 (NGC 5005) is a magnitude 9.8 barred spiral galaxy. Angular size is 5x2'.

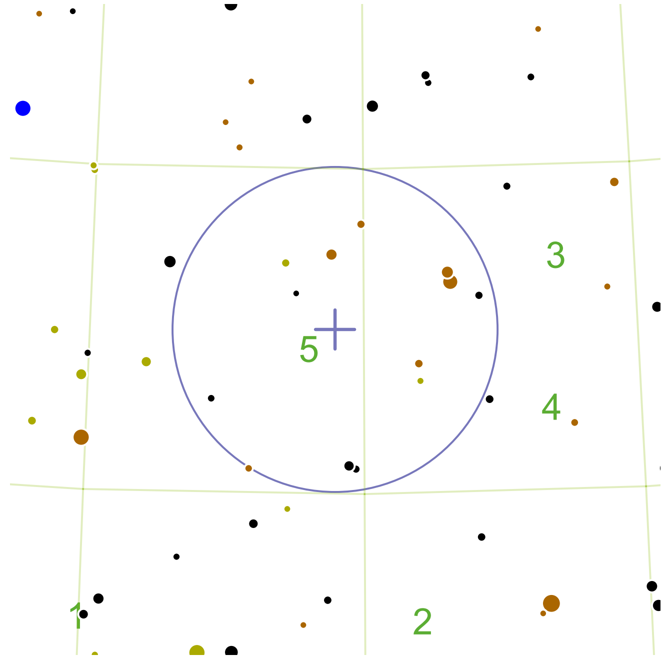
3.1° SEE from mag.2.9 Cor Caroli.

A small and relatively faint galaxy, Caldwell 29 is nevertheless easier to spot even under less-than-ideal conditions because it has a very bright, prominent core. It is a LINER galaxy, meaning that gas in the core is ionized, probably by a supermassive black hole.

Also visible:

(1) M94 *(8.2_m spiral galaxy)*

(2) NGC 5033 *(10.75_m spiral galaxy)*



C32

RA: 190.53° | 12h 42.1' — DEC: 32.53° | 32° 32'

C32 (Whale Galaxy, NGC 4631) is a magnitude 9.3 spiral galaxy. Angular size is 15x3'.

Draw a line from Mizar to Cor Caroli, and extend it by a third. C32 is slightly west of this point.

This elongated, interacting galaxy is one of the brighter Caldwell galaxies and is a viable target for smaller telescopes and poorer skies. It lies 30 million light-years from Earth.

Also visible:

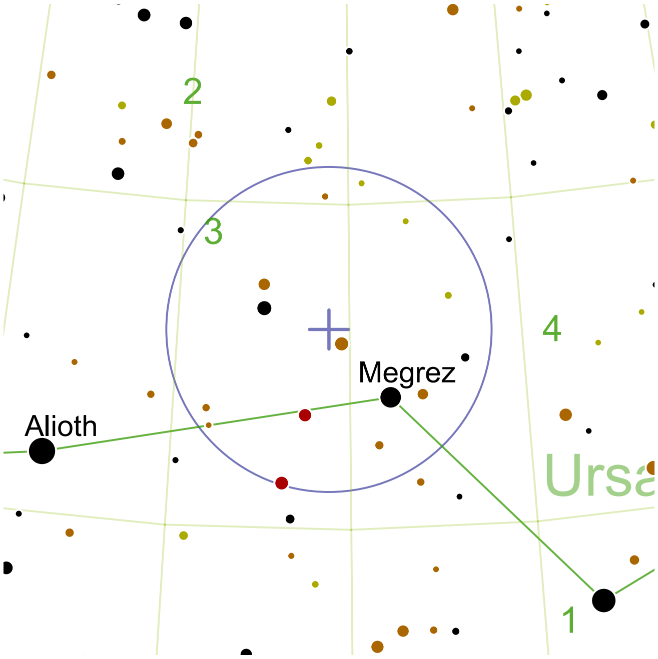
(1) C35 *(11.4_m elliptical galaxy)*

(2) C36 *(9.8_m spiral galaxy)*

(3) NGC 4395 *(10.64_m Magellanic barred spiral galaxy)*

(4) NGC 4414 *(10.96_m spiral galaxy)*

(5) NGC 4656 *(10.96_m Magellanic barred spiral galaxy)*



M40

RA: 185.6° | 12h 22.39' — DEC: 58.08° | 58° 5'

M40 (Winnecke 4, Win 4) is a magnitude 8.4 double star. Angular size is 0.8'.

1.4° NE from mag.3.44 Megrez.

This double star was included by Charles Messier in his catalog as he had a report of a nebula at that location but could find only this faint and unimpressive double star. The separations is very wide at 53", and the two components are very dim at magnitude 9.74 and 10.18. Position angle is 77°. In a larger telescope, the components are light yellow.

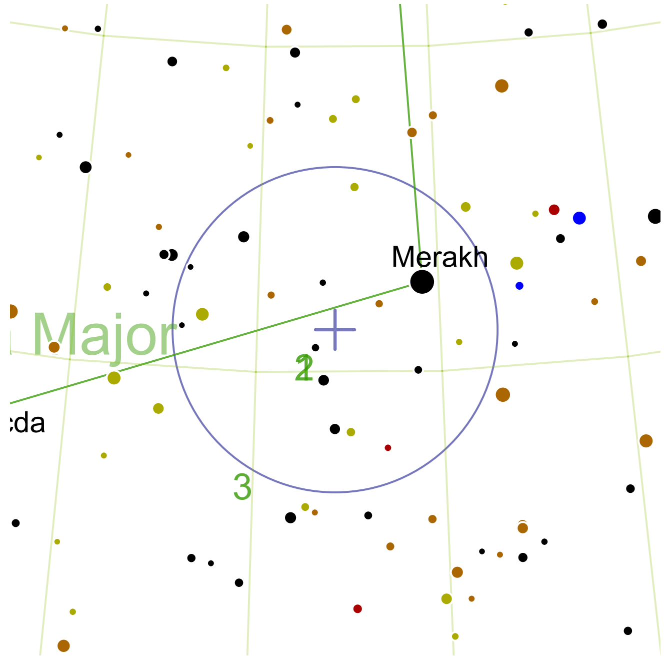
Also visible:

(1) M109 *(9.8$_m$ barred spiral galaxy)*

(2) NGC 4605 *(10.89$_m$ barred spiral galaxy)*

(3) T UMa *(6.6$_m$ variable star)*

(4) Z UMa *(6.2$_m$ variable star)*



M108

RA: 167.88° | 11h 11.5' — DEC: 55.67° | 55° 40'

M108 (NGC 3556) is a magnitude 10.0 spiral galaxy. Angular size is 8x1'.

1.5° SEE from mag.2.44 Merakh.

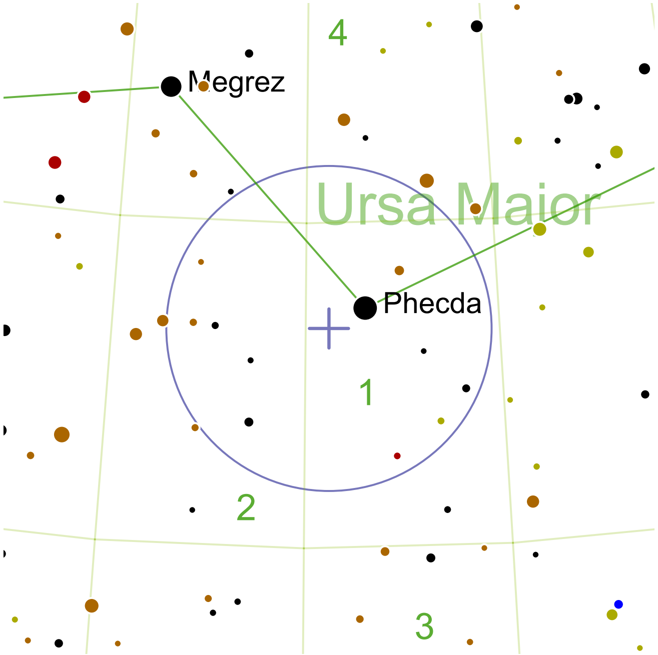
This nearly edge-on barred spiral galaxy is a member of the Ursa Major Cluster.

Also visible:

(1) M97 *(9.9$_m$ planetary nebula)*

(2) NGC 3587 *(11.0$_m$ planetary nebula)*

(3) NGC 3631 *(11.01$_m$ spiral galaxy)*



M109

RA: 179.4° | 11h 57.6' — DEC: 53.38° | 53° 23'

M109 (NGC 3992) is a magnitude 9.8 barred spiral galaxy. Angular size is 7x4'.

0.6° SEE from mag.2.54 Phecda.

This fine barred spiral galaxy is the leading galaxy of the M109 Group, which contains up to 50 galaxies.

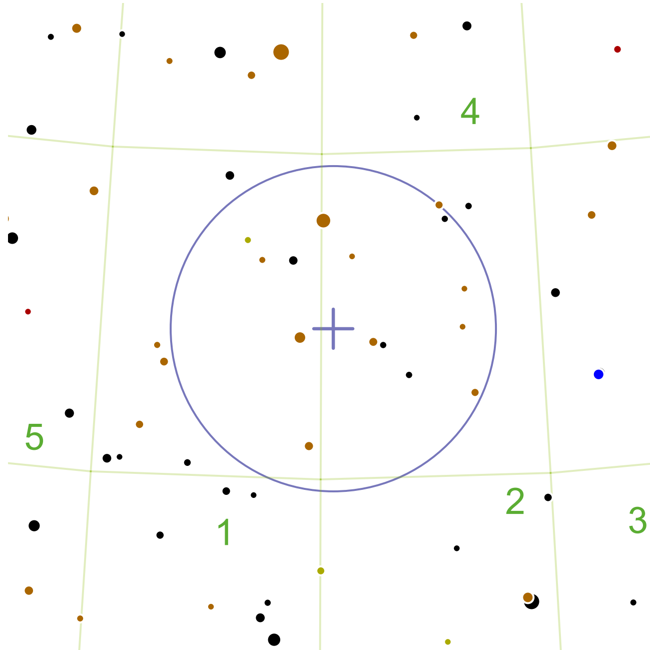
Also visible:

(1) NGC 3953 *(10.84$_m$ barred spiral galaxy)*

(2) NGC 4088 *(11.15$_m$ barred spiral galaxy)*

(3) NGC 3893 *(11.16$_m$ spiral galaxy)*

(4) Z UMa *(6.2$_m$ variable star)*



M106

RA: 184.73° | 12h 18.89' — DEC: 47.32° | 47° 19'

M106 (NGC 4258) is a magnitude 8.4 spiral galaxy. Angular size is 19x8'.

Draw a line from Dubhe through Phecda, and extend it an equal length to reach M106.

M106 resembles the much nearer Andromeda Galaxy in size and absolute brightness. The black hole at its core is nearly ten times the mass of the the Milky Way's supermassive black hole.

Also visible:

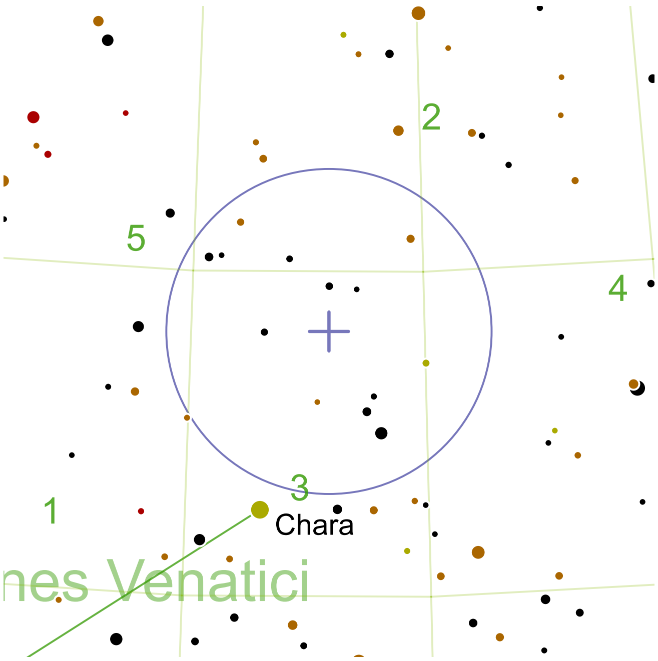
(1) C21 *(9.4$_m$ irregular galaxy)*

(2) NGC 4051 *(10.83$_m$ barred spiral galaxy)*

(3) NGC 3938 *(10.9$_m$ spiral galaxy)*

(4) NGC 4088 *(11.15$_m$ barred spiral galaxy)*

(5) Y Cvn *(5.0$_m$ carbon star)*



C21

RA: 187.05° | 12h 28.2' — DEC: 44.1° | 44° 6'

C21 (NCG 4449, NGC 4449) is a magnitude 9.4 irregular galaxy. Angular size is 6x4'.

7.7° NW from mag.2.9 Cor Caroli.

An irregular dwarf galaxy, Caldwell 21 is a nearby starburst galaxy, speckled with star-forming regions. The galaxy has a central bar making it similar to the Large Magellanic Cloud (LMC), but with 15 billion stars it is only half the size. Caldwell 21 compensates by having twice the star formation rate of the LMC.

Also visible:

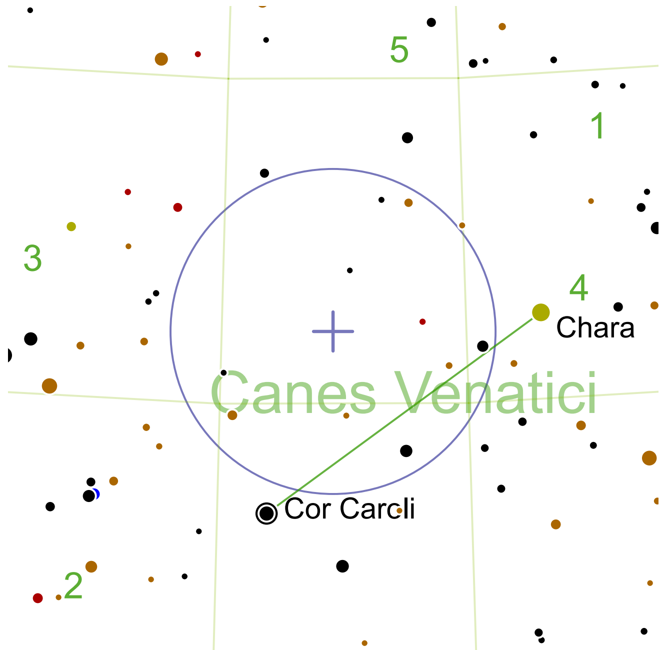
(1) M94 *(8.2$_m$ spiral galaxy)*

(2) M106 *(8.4$_m$ spiral galaxy)*

(3) NGC 4490 *(10.22$_m$ barred spiral galaxy)*

(4) NGC 4051 *(10.83$_m$ barred spiral galaxy)*

(5) Y Cvn *(5.0$_m$ carbon star)*



M94

RA: 192.73° | 12h 50.89' — DEC: 41.13° | 41° 8'

M94 (NGC 4736) is a magnitude 8.2 spiral galaxy. Angular size is 7x3'.

2.9° NNW from mag.2.9 Cor Caroli.

This spiral galaxy is distinguished by the ring of star formation around the nucleus, and its curious lack of dark matter.

Also visible:

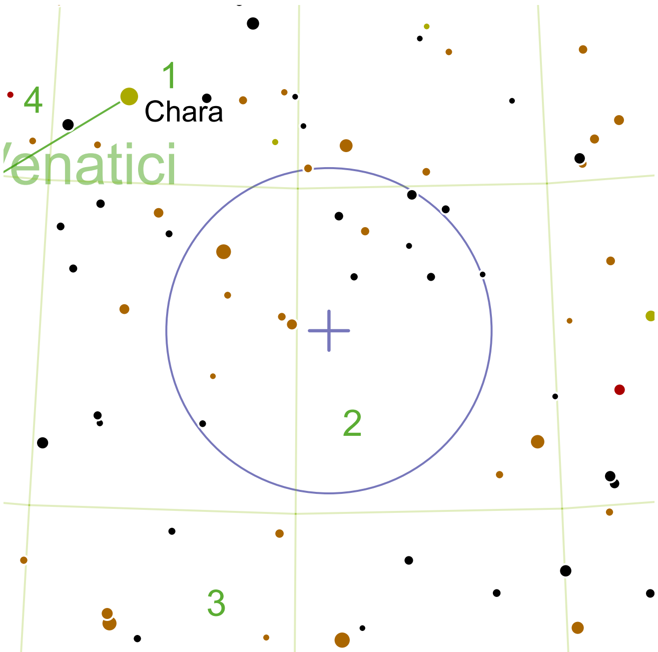
(1) C21 *(9.4$_m$ irregular galaxy)*

(2) C29 *(9.8$_m$ barred spiral galaxy)*

(3) M63 *(8.6$_m$ spiral galaxy)*

(4) NGC 4490 *(10.22$_m$ barred spiral galaxy)*

(5) Y Cvn *(5.0$_m$ carbon star)*



C26

RA: 184.38° | 12h 17.5' — DEC: 37.82° | 37° 49'

C26 (NGC 4244) is a magnitude 10.6 spiral galaxy. Angular size is 17x2'.

7.6° W from mag.2.9 Cor Caroli.

An edge-on spiral galaxy, the Silver Needle is distinguished by lacking both a prominent core and a central line of dust clouds. Like many galaxies, the Silver Needle suffers badly under light-polluted skies.

Also visible:

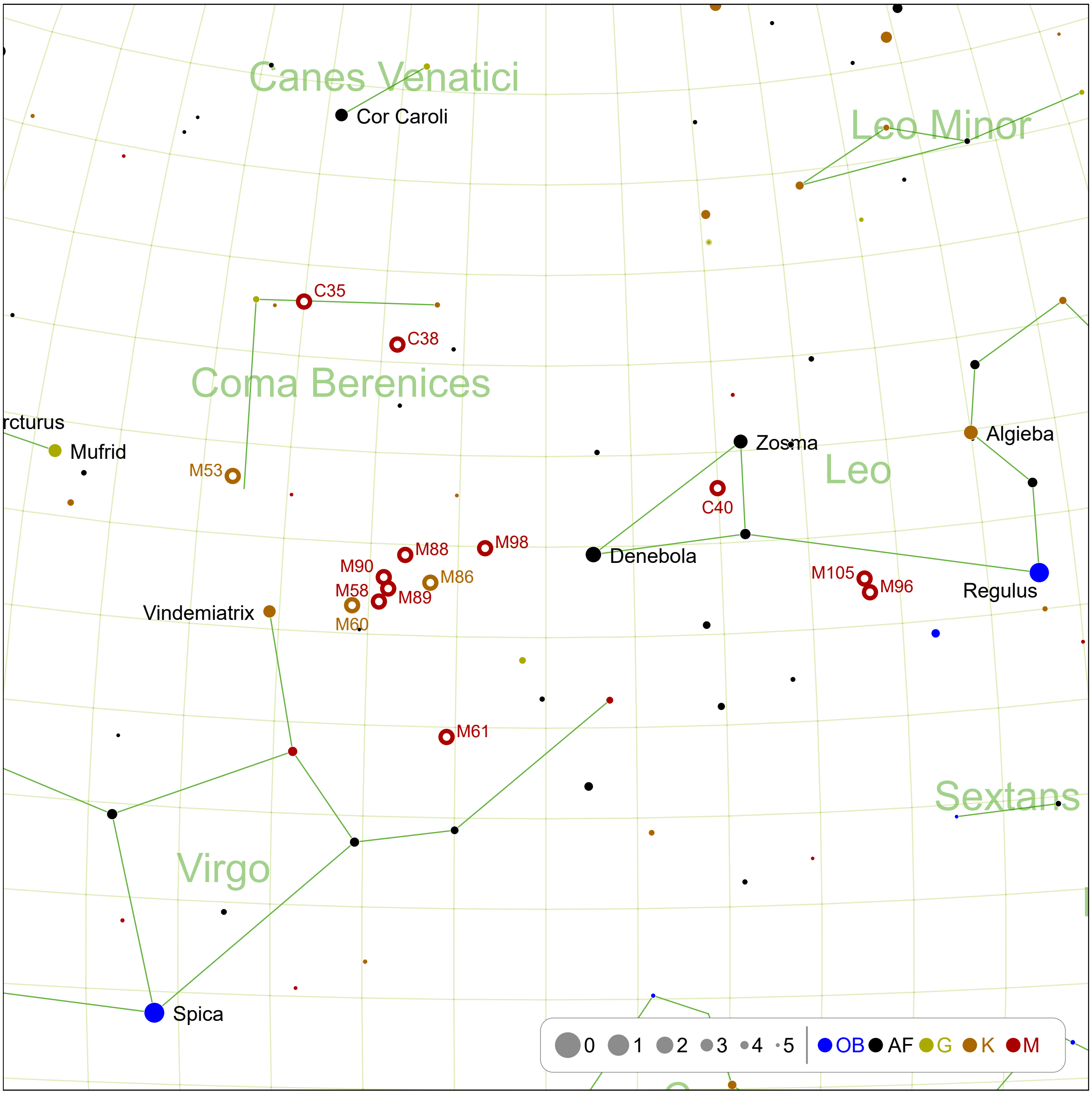
(1) NGC 4490 *(10.22$_m$ barred spiral galaxy)*

(2) NGC 4214 *(10.24$_m$ irregular galaxy)*

(3) NGC 4395 *(10.64$_m$ Magellanic barred spiral galaxy)*

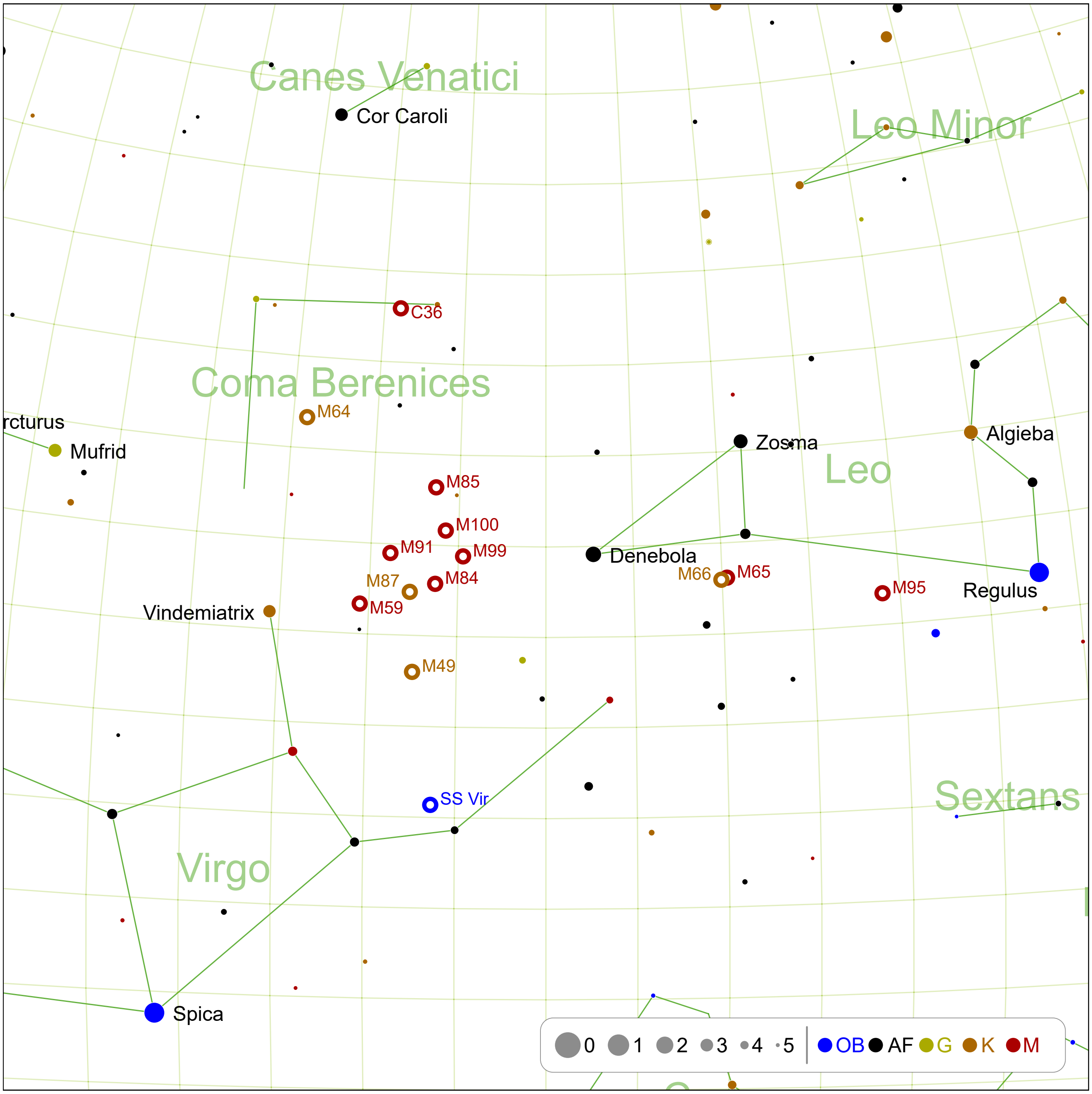
(4) NGC 4618 *(11.22$_m$ SBd)*

April: 15° North (1)

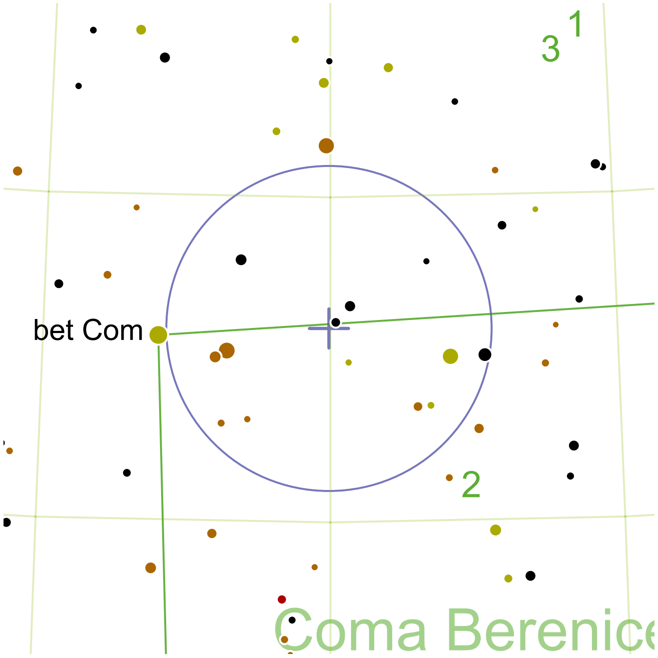


C35: page 177
C38: page 177
M53: page 178
C40: page 178
M98: page 179
M88: page 179
M90: page 180
M105: page 180
M86: page 181
M89: page 181
M96: page 182
M58: page 182
M60: page 183
M61: page 183

April: 15° North (2)



C36: page 184	M64: page 184	M85: page 185	M100: page 185
M91: page 186	M99: page 186	M65: page 187	M66: page 187
M84: page 188	M87: page 188	M95: page 189	M59: page 189
M49: page 190	SS Vir: page 190		



C35

RA: 195.03° | 13h 0.1' — DEC: 27.98° | 27° 59'

C35 (NGC 4889) is a magnitude 11.4 elliptical galaxy. Angular size is 3x2'.

10.3° S from mag.2.9 Cor Caroli.

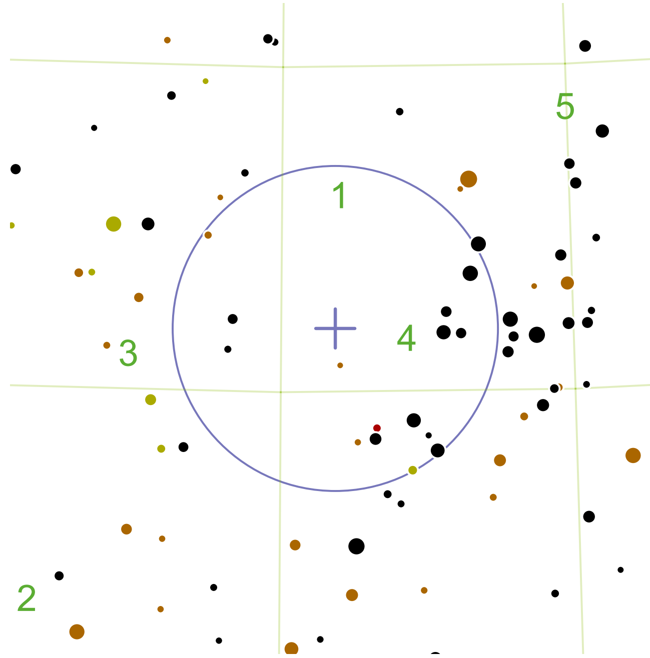
A massive galaxy over twice as large as the Milky Way, Caldwell 35 contains the largest known black hole, with a mass of 21 billion Suns. Over 300 million light-years from Earth, this object is extremely difficult for smaller telescopes or for light-polluted observing sites.

Also visible:

(1) C32 *(9.3$_m$ spiral galaxy)*

(2) NGC 4725 *(10.11$_m$ barred spiral galaxy)*

(3) NGC 4656 *(10.96$_m$ Magellanic barred spiral galaxy)*



C38

RA: 189.08° | 12h 36.29' — DEC: 25.98° | 25° 59'

C38 (Needle Galaxy, NGC 4565) is a magnitude 9.6 barred spiral galaxy. Angular size is 16x3'.

South and slightly west of Cor Caroli; it is as distant from Cor Caroli as Alkaid at the end of the Dipper's handle.

Although a faint galaxy, the Needle Galaxy can be seen with smaller telescopes as the edge-on orientation of the galaxy enhances the surface brightness. In contrast a face-one galaxy has lower surface brightness as is is viewed though its thinnest dimension. Larger telescopes will reveal the needle to be bisected lengthwise by a dark dust lane.

Also visible:

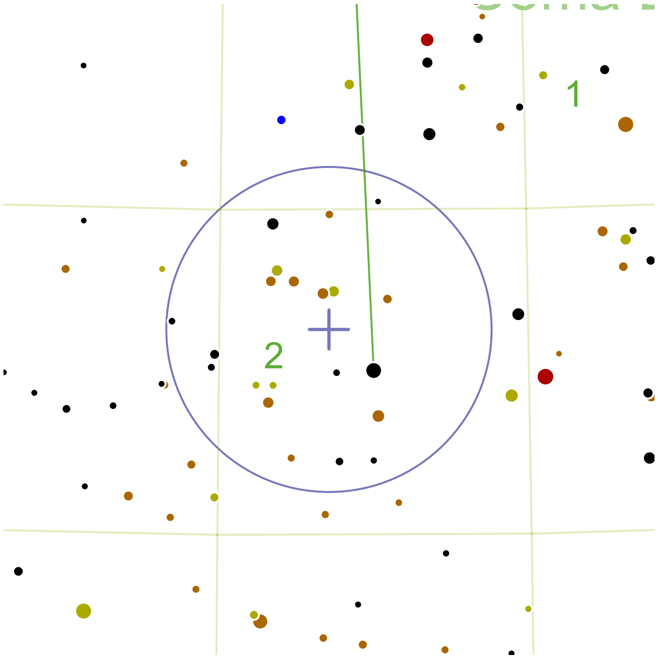
(1) C36 *(9.8$_m$ spiral galaxy)*

(2) M64 *(8.5$_m$ spiral galaxy)*

(3) NGC 4725 *(10.11$_m$ barred spiral galaxy)*

(4) NGC 4494 *(10.71$_m$ elliptical galaxy)*

(5) NGC 4278 *(11.09$_m$ elliptical galaxy)*



M53

RA: 198.23° | 13h 12.89' — DEC: 18.17° | 18° 10'

M53 (NGC 5024) is a magnitude 7.6 globular cluster. Angular size is 13'.

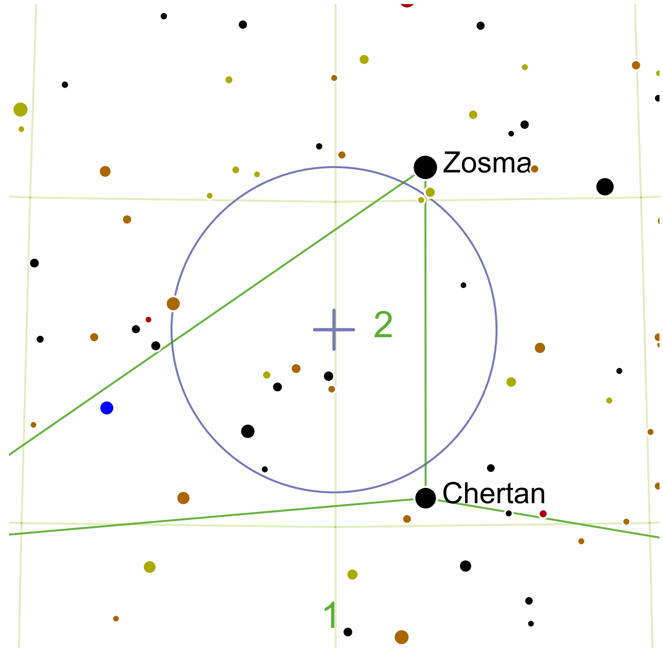
Two-fifths of the way from Arcturus to Denebola.

A very distant globular cluster (60,000 light-years from Earth). The member stars of this cluster are dimmed greatly by distance and require a larger telescope to resolve them. It is quite old for a globular cluster at 12.67 billion years, and its stars are largely first-generation stars (they formed from gas that has not been recycled through other stars). It is interacting with NGC 5053 (mag. 9.96, one degree SE), to which it is connected by a tidal stream.

Also visible:

(1) M64 *(8.5$_m$ spiral galaxy)*

(2) NGC 5053 *(9.47$_m$ globular cluster)*



C40

RA: 170.03° | 11h 20.1' — DEC: 18.03° | 18° 2'

C40 (NGC 3626) is a magnitude 10.9 barred spiral galaxy. Angular size is 3x2'.

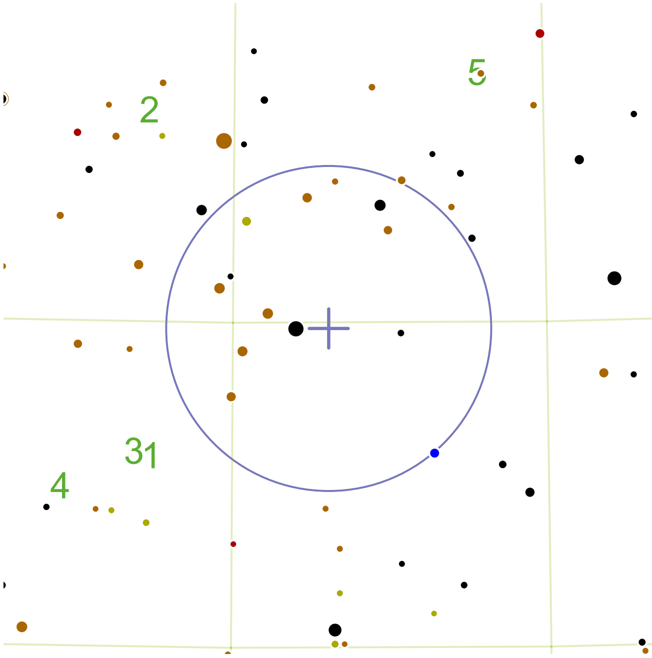
2.8° SSE from mag.2.58 Zosma.

This is one of the smallest Caldwell objects (as viewed from Earth) and it is also not particularly bright. It has a relatively prominent core, making it more accessible to smaller telescopes.

Also visible:

(1) NGC 3628 *(10.28$_m$ barred spiral galaxy)*

(2) NGC 3607 *(10.82$_m$ lenticular galaxy)*



M98

RA: 183.48° | 12h 13.89' — DEC: 14.92° | 14° 55'

M98 (NGC 4192) is a magnitude 10.1 spiral galaxy. Angular size is 10x3'.

Slightly north of a point one quarter of the way from Denebola in Leo to Vindemiatrix in Virgo.

This intermediate spiral galaxy is a member of the Virgo Cluster, and is approaching us at 140 km/s.

Also visible:

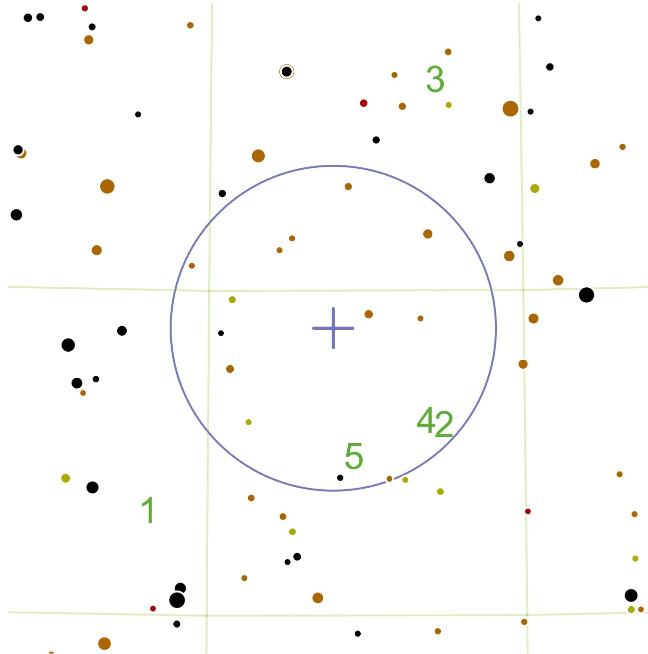
(1) M84 *(9.1$_m$ lenticular galaxy)*

(2) M85 *(9.1$_m$ lenticular galaxy)*

(3) M86 *(8.9$_m$ lenticular galaxy)*

(4) M87 *(8.6$_m$ elliptical galaxy)*

(5) R Com *(7.1$_m$ variable star)*



M88

RA: 188.03° | 12h 32.1' — DEC: 14.43° | 14° 26'

M88 (NGC 4501) is a magnitude 9.6 spiral galaxy. Angular size is 7x4'.

Slightly north of a point halfway between the splendidly named Vindemiatrix in Virgo and Denebola in Leo.

This spiral galaxy is a member of the Virgo Cluster of galaxies. It is on course for the center of the cluster, and may make a close pass by Messier 87 in 200-300 million years.

Also visible:

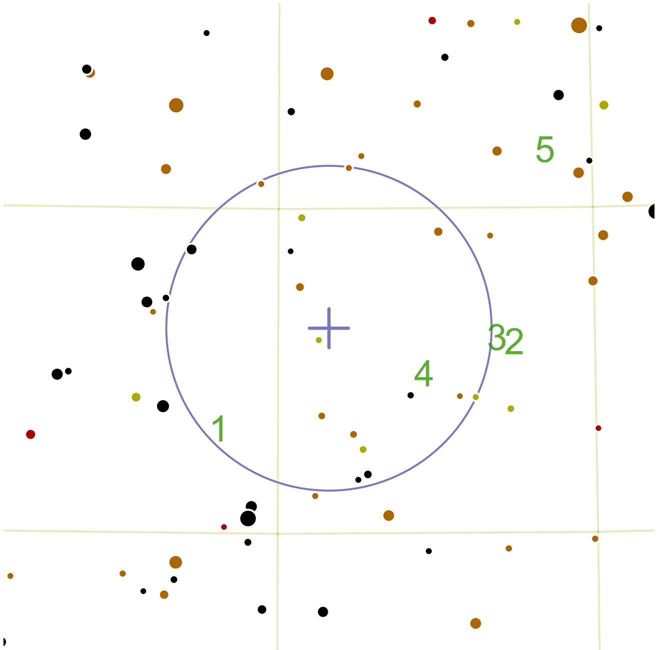
(1) M60 *(8.8$_m$ elliptical galaxy)*

(2) M84 *(9.1$_m$ lenticular galaxy)*

(3) M85 *(9.1$_m$ lenticular galaxy)*

(4) M86 *(8.9$_m$ lenticular galaxy)*

(5) M87 *(8.6$_m$ elliptical galaxy)*



M90

RA: 189.2° | 12h 36.79' — DEC: 13.17° | 13° 10'

M90 (NGC 4569) is a magnitude 9.5 spiral galaxy. Angular size is 10x5'.

Two thirds of the way from Denebola in Leo to Vindemiatrix in Virgo.

This spiral galaxy, like many other members of the massive Virgo Cluster, has lost much of its gas due to ram pressure due to the speed with which the galaxy is moving the the Virgo Cluster's intergalactic medium. The galaxy has a 260,000 light-year tail of ionized gas lost due to this ram pressure.

Also visible:

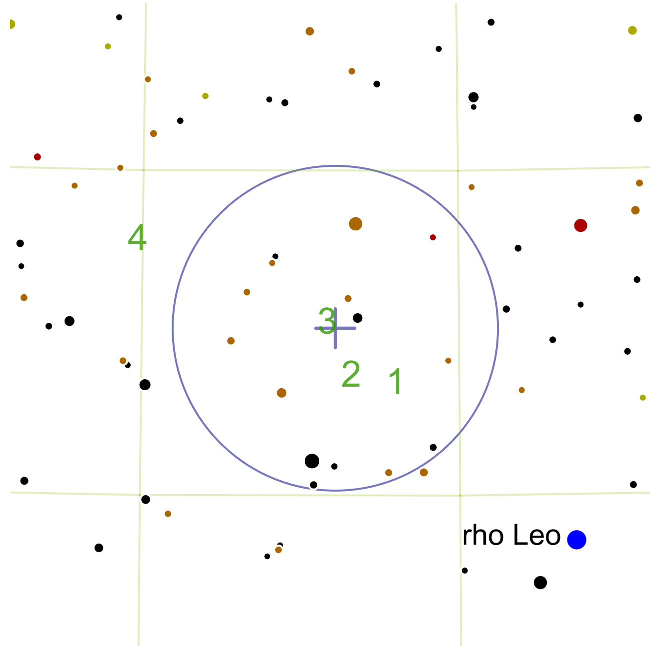
(1) M60 *(8.8$_m$ elliptical galaxy)*

(2) M84 *(9.1$_m$ lenticular galaxy)*

(3) M86 *(8.9$_m$ lenticular galaxy)*

(4) M87 *(8.6$_m$ elliptical galaxy)*

(5) M100 *(9.3$_m$ spiral galaxy)*



M105

RA: 161.95° | 10h 47.79' — DEC: 12.58° | 12° 35'

M105 (NGC 3379) is a magnitude 9.3 elliptical galaxy. Angular size is 2'.

Equally distant from Zosma, Algeiba and Regulus.

This large elliptical galaxy is part of the M96 Group. There is some evidence of current star formation within this galaxy, suggesting that elliptical galaxies are capable of star formation at a reduced rate.

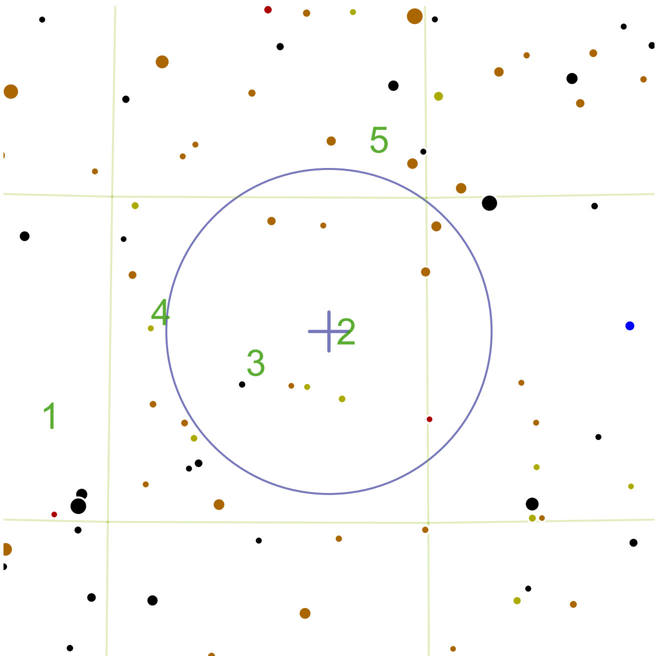
Also visible:

(1) M95 *(9.7$_m$ barred spiral galaxy)*

(2) M96 *(9.2$_m$ spiral galaxy)*

(3) NGC 3384 *(10.85$_m$ elliptical galaxy)*

(4) NGC 3489 *(11.12$_m$ lenticular galaxy)*



M86

RA: 186.55° | 12h 26.2' — DEC: 12.95° | 12° 57'

M86 (NGC 4406) is a magnitude 8.9 lenticular galaxy. Angular size is 8x6'.

Draw a line from Chertan through Denebola in Leo and extend it an equal distance.

This galaxy has the highest blue shift of all Messier galaxies, as it is approaching the Milky Way at 244 km/s. It is moving so fast through the intergalactic medium of the Virgo Cluster, that ram pressure is stripping the galaxy of its gas, leaving behind a wake of ionized matter glowing in the X-ray spectrum.

Also visible:

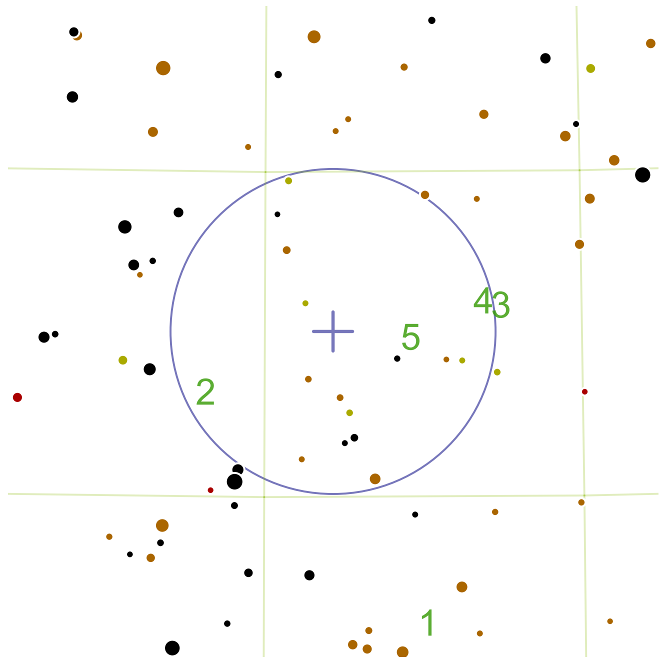
(1) M60 *(8.8$_m$ elliptical galaxy)*

(2) M84 *(9.1$_m$ lenticular galaxy)*

(3) M87 *(8.6$_m$ elliptical galaxy)*

(4) M90 *(9.5$_m$ spiral galaxy)*

(5) M100 *(9.3$_m$ spiral galaxy)*



M89

RA: 188.93° | 12h 35.7' — DEC: 12.55° | 12° 33'

M89 (NGC 4552) is a magnitude 9.8 elliptical galaxy. Angular size is 4'.

Two thirds of the way from Denebola in Leo to Vindemiatrix in Virgo.

This elliptical galaxy may in fact be almost perfectly spherical. It has ten times as many globular clusters as the Milky Way.

Also visible:

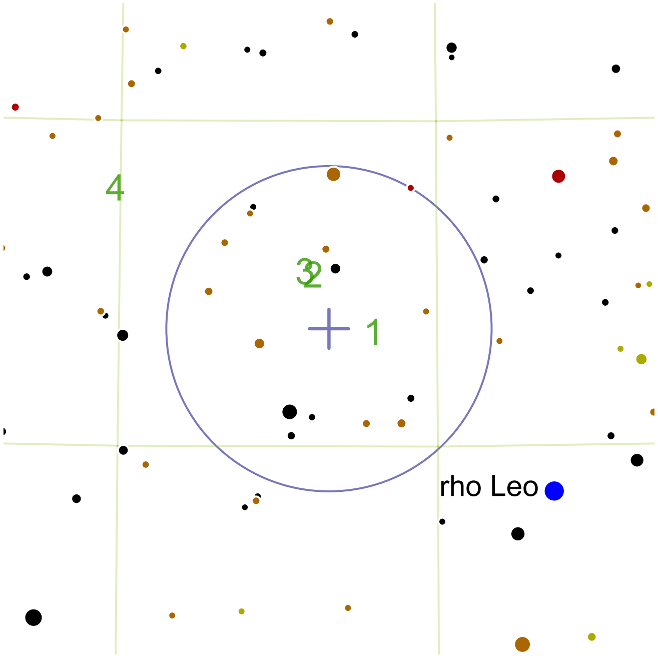
(1) M49 *(8.4$_m$ elliptical galaxy)*

(2) M60 *(8.8$_m$ elliptical galaxy)*

(3) M84 *(9.1$_m$ lenticular galaxy)*

(4) M86 *(8.9$_m$ lenticular galaxy)*

(5) M87 *(8.6$_m$ elliptical galaxy)*



M96

RA: 161.7° | 10h 46.79' — DEC: 11.82° | 11° 49'

M96 (NGC 3368) is a magnitude 9.2 spiral galaxy. Angular size is 6x4'.

4.2° NE from mag.3.85 rho Leo.

The lead member of the eponymous M96 Group, this dim galaxy has very weak spiral arms and a relatively bright core. A unique feature of this galaxy is the core not quite at the center of the galaxy, a distortion doubtlessly caused by interaction with its neighboring galaxies.

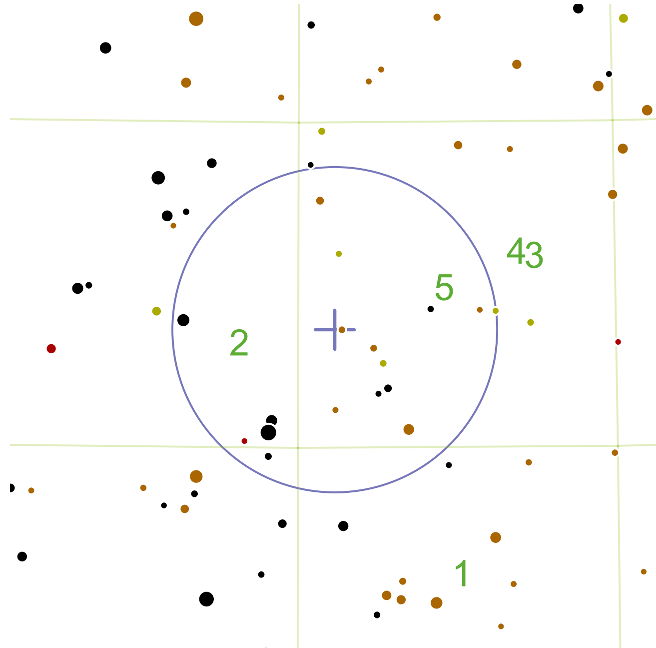
Also visible:

(1) M95 *(9.7_m barred spiral galaxy)*

(2) M105 *(9.3_m elliptical galaxy)*

(3) NGC 3384 *(10.85_m elliptical galaxy)*

(4) NGC 3489 *(11.12_m lenticular galaxy)*



M58

RA: 189.43° | 12h 37.7' — DEC: 11.82° | 11° 49'

M58 (NGC 4579) is a magnitude 9.7 barred spiral galaxy. Angular size is 6x5'.

Draw a line from Chertan in Leo through Denebola, and extend it one-and-a-half times.

The most distant Messier object at 62 million light-years, and one of the brightest Virgo galaxies. This barred spiral has a bright core, which is all that is visible in smaller telescopes. Larger telescopes have a chance of seeing some structure in the spiral disk on dark nights.

Also visible:

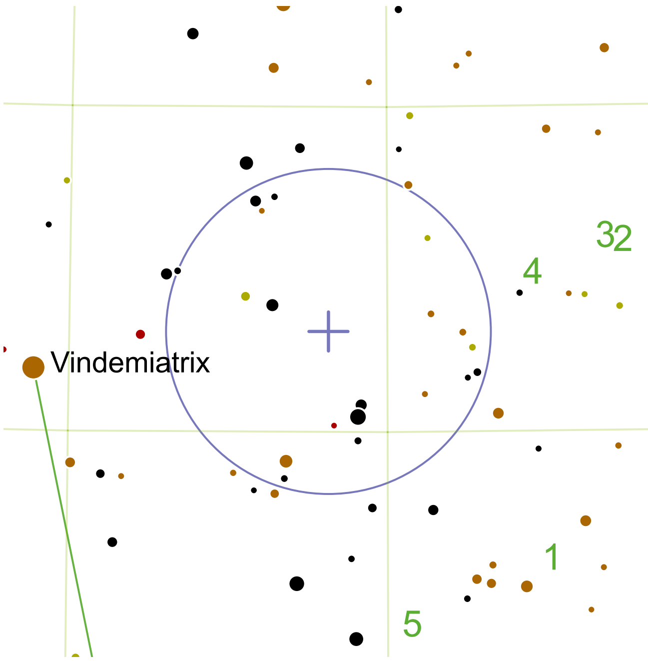
(1) M49 *(8.4_m elliptical galaxy)*

(2) M60 *(8.8_m elliptical galaxy)*

(3) M84 *(9.1_m lenticular galaxy)*

(4) M86 *(8.9_m lenticular galaxy)*

(5) M87 *(8.6_m elliptical galaxy)*



M60

RA: 190.93° | 12h 43.7' — DEC: 11.55° | 11° 33'

M60 (NGC 4649) is a magnitude 8.8 elliptical galaxy. Angular size is 7x6'.

Draw a line from Chertan in Leo through Denebola, and extend it one-and-a-half times.

M60 has one of the largest supermassive black holes at its heart - approximately 4.5 billion solar masses. NGC 4647, an intermediate spiral galaxy (magnitude 11.94), overlaps with M60.

Also visible:

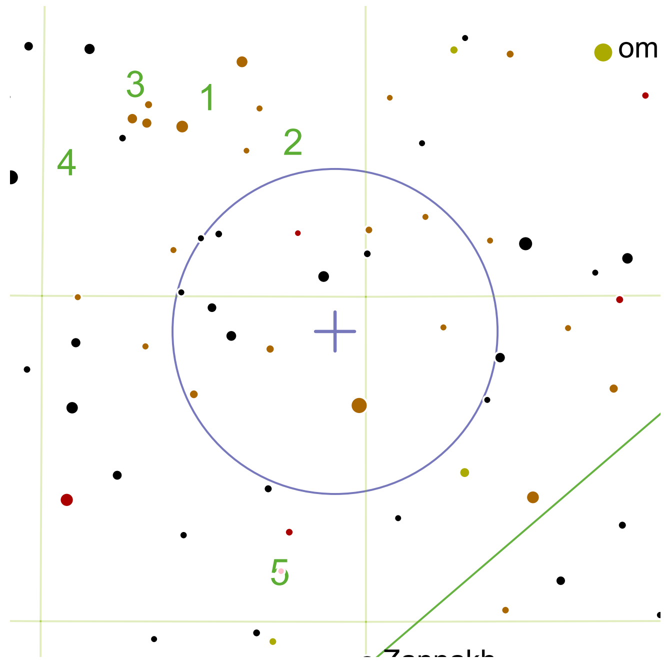
(1) M49 *(8.4_m elliptical galaxy)*

(2) M84 *(9.1_m lenticular galaxy)*

(3) M86 *(8.9_m lenticular galaxy)*

(4) M87 *(8.6_m elliptical galaxy)*

(5) R Vir *(6.1_m variable star)*



M61

RA: 185.48° | 12h 21.89' — DEC: 4.47° | 4° 28'

M61 (NGC 4303) is a magnitude 9.7 spiral galaxy. Angular size is 6'.

Draw a line from Zosma in Leo through Denebola, and extend it one-and-a-half times. M61 is slightly south of this point.

Home to seven recent supernovae, this starburst galaxy is 55 million light-years from Earth. Small telescopes will struggle with this target.

Also visible:

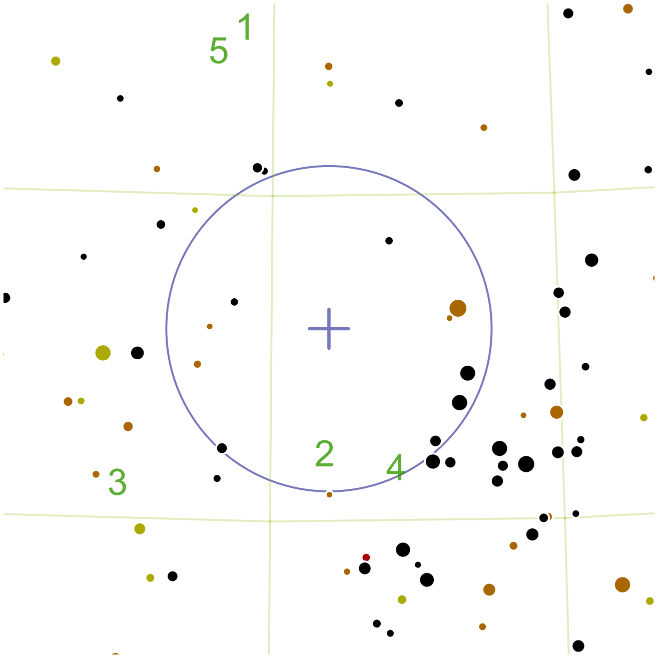
(1) M49 *(8.4_m elliptical galaxy)*

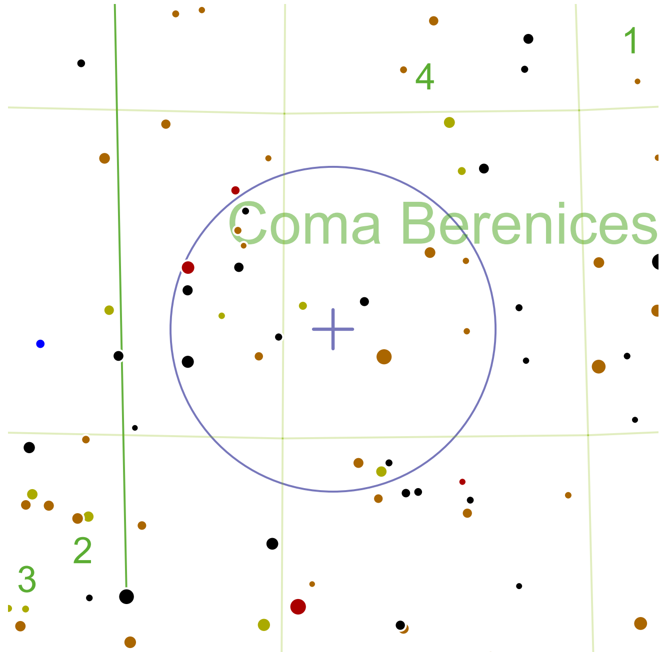
(2) NGC 4365 *(10.52_m elliptical galaxy)*

(3) NGC 4535 *(10.59_m spiral galaxy)*

(4) R Vir *(6.1_m variable star)*

(5) SS Vir *(6.0_m carbon star)*





C36

RA: 189.0° | 12h 36.0' — DEC: 27.97° | 27° 58'

C36 (Koi Fish Galaxy, NGC 4559) is a magnitude 9.8 spiral galaxy. Angular size is 10x4'.

11.1° SSW from mag.2.9 Cor Caroli.

An almost edge-on spiral galaxy with a irregular texture. It is the site of an active and exceedingly rare Luminous Blue Variable star AT2016blu, which has erupted with supernova-like intensity in 2014, 2016, 2017, 2018, 2019, 2020 and 2021.

Also visible:

(1) C32 *(9.3$_m$ spiral galaxy)*

(2) C38 *(9.6$_m$ barred spiral galaxy)*

(3) NGC 4725 *(10.11$_m$ barred spiral galaxy)*

(4) NGC 4494 *(10.71$_m$ elliptical galaxy)*

(5) NGC 4656 *(10.96$_m$ Magellanic barred spiral galaxy)*

M64

RA: 194.18° | 12h 56.7' — DEC: 21.68° | 21° 41'

M64 (Black Eye Galaxy, NGC 4826) is a magnitude 8.5 spiral galaxy. Angular size is 9x5'.

Slightly less than halfway from Muphrid to Zosma.

Distinguished by a dark lane of dust partially occluding the bright nucleus, Messier 64 is a Seyfert galaxy. Part of the gas in this galaxy orbits the core in a retrograde direction, possibly indicating a galaxy merger in the past, or continuing absorption of gas from the intergalactic medium.

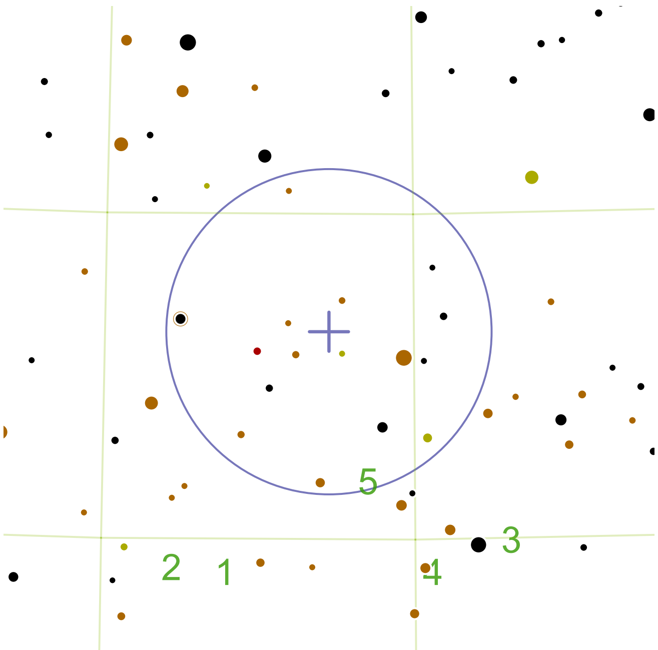
Also visible:

(1) C38 *(9.6$_m$ barred spiral galaxy)*

(2) M53 *(7.6$_m$ globular cluster)*

(3) NGC 5053 *(9.47$_m$ globular cluster)*

(4) NGC 4725 *(10.11$_m$ barred spiral galaxy)*



M85

RA: 186.38° | 12h 25.5' — DEC: 18.2° | 18° 12'

M85 (NGC 4382) is a magnitude 9.1 lenticular galaxy. Angular size is 7x5'.

Draw a line from Regulus through Chertan in Leo, and extend it an equal distance.

This featureless lenticular galaxy is the northernmost member of the Virgo Cluster, with a mass in the region of 100 billion solar masses.

Also visible:

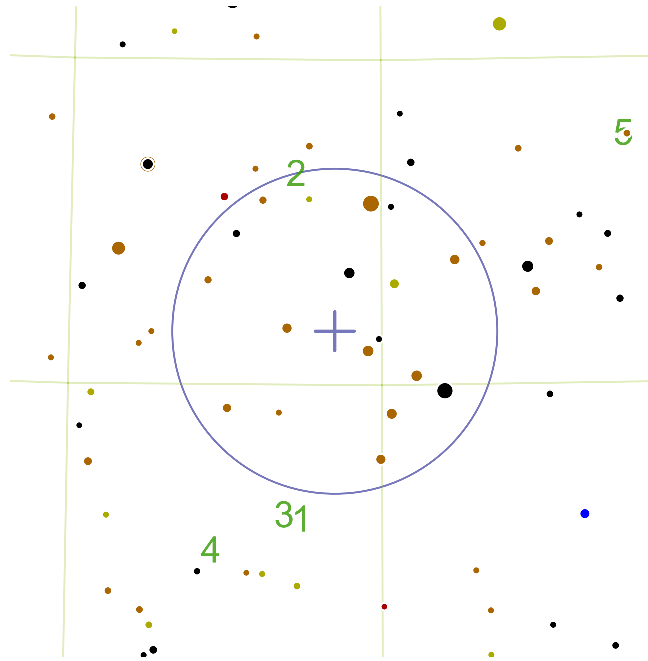
(1) M88 *(9.6_m spiral galaxy)*

(2) M91 *(10.2_m barred spiral galaxy)*

(3) M98 *(10.1_m spiral galaxy)*

(4) M99 *(9.9_m spiral galaxy)*

(5) M100 *(9.3_m spiral galaxy)*



M100

RA: 185.75° | 12h 23.0' — DEC: 15.83° | 15° 50'

M100 (NGC 4321) is a magnitude 9.3 spiral galaxy. Angular size is 7x6'.

Slightly north of a point one third of the way from Denebola in Leo to Vindemiatrix in Virgo.

This grand-design spiral galaxy is 56 million light-years from Earth. While M100 is very photogenic, larger telescopes and good skies are needed to see any of its beautiful details.

Also visible:

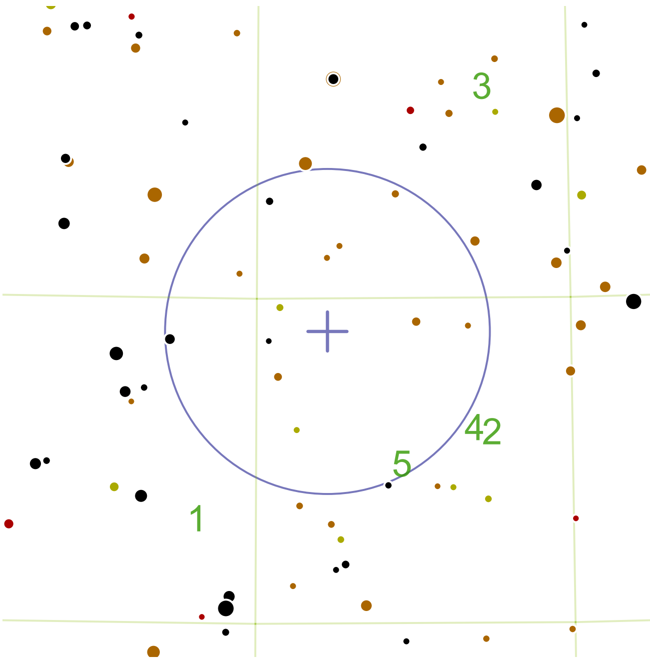
(1) M84 *(9.1_m lenticular galaxy)*

(2) M85 *(9.1_m lenticular galaxy)*

(3) M86 *(8.9_m lenticular galaxy)*

(4) M87 *(8.6_m elliptical galaxy)*

(5) R Com *(7.1_m variable star)*



M91

RA: 188.88° | 12h 35.5' — DEC: 14.5° | 14° 30'

M91 (NGC 4548) is a magnitude 10.2 barred spiral galaxy. Angular size is 5'.

Slightly north of a point halfway between Vindemiatrix in Virgo and Denebola in Leo.

One of the faintest Messier objects, this object was "lost" until 1969 as Charles Messier made a mistake in logging the location (he measured the location relative to Messier 89, but logged the directions as being relative to Messier 58 by mistake). Like many galaxies in the Virgo Cluster, M91 is deficient in interstellar gas.

Also visible:

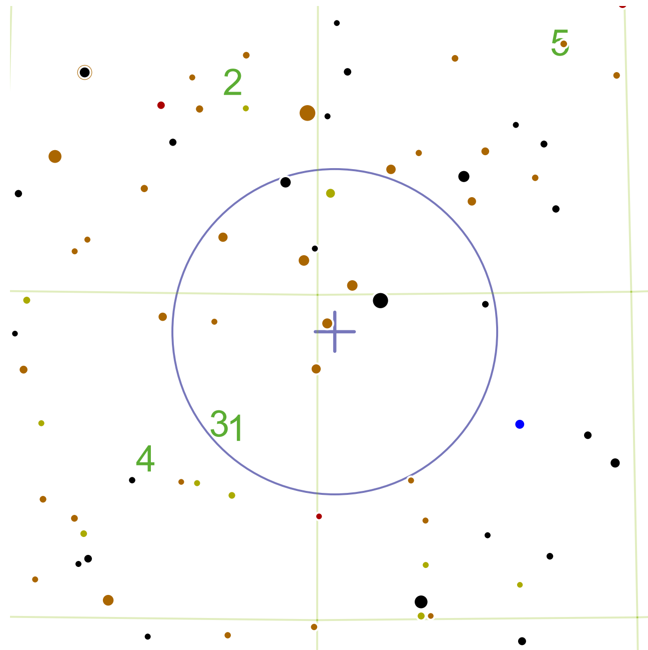
(1) M60 *(8.8_m elliptical galaxy)*

(2) M84 *(9.1_m lenticular galaxy)*

(3) M85 *(9.1_m lenticular galaxy)*

(4) M86 *(8.9_m lenticular galaxy)*

(5) M87 *(8.6_m elliptical galaxy)*



M99

RA: 184.73° | 12h 18.89' — DEC: 14.43° | 14° 26'

M99 (NGC 4254) is a magnitude 9.9 spiral galaxy. Angular size is 5'.

One third of the way from Denebola in Leo to Vindemiatrix in Virgo.

This grand-design spiral galaxy is 55 million light-years from Earth.

Also visible:

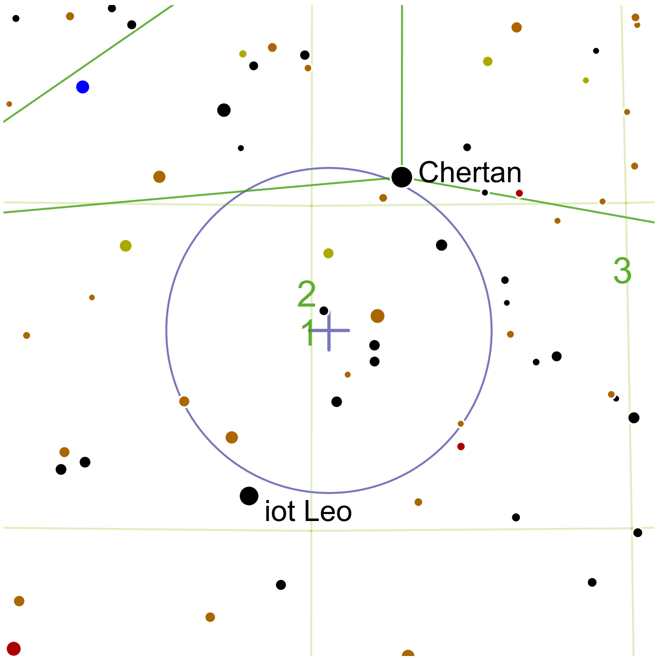
(1) M84 *(9.1_m lenticular galaxy)*

(2) M85 *(9.1_m lenticular galaxy)*

(3) M86 *(8.9_m lenticular galaxy)*

(4) M87 *(8.6_m elliptical galaxy)*

(5) R Com *(7.1_m variable star)*



M65

RA: 169.73° | 11h 18.89' — DEC: 13.08° | 13° 5'

M65 (NGC 3623) is a magnitude 9.3 spiral galaxy. Angular size is 8x1.5'.

2.6° SSE from mag.3.41 Chertan.

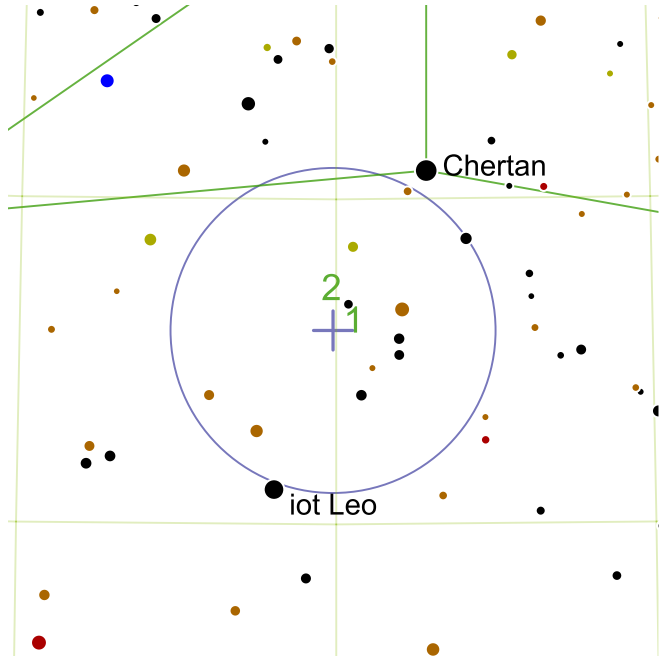
Part of the famous Leo Triplet of galaxies (with Messier 66 and NGC 3623). The galaxy is 35 million light-years from Earth. There is very little star-forming activity in this galaxy and very little gas, leading to relatively featureless photographs.

Also visible:

(1) M66 *(8.9$_m$ spiral galaxy)*

(2) NGC 3628 *(10.28$_m$ barred spiral galaxy)*

(3) NGC 3489 *(11.12$_m$ lenticular galaxy)*



M66

RA: 170.05° | 11h 20.2' — DEC: 12.98° | 12° 59'

M66 (NGC 3627) is a magnitude 8.9 spiral galaxy. Angular size is 8x2.5'.

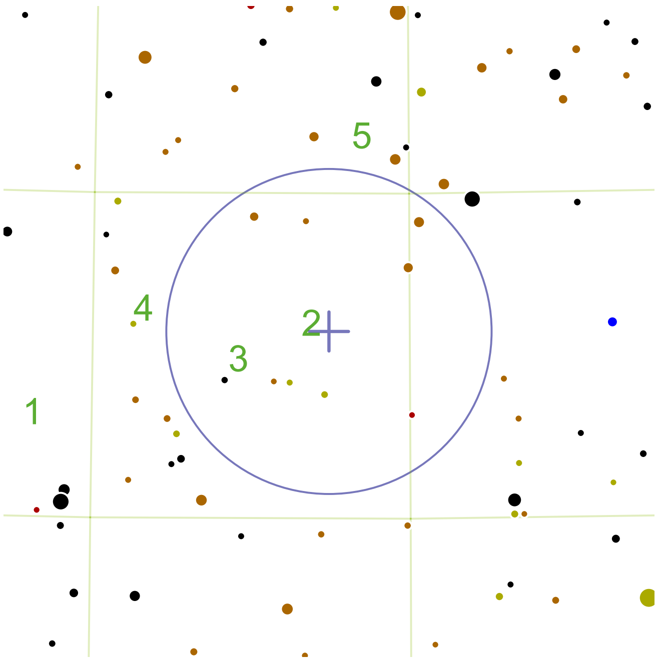
2.8° SSE from mag.3.41 Chertan.

Part of the famous Leo Triplet of galaxies (with Messier 65 and NGC 3623). In his discovery notes, Messier described this galaxy as "very long and very faint". Messier 65 is only 20' away, making an attractive pair in dark conditions.

Also visible:

(1) M65 *(9.3$_m$ spiral galaxy)*

(2) NGC 3628 *(10.28$_m$ barred spiral galaxy)*



M84

RA: 186.28° | 12h 25.1' — DEC: 12.88° | 12° 53'

M84 (NGC 4374) is a magnitude 9.1 lenticular galaxy. Angular size is 5'.

Draw a line from Chertan through Denebola in Leo and extend it an equal distance.

M84 is a giant elliptical or lenticular galaxy distinguished by a dark dust lane and two jets of matter shooting from its central black hole (which is an impressive 1.5 billion solar masses). The galaxy has nearly 2000 globular clusters, which is actually less than expected for an elliptical galaxy of this size. M84 has some young star clusters and has had at least two supernovae since 1957, so it clearly still has continuing star-forming activity.

Also visible:

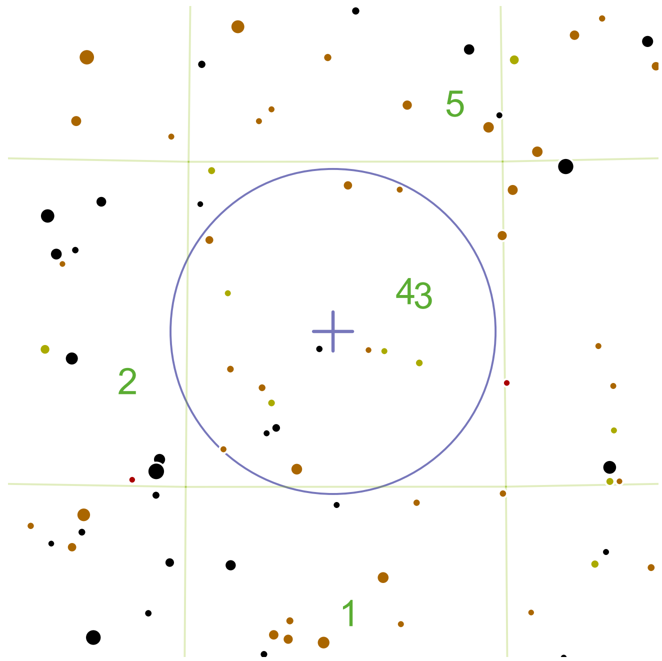
(1) M60 *(8.8$_m$ elliptical galaxy)*

(2) M86 *(8.9$_m$ lenticular galaxy)*

(3) M87 *(8.6$_m$ elliptical galaxy)*

(4) M90 *(9.5$_m$ spiral galaxy)*

(5) M100 *(9.3$_m$ spiral galaxy)*



M87

RA: 187.7° | 12h 30.79' — DEC: 12.4° | 12° 24'

M87 (NGC 4486) is a magnitude 8.6 elliptical galaxy. Angular size is 7'.

Draw a line from Chertan through Denebola in Leo and extend it an equal distance.

This supergiant elliptical galaxy comprising trillions of stars is one of the most massive galaxies in the sky. It has 15,000 globular clusters. This galaxy is famous for its iconic plasma jet that originate from its central black hole (the corresponding jet on the far side of the galaxy is hidden by relativistic effects). This black hole is believed to be 6,5 billion solar masses, amongst the largest known, and also the first to be directly imaged (April 2019).

Also visible:

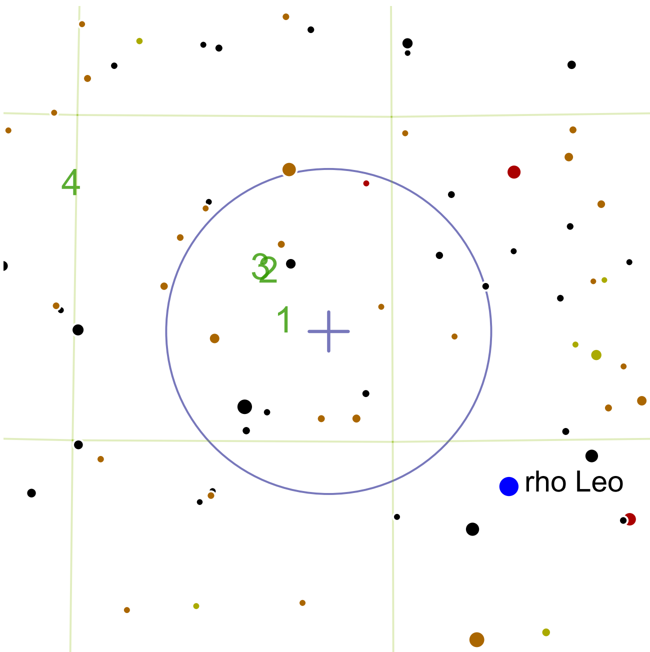
(1) M49 *(8.4$_m$ elliptical galaxy)*

(2) M60 *(8.8$_m$ elliptical galaxy)*

(3) M84 *(9.1$_m$ lenticular galaxy)*

(4) M86 *(8.9$_m$ lenticular galaxy)*

(5) M100 *(9.3$_m$ spiral galaxy)*



M95

RA: 161.0° | 10h 44.0' — DEC: 11.7° | 11° 42'

M95 (NGC 3351) is a magnitude 9.7 barred spiral galaxy. Angular size is 4x3'.

3.6° NE from mag.3.85 rho Leo.

Like M94, M95 has a ring-shaped circumnuclear star-forming region, which include several large star clusters that may are massive enough to be potentially become globular clusters. This faint galaxy is a member of the M96 Group, which includes a third Messier object, M105.

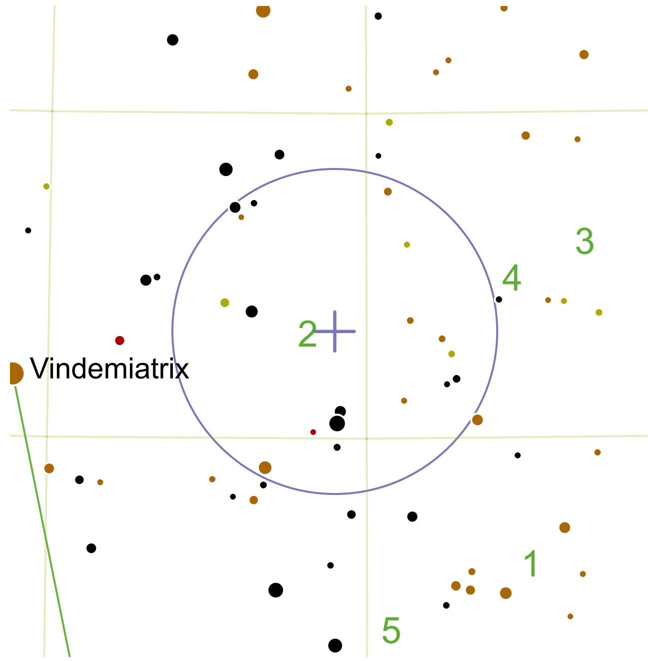
Also visible:

(1) M96 *(9.2$_m$ spiral galaxy)*

(2) M105 *(9.3$_m$ elliptical galaxy)*

(3) NGC 3384 *(10.85$_m$ elliptical galaxy)*

(4) NGC 3489 *(11.12$_m$ lenticular galaxy)*



M59

RA: 190.5° | 12h 42.0' — DEC: 11.65° | 11° 39'

M59 (NGC 4621) is a magnitude 9.6 elliptical galaxy. Angular size is 5x4'.

Draw a line from Chertan in Leo through Denebola, and extend it one-and-a-half times.

M59 and M60 were spotted and cataloged by Charles Messier as he searched for the newly discovered Bode's Comet in Spring 1779. As an elliptical galaxy, M59 has no structure and while a small telescope can reveal the elongated shape, a larger telescope will not show more.

Also visible:

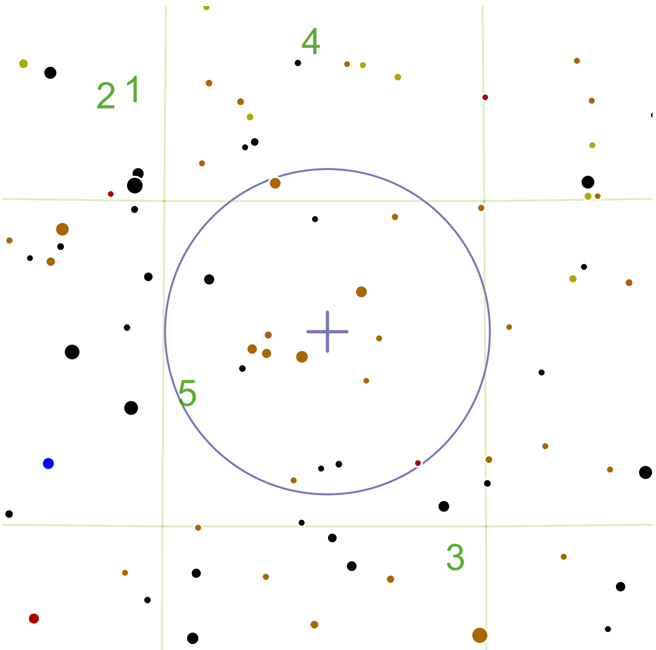
(1) M49 *(8.4$_m$ elliptical galaxy)*

(2) M60 *(8.8$_m$ elliptical galaxy)*

(3) M86 *(8.9$_m$ lenticular galaxy)*

(4) M87 *(8.6$_m$ elliptical galaxy)*

(5) R Vir *(6.1$_m$ variable star)*



M49

RA: 187.45° | 12h 29.79' — DEC: 8.0° | 8° 0'

M49 (NGC 4472) is a magnitude 8.4 elliptical galaxy. Angular size is 9x7.5'.

Draw a line from Zosma through Denebola in Leo, and extend it one-and-a-half times.

This giant elliptical galaxy is believed to harbor a supermassive black hole 565 million times more massive than the Sun (to put it differently, 150 times more massive than the black hole in the center of the Milky Way). M49 has nearly 6,000 globular clusters, significantly more than the 200 that can be found in our own galaxy. M49 was the first Virgo galaxy to be discovered.

Also visible:

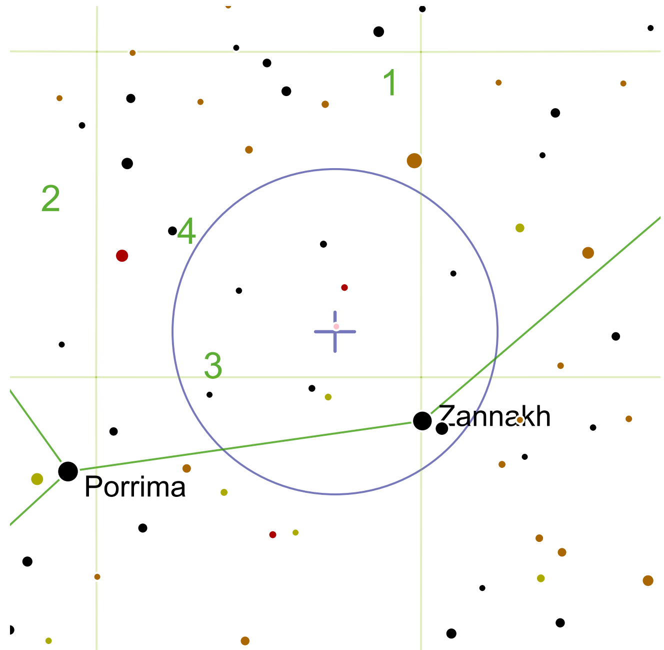
(1) M59 *(9.6$_m$ elliptical galaxy)*

(2) M60 *(8.8$_m$ elliptical galaxy)*

(3) M61 *(9.7$_m$ spiral galaxy)*

(4) M87 *(8.6$_m$ elliptical galaxy)*

(5) R Vir *(6.1$_m$ variable star)*



SS Vir

RA: 186.33° | 12h 25.29' — DEC: 0.7° | 0° 42'

SS Vir (HD 108105) is a magnitude 6.0 carbon star. Magnitude ranges from 9.6 to 6.0 (Δ mag. 3.6) with a period of 355d.

4.6° NWW from mag.3.68 gam Vir.

A deeply red (B-V color index of 3.5) carbon star classified as C-N4.5. Located 2,280 light-years from Earth.

Also visible:

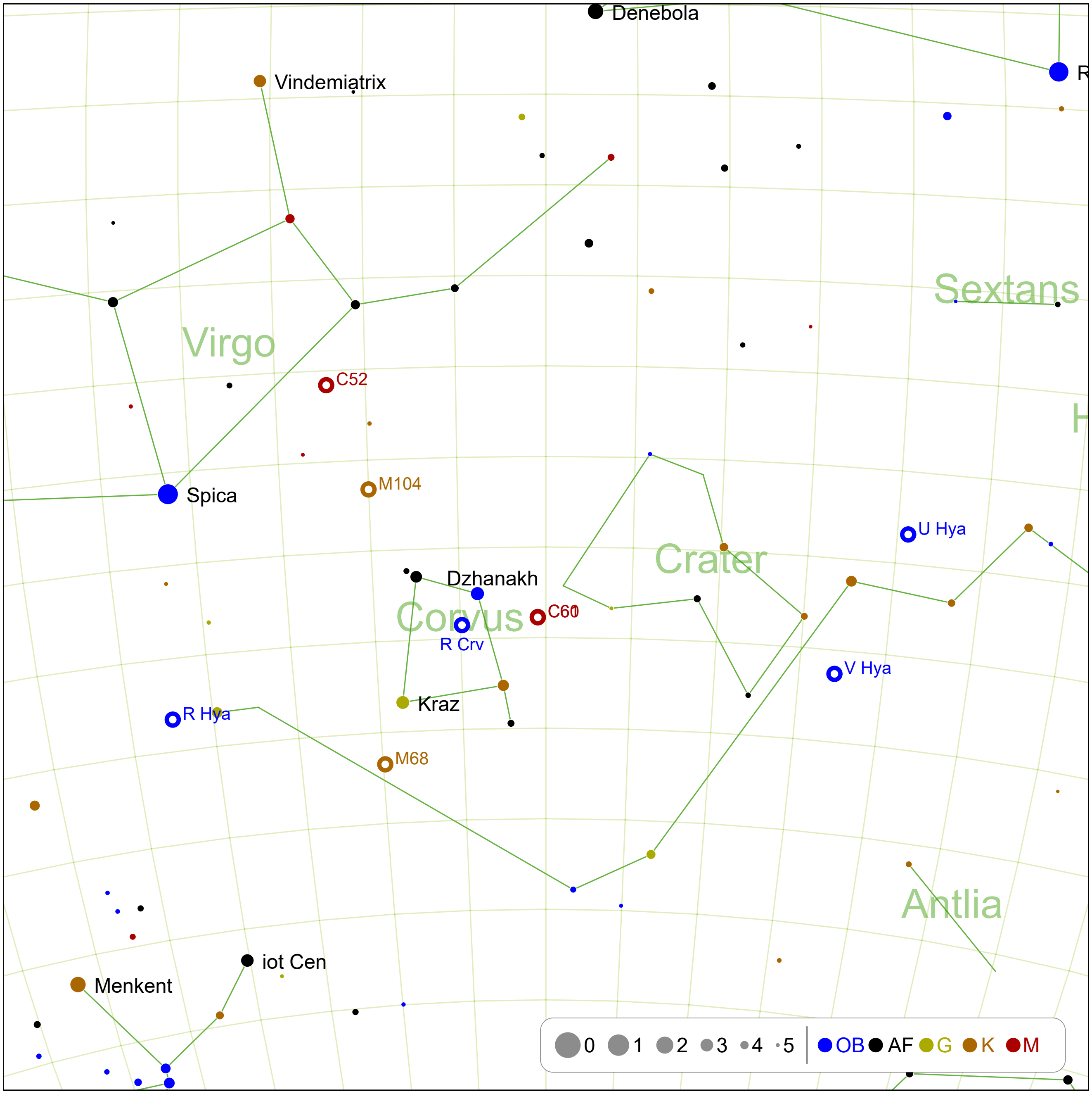
(1) M61 *(9.7$_m$ spiral galaxy)*

(2) NGC 4636 *(10.43$_m$ elliptical galaxy)*

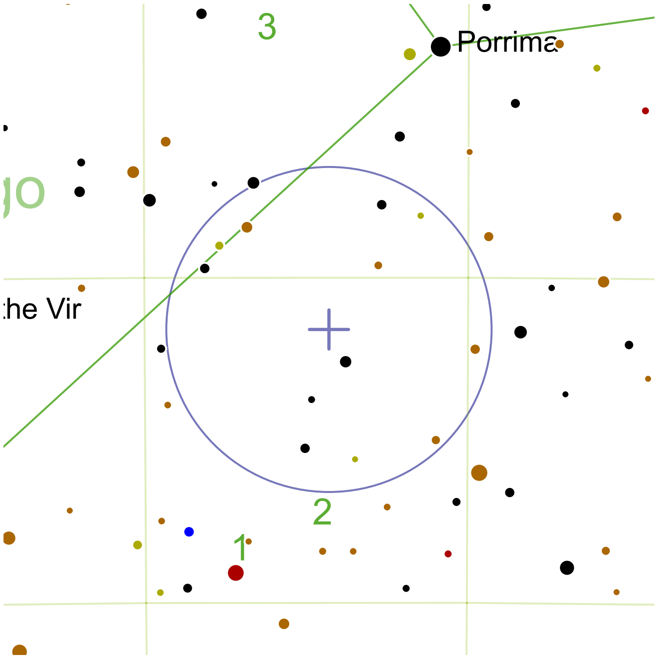
(3) NGC 4517 *(11.1$_m$ spiral galaxy)*

(4) NGC 4536 *(11.16$_m$ barred spiral galaxy)*

April: -15° South



C52: page 192	M104: page 192	U Hya: page 193	C60: page 193
C61: page 194	R Crv: page 194	V Hya: page 195	R Hya: page 195
M68: page 196			



C52

RA: 192.15° | 12h 48.6' — DEC: -5.8° | -5° 47'

C52 (NGC 4697) is a magnitude 9.3 elliptical galaxy. Angular size is 6x3'.

4.6° SSE from mag.3.68 gam Vir.

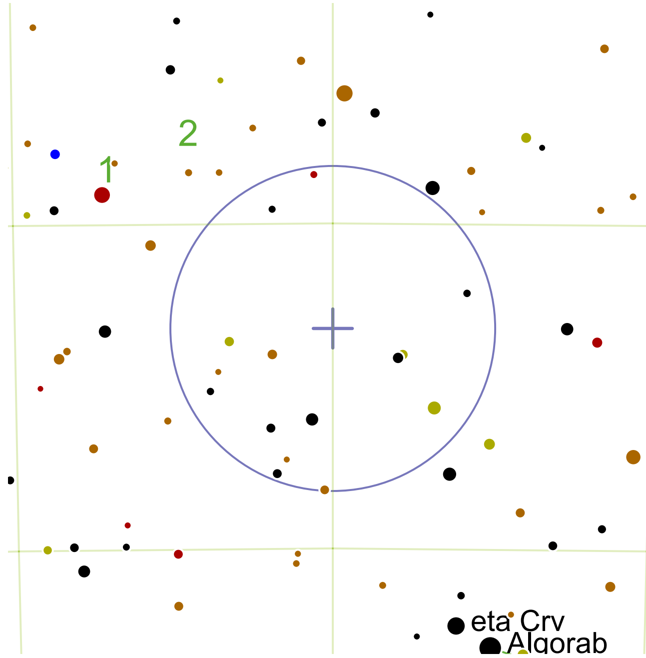
The bright core of this galaxy can be seen in light-polluted skies with a small telescope. Larger telescopes only reveal a larger and somewhat elongated smudge.

Also visible:

(1) NGC 4776 *(11.5_m planetary nebula)*

(2) NGC 4699 *(10.41_m barred spiral galaxy)*

(3) NGC 4753 *(10.85_m irregular galaxy)*



M104

RA: 190.0° | 12h 40.0' — DEC: -11.62° | -11° 36'

M104 (Sombrero Galaxy, NGC 4594) is a magnitude 8.0 spiral galaxy. Angular size is 9x4'.

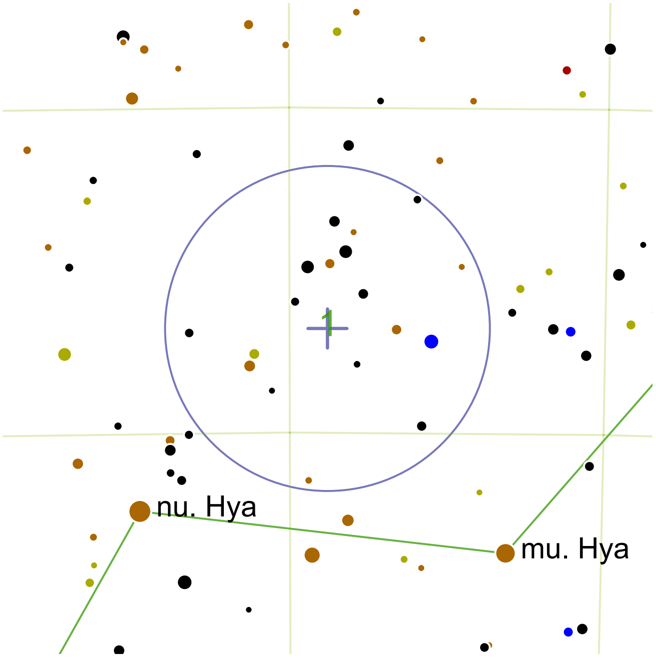
5.4° NNE from mag.3.11 Algorab.

The Sombrero Galaxy is so named because of its prominent outer dust ring and large central bulge give it a hat shape. This is a brighter galaxy with high contrast, so it is a good one for smaller telescopes.

Also visible:

(1) NGC 4776 *(11.5_m planetary nebula)*

(2) NGC 4699 *(10.41_m barred spiral galaxy)*



U Hya

RA: 159.4° | 10h 37.6' — DEC: -13.4° | -13° 23'

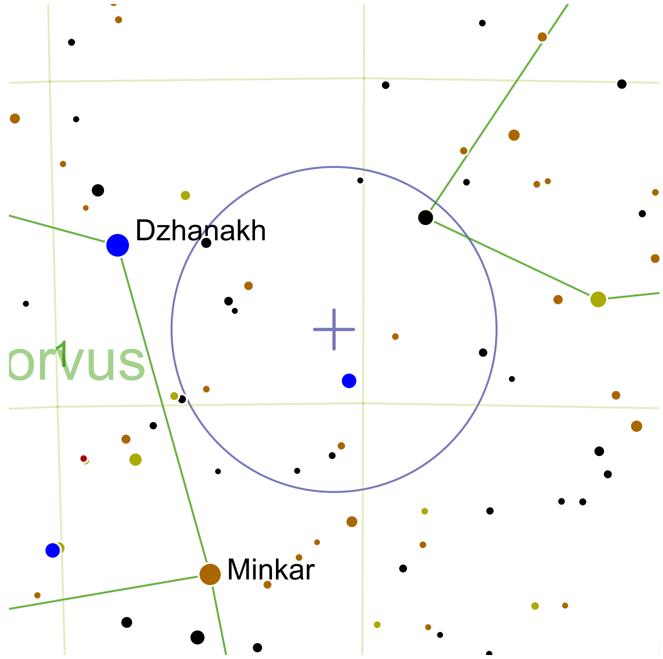
U Hya (HD 92055) is a magnitude 4.7 carbon star. Magnitude ranges from 6.2 to 4.7 (Δ mag. 1.5).

4.0° NW from mag.3.32 nu. Hya.

This carbon star has a B-V color index of 2.81 and spectral class of C-N5. SAO 150629 (HD 91120) is 1.5 degrees west and at magnitude 5.55 marks a midpoint in the brightness range of this star.

Also visible:

(1) U Hya *(7.0$_m$ variable star)*



C60

RA: 180.48° | 12h 1.89' — DEC: -18.87° | -18° 51'

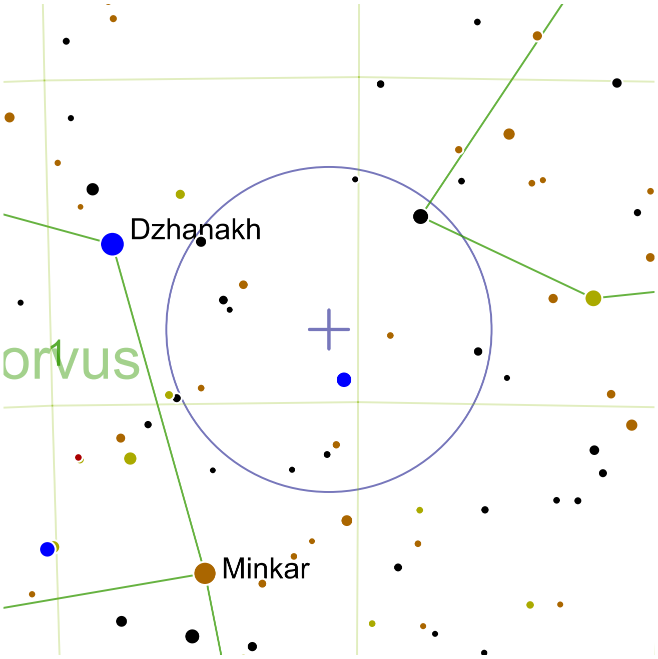
C60 (Antennae Galaxies, NGC 4038) is a magnitude 11.3 spiral galaxy. Angular size is 2.6x1.8'.

3.5° SWW from mag.2.78 Dzhanakh.

An interesting pair of colliding galaxies riven by colossal star forming regions.

Also visible:

(1) R Crv *(6.7$_m$ variable star)*



C61

RA: 180.48° | 12h 1.89' — DEC: -18.88° | -18° 52'

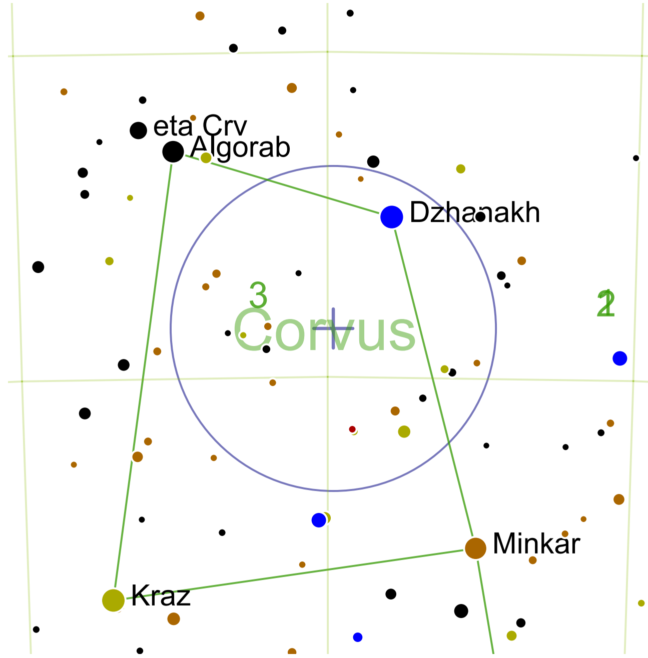
C61 (Antennae Galaxies, NGC 4039) is a magnitude 13.0 spiral galaxy. Angular size is 3.2x2.2'.

3.5° SWW from mag.2.78 Dzhanakh.

An interesting pair of colliding galaxies riven by colossal star forming regions.

Also visible:

(1) R Crv *(6.7$_m$ variable star)*



R Crv

RA: 184.91° | 12h 19.63' — DEC: -19.26° | -19° 14'

R Crv (HD 107199) is a magnitude 6.7 variable star. Magnitude ranges from 14.4 to 6.7 (Δ mag. 7.7) with a period of 317d.

1.9° SSE from mag.2.78 Dzhanakh.

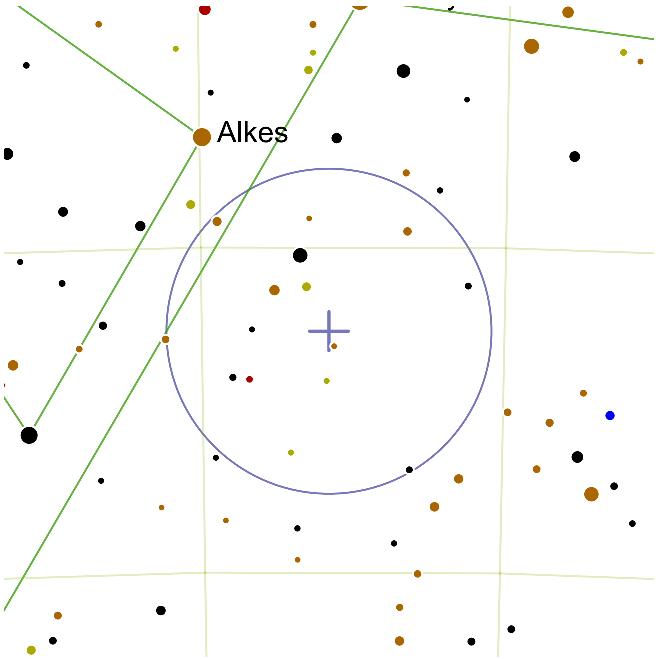
Deeply red (B-V color index: 3.7), R Corvi has a very deep minimum brightness and only spends about a quarter of its cycle brighter than magnitude 9.0. R Corvi is a Mira-type variable.

Also visible:

(1) C60 *(11.3$_m$ spiral galaxy)*

(2) C61 *(13.0$_m$ spiral galaxy)*

(3) NGC 4361 *(10.5$_m$ planetary nebula)*



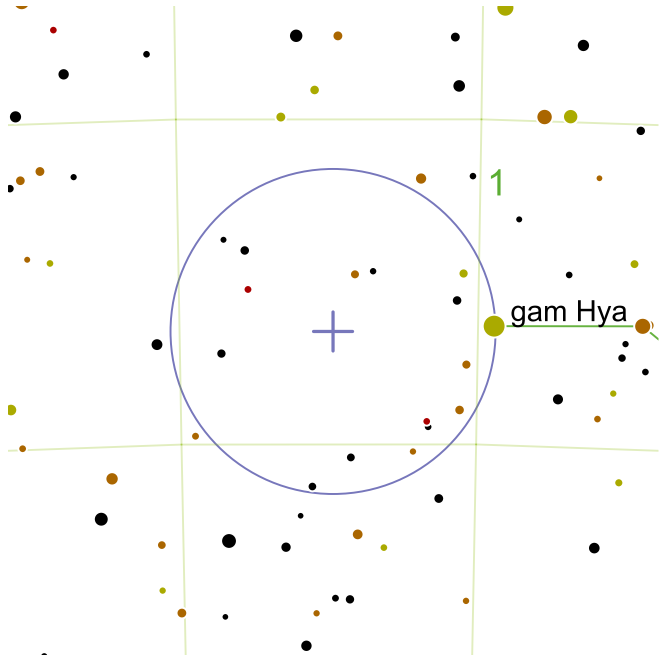
V Hya

RA: 162.9° | 10h 51.6' — DEC: -21.3° | -21° 17'

V Hya (SAO 179278) is a magnitude 6.5 carbon star. Magnitude ranges from 12.0 to 6.5 (Δ mag. 5.5) with a period of 533d.

5.1° S from mag.3.32 nu. Hya.

An utterly unique star. A carbon star with a B-V color index of 2.59, it varies in magnitude from 6 to 8 over 530 days, but every 6160 days it drops down to magnitude 12. The star is believed to be transitioning to a planetary nebula. It is interacting with an unseen companion to eject jets of matter periodically.



R Hya

RA: 202.43° | 13h 29.71' — DEC: -23.28° | -23° 16'

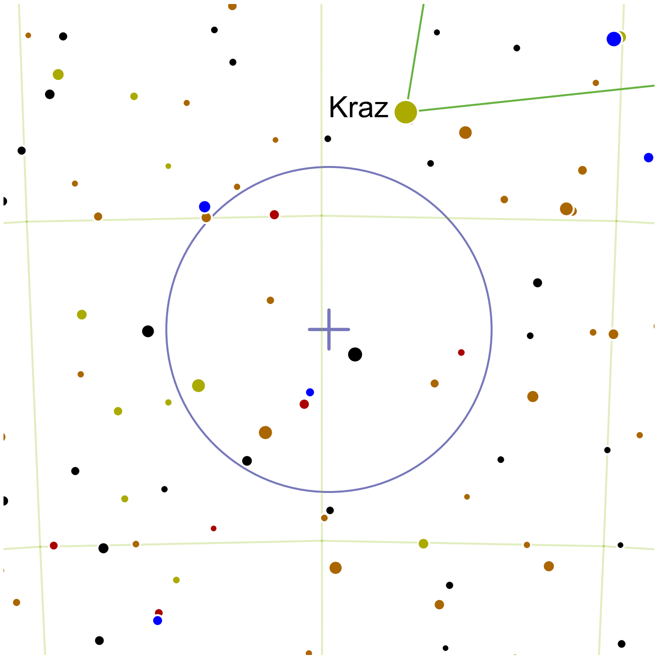
R Hya (HD 117287) is a magnitude 3.5 variable star. Magnitude ranges from 10.9 to 3.5 (Δ mag. 7.4) with a period of 389d.

2.4° E from mag.3.33 gam Hya.

A very bright Mira-type variable that spends almost half its life brighter than magnitude 6. It is thought to be between 500 to 1,000 million years old and possibly twice the mass of the Sun.

Also visible:

(1) NGC 5068 *(10.7$_m$ barred spiral galaxy)*



M68

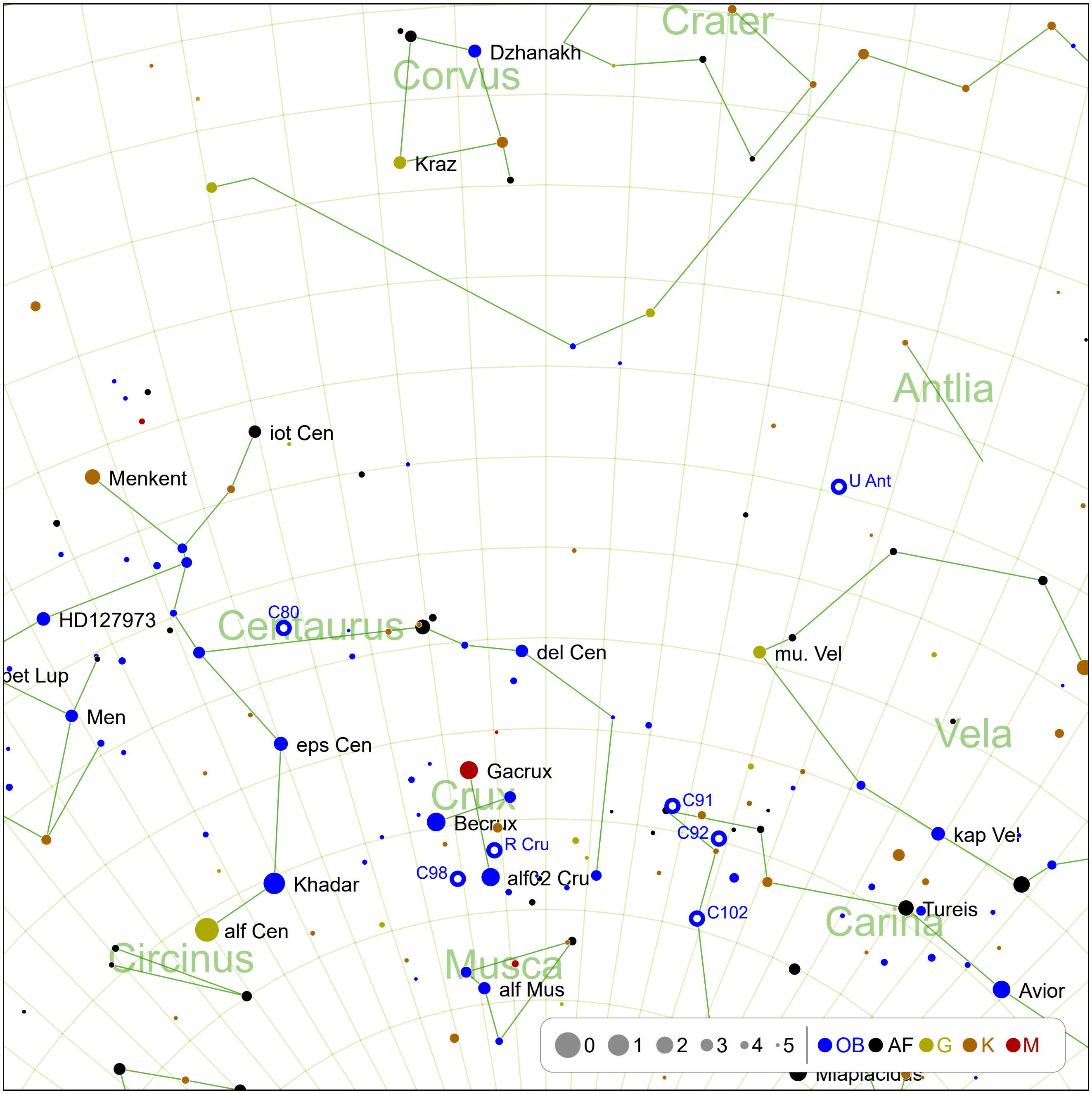
RA: 189.88° | 12h 39.5' — DEC: -26.75° | -26° 44'

M68 (NGC 4590) is a magnitude 7.8 globular cluster. Angular size is 12'.

3.5° SSE from mag.2.84 Kraz.

William Herschel described this globular cluster as follows in 1780: "a beautiful cluster of stars, extremely rich, and so compressed that most of the stars are blended together". Messier 68 appears to be undergoing core-collapse, whereby momentum is transferred from the core of the cluster to its fringes, resulting in a very dense core.

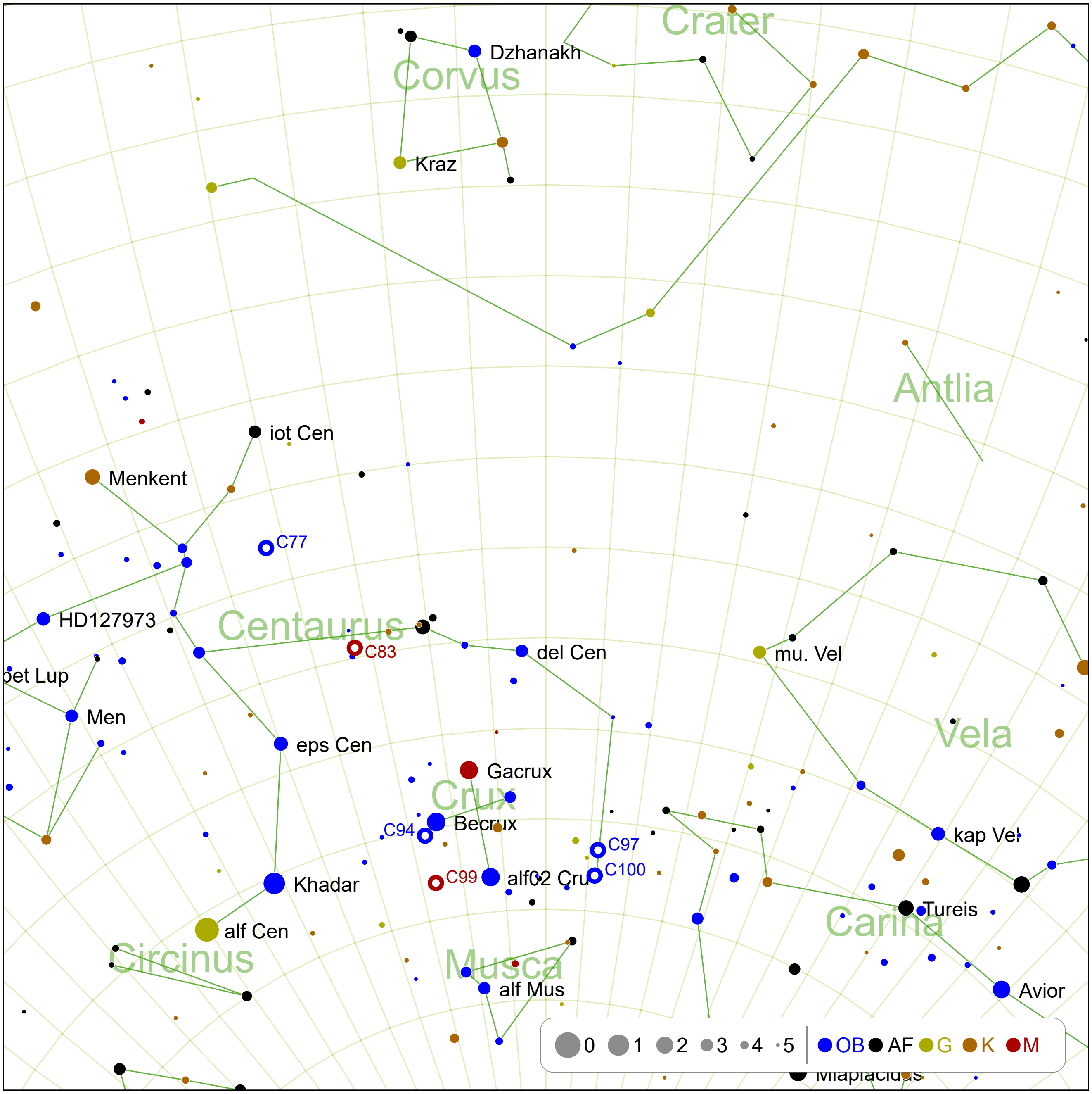
April: -45° South (1)



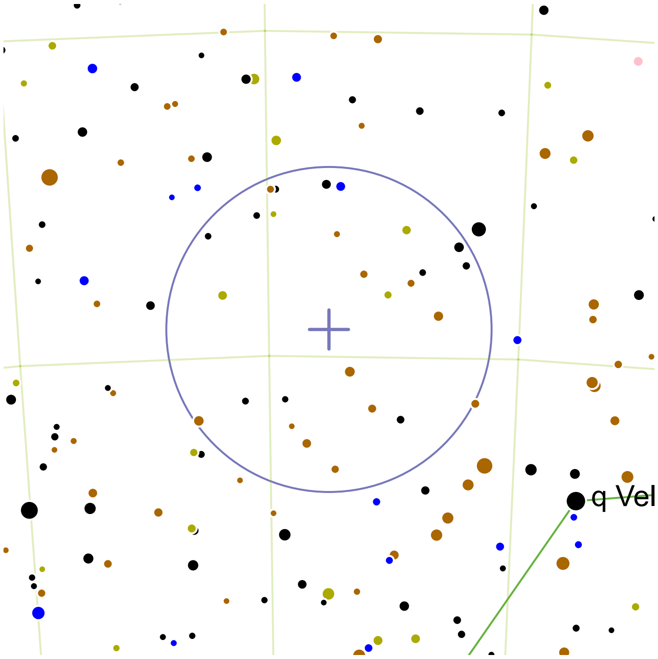
U Ant: page 199 C80: page 199 C91: page 200 C92: page 200

R Cru: page 201 C98: page 201 C102: page 202

April: -45° South (2)



C77: page 202
C83: page 203
C94: page 203
C97: page 204
C100: page 204
C99: page 205



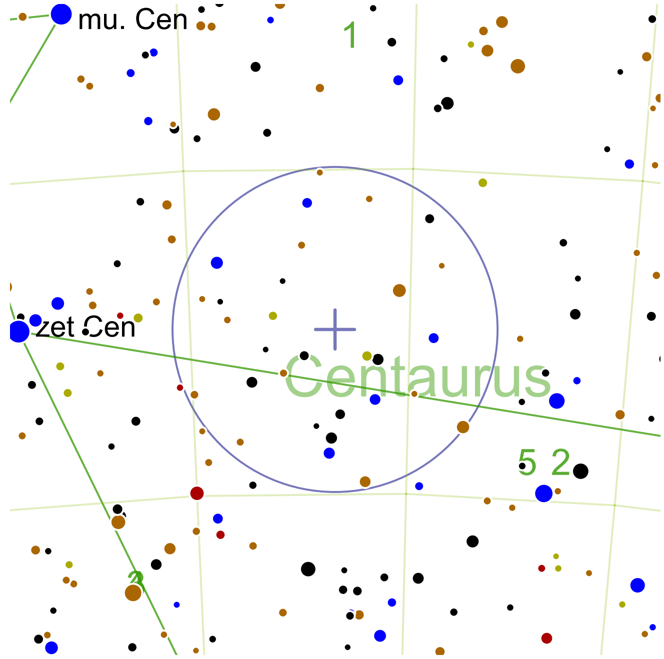
U Ant

RA: 158.8° | 10h 35.2' — DEC: -39.6° | -39° 35'

U Ant (HD 91793) is a magnitude 5.7 carbon star. Magnitude ranges from 8.6 to 5.7 (Δ mag. 2.9) with a period of 170d.

10.0° NNW from mag.2.84 mu. Vel.

A deeply red carbon star (B-V color index: 3.03). It emits 8,000 times more energy than the Sun, but mostly as infrared light; in the visible spectrum the star is only 500 times brighter than the Sun.



C80

RA: 201.7° | 13h 26.79' — DEC: -47.48° | -47° 28'

C80 (Omega Centauri, NGC 5139) is a magnitude 3.6 globular cluster. Angular size is 36'.

4.8° W from mag.3.06 zet Cen.

By far the brightest globular cluster in Earth's sky, Omega Centauri may well be the remnant core of a captured galaxy. It has a mass of four million Suns, seven time more than the most famous northern hemisphere globular, Messier 13.

Also visible:

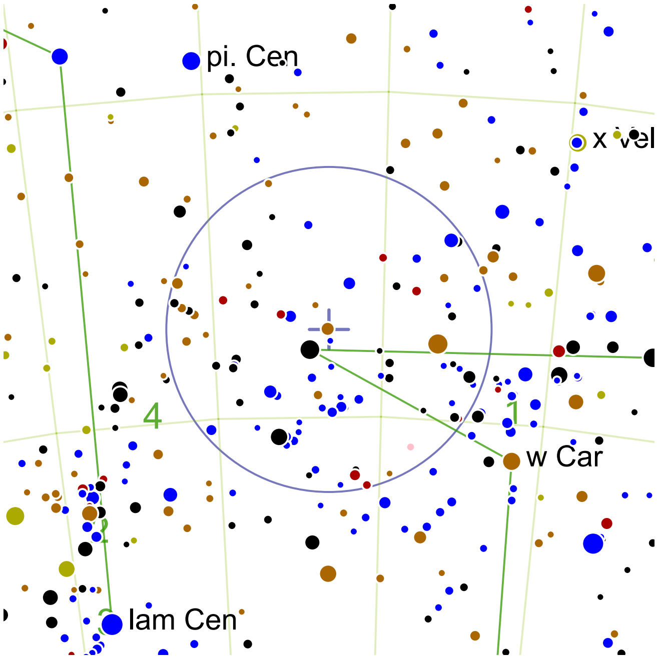
(1) C77 *(7.0_m peculiar galaxy)*

(2) C83 *(9.5_m spiral galaxy)*

(3) C84 *(7.6_m globular cluster)*

(4) NGC 5286 *(7.34_m globular cluster)*

(5) NGC 4976 *(11.04_m elliptical galaxy)*



C91

RA: 166.6° | 11h 6.39' — DEC: -58.67° | -58° 39'

C91 (Wishing Well Cluster, NGC 3532) is a magnitude 3.0 open cluster. Angular size is 55'.

1.6° E from mag.3.88 u Car.

This brilliant, naked-eye cluster is twice the size of the full moon. It was the first target observed by the Hubble Space Telescope (20 May 1990). It is the subject of the photograph taken at the greatest distance from the Earth, by New Horizons on December 5, 2017.

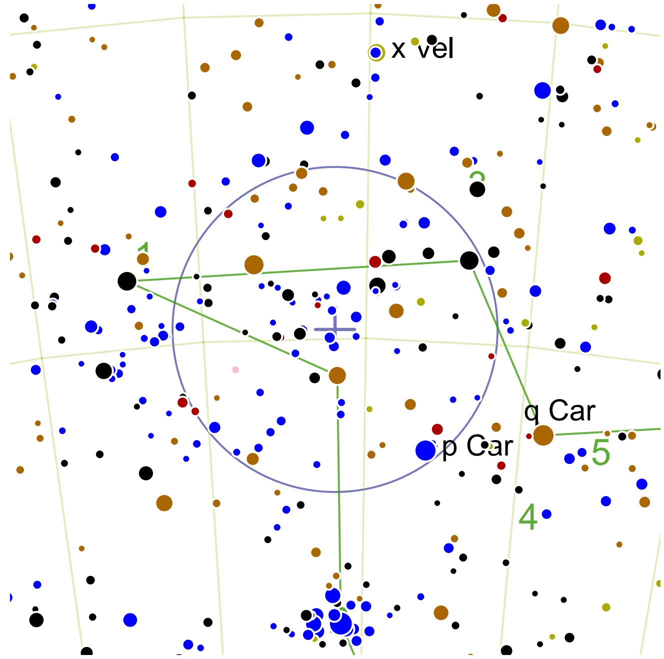
Also visible:

(1) C92 *(6.2_m bright nebula)*

(2) C97 *(5.3_m open cluster)*

(3) C100 *(4.5_m open cluster)*

(4) NGC 3699 *(11.0_m planetary nebula)*



C92

RA: 160.95° | 10h 43.79' — DEC: -59.87° | -59° 51'

C92 (Eta Carinae Nebula, NGC 3372) is a magnitude 6.2 bright nebula. Angular size is 120x120'.

1.5° SW from mag.3.88 u Car.

This naked-eye emission nebula is home to Eta Carina, one of the most massive stars known with a mass of 100 Suns and a luminosity five million times greater than the Sun. Given its huge extent, this object is best viewed in small wide-field telescopes or binoculars.

Also visible:

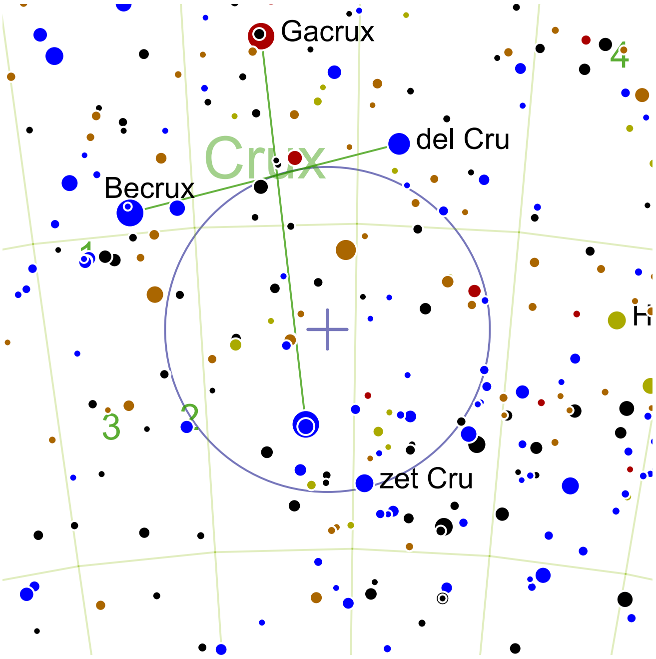
(1) C91 *(3.0_m open cluster)*

(2) C102 *(1.9_m open cluster)*

(3) IC 2581 *(4.3_m open cluster)*

(4) NGC 3211 *(11.5_m planetary nebula)*

(5) S Car *(4.5_m variable star)*



R Cru

RA: 185.91° | 12h 23.62' — DEC: -61.63° | -61° 37'

R Cru (HD 107805) is a magnitude 6.4 variable star. Magnitude ranges from 7.23 to 6.4 (Δ mag. 0.8) with a period of 5.82575d.

1.2° SSE from mag.3.57 eps Cru.

A Cepheid variable, this yellow supergiant pulsates with a radius varying between 42 and 47 times the radius of the Sun. It is approximately 1,600 light-years distant.

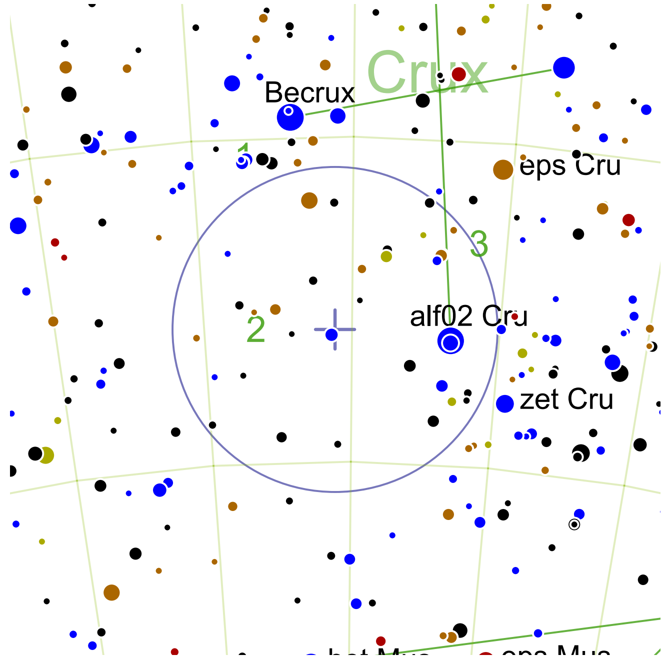
Also visible:

(1) C94 *(4.2$_m$ open cluster)*

(2) C98 *(6.9$_m$ open cluster)*

(3) C99 *(20.0$_m$ dark nebula)*

(4) NGC 3918 *(8.0$_m$ Type)*



C98

RA: 190.58° | 12h 42.29' — DEC: -62.97° | -62° 57'

C98 (Coalsack Cluster, NGC 4609) is a magnitude 6.9 open cluster. Angular size is 5'.

1.7° E from mag.2.09 alf02 Cru.

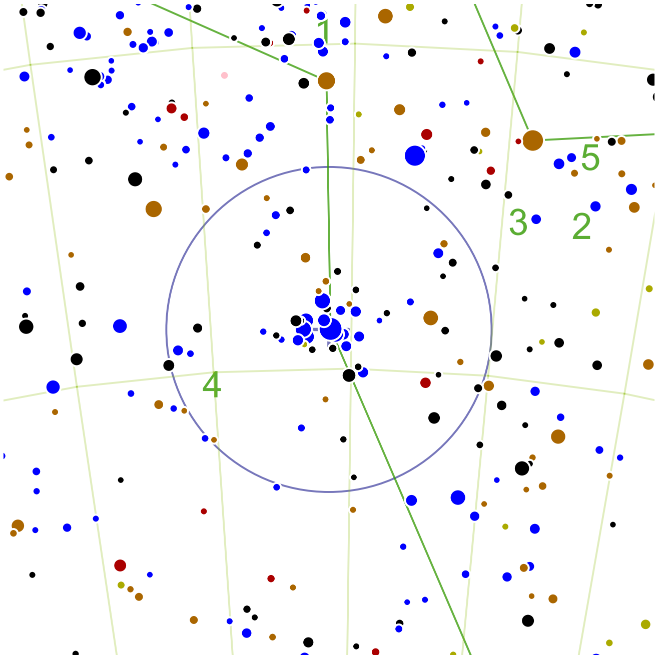
In comparison to other southern hemisphere Caldwell clusters that are prominent naked-eye objects, Caldwell 98 is somewhat more pedestrian, only visible with the aid of binoculars at least, and being relatively sparse.

Also visible:

(1) C94 *(4.2$_m$ open cluster)*

(2) C99 *(20.0$_m$ dark nebula)*

(3) R Cru *(6.4$_m$ variable star)*



C102

RA: 160.8° | 10h 43.2' — DEC: -64.4° | -64° 23'

C102 (Theta Car Cluster, IC 2602) is a magnitude 1.9 open cluster. Angular size is 50'.

0.0° SEE from mag.3.03 the Car.

The Theta Carinae cluster (also known as the Southern Pleiades) is the third brightest open cluster in Earth's skies, outshone only by the Hyades and Pleiades.

Also visible:

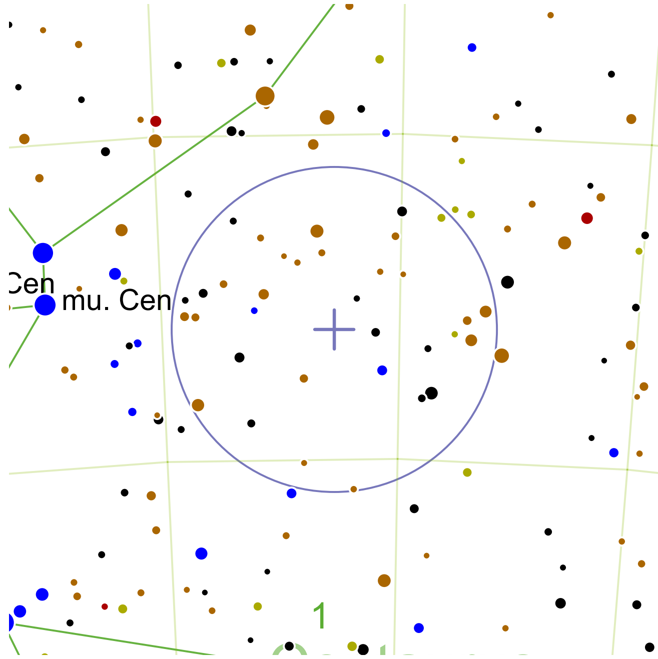
(1) C92 *(6.2$_m$ bright nebula)*

(2) IC 2553 *(11.5$_m$ planetary nebula)*

(3) NGC 3211 *(11.5$_m$ planetary nebula)*

(4) IC 2621 *(11.5$_m$ planetary nebula)*

(5) S Car *(4.5$_m$ variable star)*



C77

RA: 201.38° | 13h 25.5' — DEC: -43.02° | -43° 0'

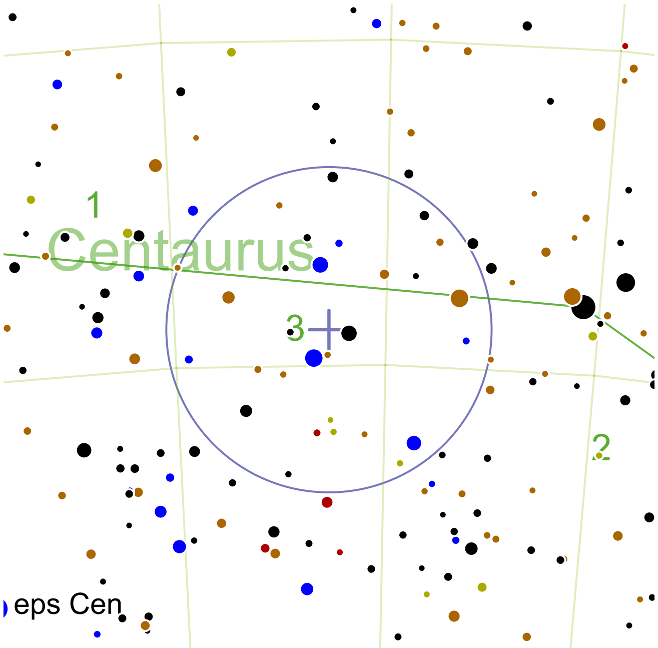
C77 (Centaurus A, NGC 5128) is a magnitude 7.0 peculiar galaxy. Angular size is 18x14'.

3.7° SSW from mag.3.96 d Cen.

This peculiar galaxy is the fifth-brightest galaxy in the sky, and is relatively close at 10-16 million light-years. It has an active galactic nucleus that strongly emits in the radio spectrum (hence its radio source name Centaurus A). It is believed that the galaxy is a merger between an elliptical galaxy and a smaller spiral galaxy.

Also visible:

(1) C80 *(3.6$_m$ globular cluster)*



C83

RA: 196.35° | 13h 5.39' — DEC: -49.47° | -49° 27'

C83 (NGC 4945) is a magnitude 9.5 spiral galaxy. Angular size is 20x4'.

3.9° E from mag.2.38 gam Cen.

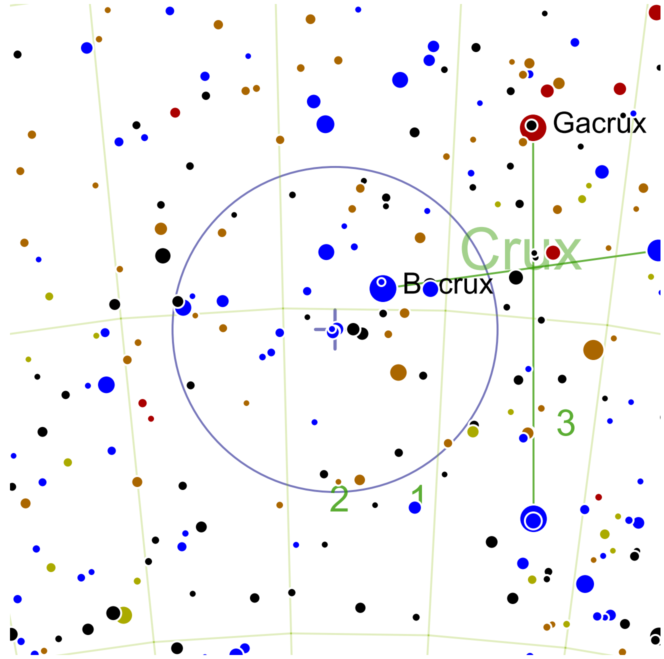
This edge-on barred spiral galaxy is home to a water megamaser (a vast structure emitting coherent microwave radiation, similar to a laser).

Also visible:

(1) C80 *(3.6$_m$ globular cluster)*

(2) Ruprecht 106 *(10.9$_m$ globular cluster)*

(3) NGC 4976 *(11.04$_m$ elliptical galaxy)*



C94

RA: 193.4° | 12h 53.6' — DEC: -60.33° | -60° 19'

C94 (Jewel Box, NGC 4755) is a magnitude 4.2 open cluster. Angular size is 10'.

0.9° SE from mag.1.5 Becrux.

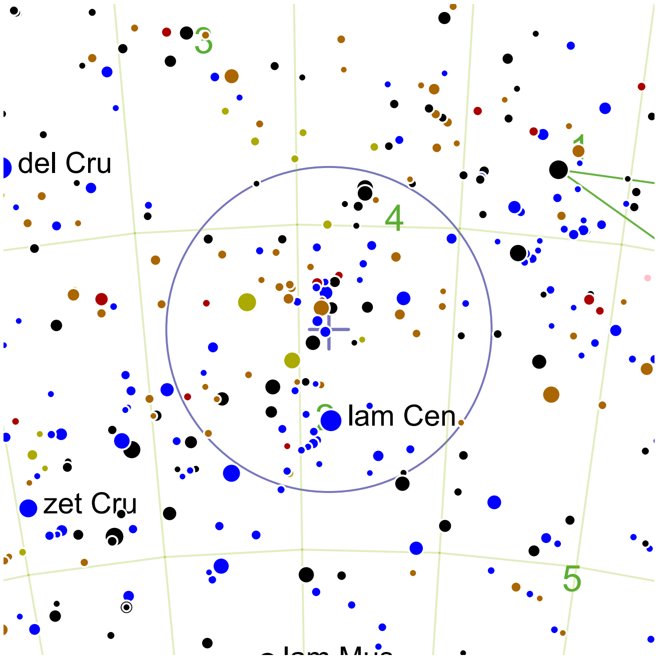
This bright naked-eye cluster can be resolved into its stars with binoculars. It is quite distant at 6,500 light-years, and consists of 100 stars.

Also visible:

(1) C98 *(6.9$_m$ open cluster)*

(2) C99 *(20.0$_m$ dark nebula)*

(3) R Cru *(6.4$_m$ variable star)*



C97

RA: 174.03° | 11h 36.1' — DEC: -61.62° | -61° 36'

C97 (Pearl Cluster, NGC 3766) is a magnitude 5.3 open cluster. Angular size is 12'.

1.4° N from mag.3.34 lam Cen.

Located in the Carina molecular cloud, this open cluster contains over 100 stars within a 10 light-year radius.

Also visible:

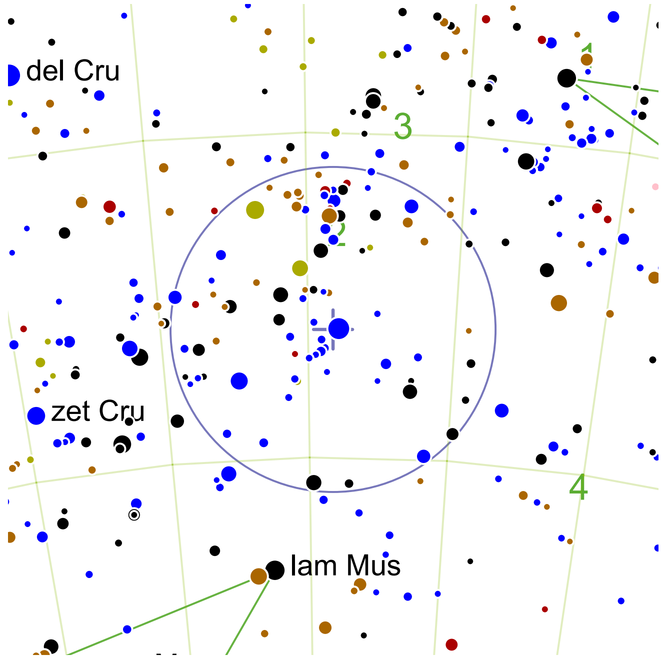
(1) C91 *(3.0$_m$ open cluster)*

(2) C100 *(4.5$_m$ open cluster)*

(3) NGC 3918 *(8.0$_m$ Type)*

(4) NGC 3699 *(11.0$_m$ planetary nebula)*

(5) IC 2621 *(11.5$_m$ planetary nebula)*



C100

RA: 174.15° | 11h 36.6' — DEC: -63.03° | -63° 1'

C100 (Lambda Centauri Nebula, IC 2944) is a magnitude 4.5 open cluster. Angular size is 15'.

0.0° E from mag.3.34 lam Cen.

A combination of a very bright nebula and an open cluster with many prominent members, Caldwell 100 is a good binocular target that benefits greatly from dark skies.

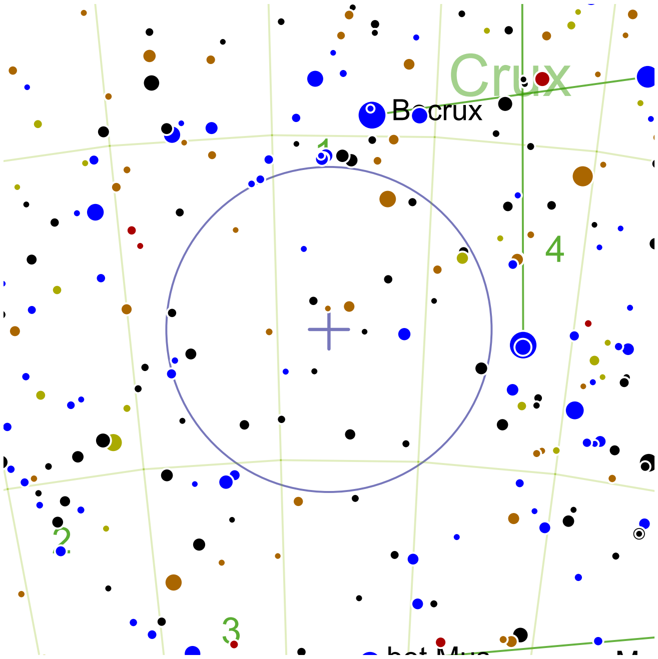
Also visible:

(1) C91 *(3.0$_m$ open cluster)*

(2) C97 *(5.3$_m$ open cluster)*

(3) NGC 3699 *(11.0$_m$ planetary nebula)*

(4) IC 2621 *(11.5$_m$ planetary nebula)*



C99

RA: 193.25° | 12h 53.0' — DEC: -63.0° | -63° 0'

C99 (Coalsack Nebula, TGU H1867) is a magnitude 20.0 dark nebula. Angular size is 400x300'.

2.9° E from mag.2.09 alf02 Cru.

This dark cloud of dust is only 600 light-years from Earth, obscuring the light of everything behind it. As it is relatively close, few stars shine in front of the Coalsack, making this dark patch stand out prominently under dark skies, either with binoculars or the unaided naked eye.

Also visible:

(1) C94 *(4.2_m open cluster)*

(2) NGC 5189 *(10.0_m planetary nebula)*

(3) IC 4191 *(11.5_m planetary nebula)*

(4) R Cru *(6.4_m variable star)*

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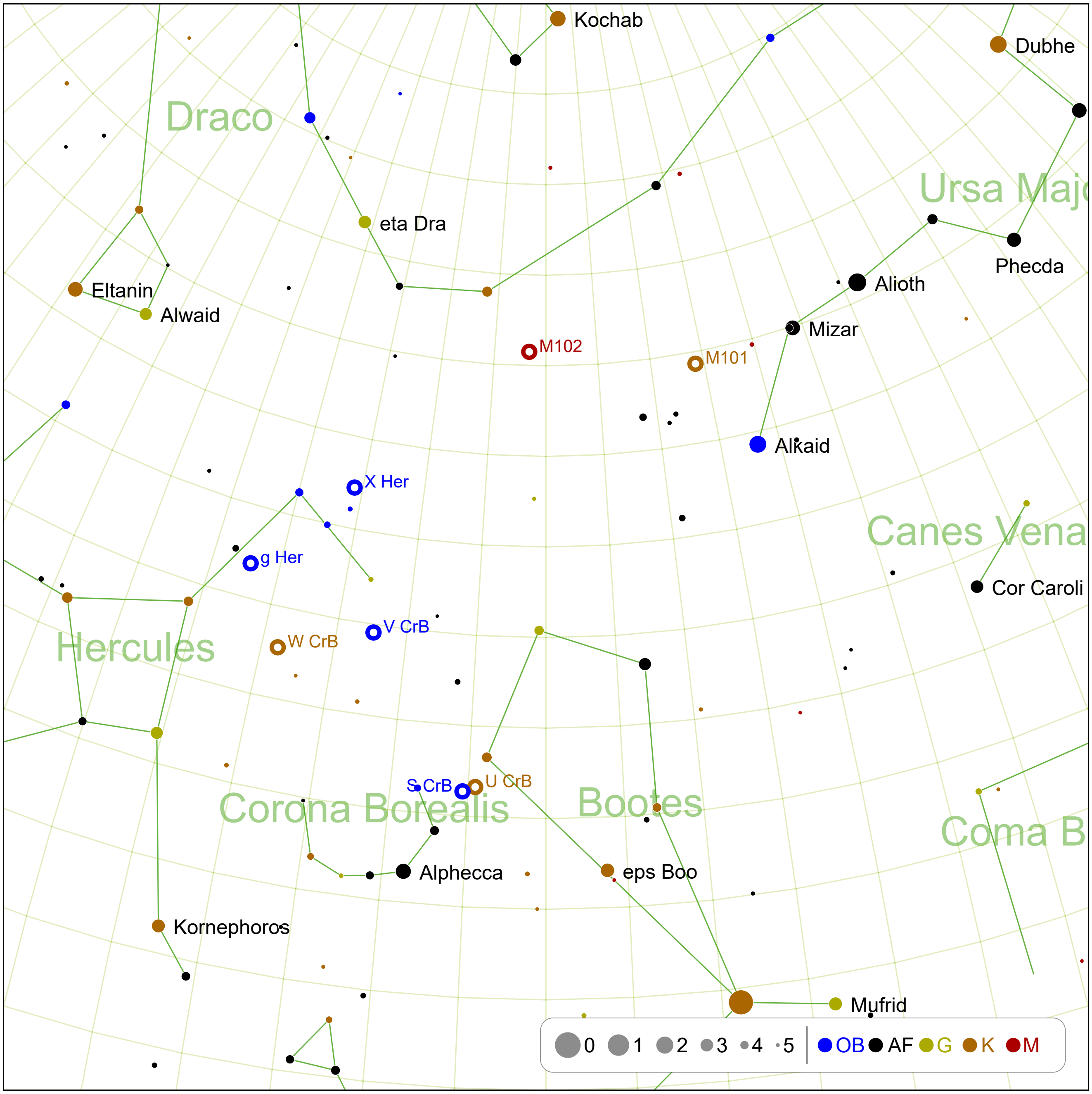
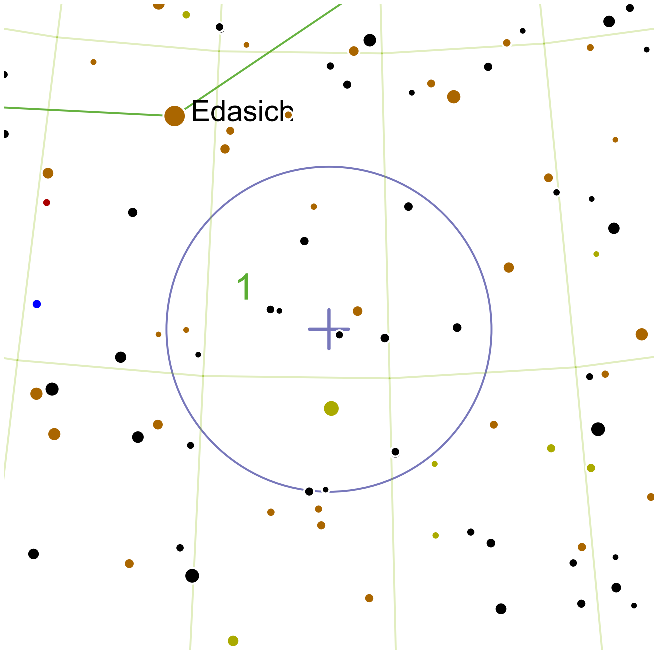
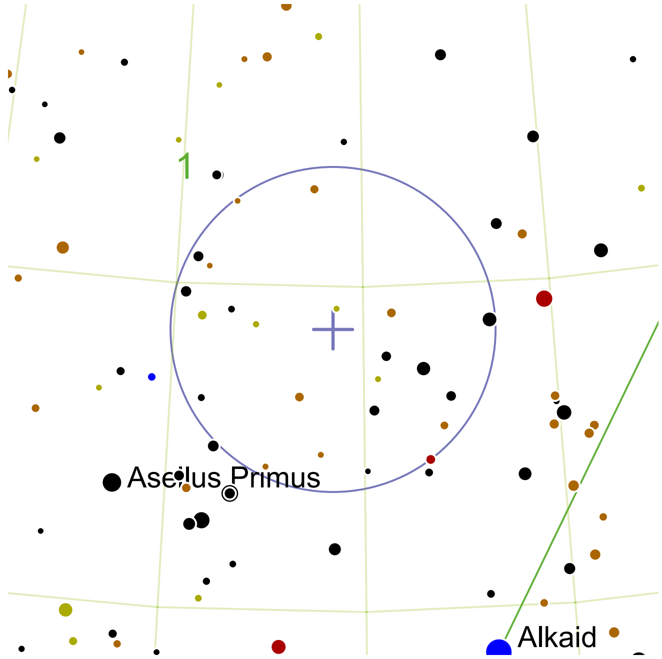
May: 45° North



M102: page 208	M101: page 208	X Her: page 209	g Her: page 209
V CrB: page 210	W CrB: page 210	U CrB: page 211	S CrB: page 211





M102

RA: 226.63° | 15h 6.5' — DEC: 55.77° | 55° 46'

M102 (NGC 5866) is a magnitude 9.9 lenticular galaxy. Angular size is 5x2'.

Two fifths of the way from Pherkad in Ursa Minor to Izar in Bootes.

Two fifths of the way from Pherkad in Ursa Minor to Izar in Bootes.

One of the more doubtful Messiers, M102 was disowned by its discoverer Pierre Méchain as a duplicate discovery of M101. However the modern consensus is that M102 was a genuine discovery corresponding to the edge-on spiral galaxy NGC 5866.

Also visible:

(1) NGC 5907 *(11.12$_m$ spiral galaxy)*

M101

RA: 210.8° | 14h 3.2' — DEC: 54.35° | 54° 21'

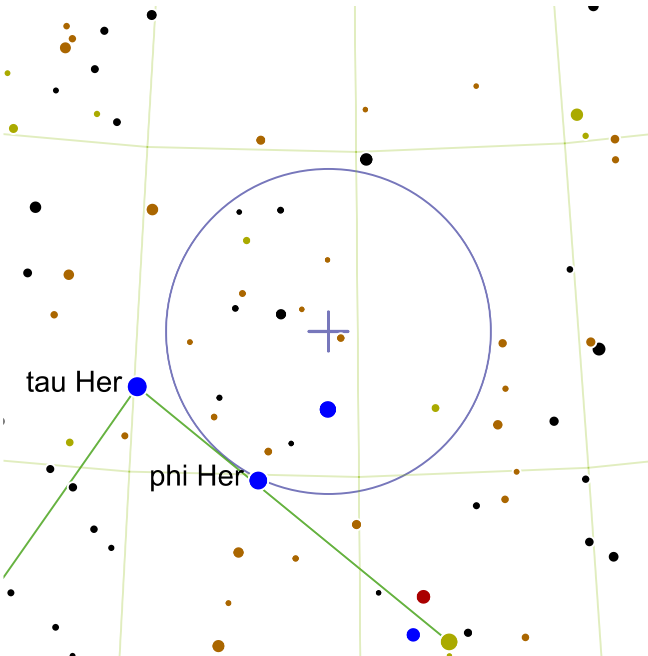
M101 (Pinwheel Galaxy, NGC 5457) is a magnitude 7.9 spiral galaxy. Angular size is 22'.

Forms an equilateral triangle with triple star Mizar and Alkaid.

Pierre Méchain described this galaxy as "very obscure and pretty large, 6' to 7' in diameter, between the left hand of Bootes and the tail of the great Bear." In 1784 William Herschel could make out the mottled appearance of the object, and even thought he would be able to resolve the stars of it is composed. William Parsons was the first to detect the spiral shape of the galaxy in the latter half of the 19th century. To repeat Parson's feat requires dark skies and a substantial telescope.

Also visible:

(1) NGC 5585 *(11.2$_m$ spiral galaxy)*



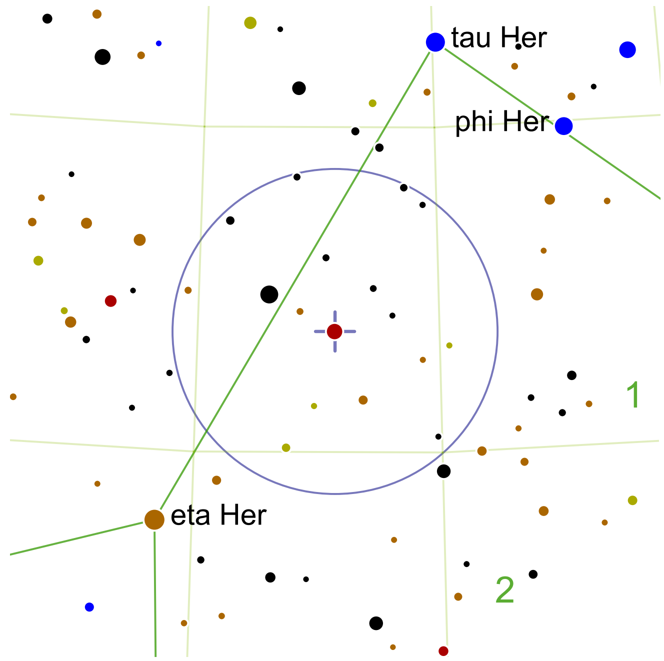
X Her

RA: 240.66° | 16h 2.65' — DEC: 47.24° | 47° 14'

X Her (HD 144205) is a magnitude 6.0 variable star. Magnitude ranges from 7.0 to 6.0 (Δ mag. 1.0) with a period of 95.0d.

3.0° NWW from mag.3.91 tau Her.

This red giant radiates 680 times the energy of the Sun and is 449 light-years distant. Just less than a degree to the northeast, SAO 45895 (HD 145082) is magnitude 6.65 and marks a rough midpoint in the range of X Her.



g Her

RA: 247.16° | 16h 28.64' — DEC: 41.88° | 41° 53'

g Her (HD 148783) is a magnitude 4.3 variable star. Magnitude ranges from 6.3 to 4.3 (Δ mag. 2.0) with a period of 89.2d.

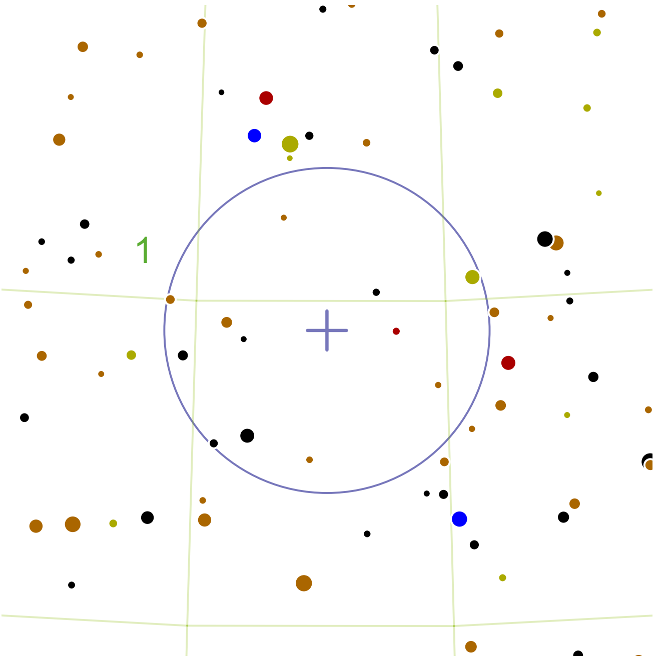
4.0° NW from mag.3.61 eta Her.

This pulsating variable star is 354 light years from Earth. 35 Herculis is one degree to the northeast, and at magnitude 4.2 marks the bright end of g Herculis' range.

Also visible:

(1) NGC 6058 *(13.0$_m$ planetary nebula)*

(2) W CrB *(7.8$_m$ variable star)*



V CrB

RA: 237.38° | 15h 49.52' — DEC: 39.57° | 39° 34'

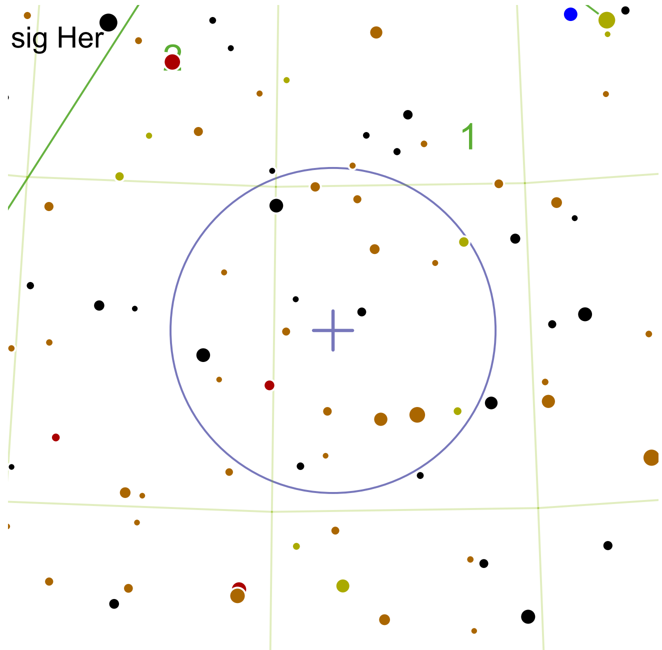
V CrB (HD 141826) is a magnitude 6.9 variable star. Magnitude ranges from 12.6 to 6.9 (Δ mag. 5.7) with a period of 358d.

8.7° SW from mag.3.91 tau Her.

This carbon star is extremely red with a B-V color index of 3.5. The spectral class is C6,2eMS3. This star is 2,740 light-years from Earth.

Also visible:

(1) NGC 6058 *(13.0$_m$ planetary nebula)*



W CrB

RA: 243.85° | 16h 15.4' — DEC: 37.8° | 37° 48'

W CrB (HD 146560) is a magnitude 7.8 variable star. Magnitude ranges from 14.3 to 7.8 (Δ mag. 6.5) with a period of 238d.

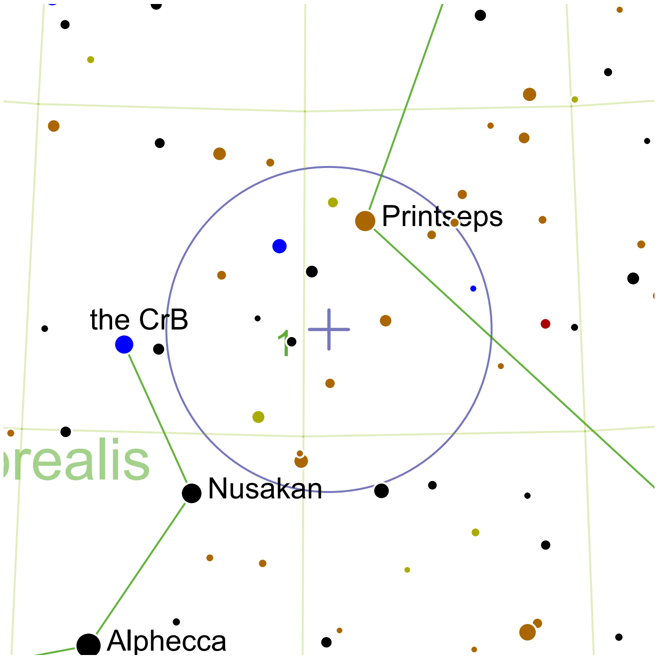
Halfway between Chi and Zeta Herculis. Also, one finder circle west of M13.

This star is roughly 7,800 light-years from Earth.

Also visible:

(1) NGC 6058 *(13.0$_m$ planetary nebula)*

(2) g Her *(4.3$_m$ variable star)*



U CrB

RA: 229.55° | 15h 18.18' — DEC: 31.65° | 31° 39'

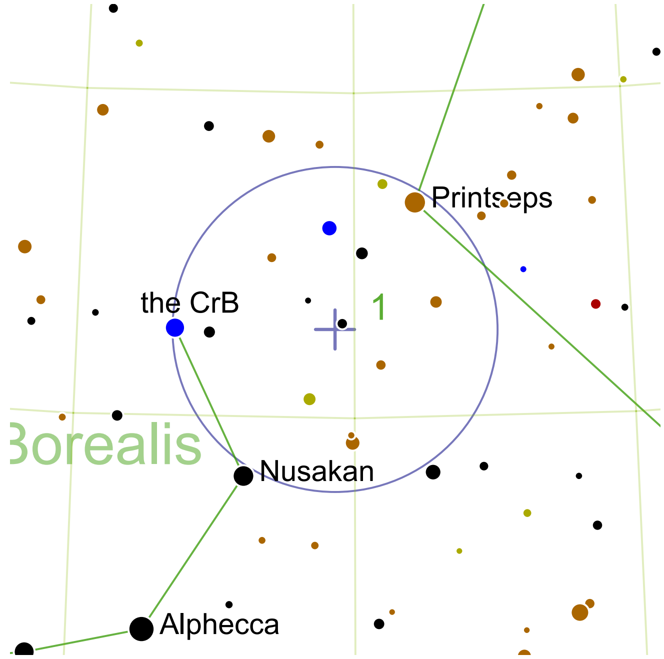
U CrB (HD 136175) is a magnitude 7.66 variable star. Magnitude ranges from 8.79 to 7.66 (Δ mag. 1.1) with a period of 3.45220d.

Two degrees south and very slightly east of Thiba (Delta Bootis).

This spectroscopic pair, consisting of a bluish B6V main-sequence star and a yellowish F8III-IV subgiant, is an Algol-type eclipsing binary.

Also visible:

(1) S CrB *(5.8_m variable star)*



S CrB

RA: 230.35° | 15h 21.39' — DEC: 31.37° | 31° 22'

S CrB (HD 136753) is a magnitude 5.8 variable star. Magnitude ranges from 14.1 to 5.8 (Δ mag. 8.3) with a period of 360d.

2.3° SSE from mag.3.54 Printseps.

The Mira-type variable has a period of almost exactly a year. It is roughly 1,300 light-years distant and has a radius 308 times greater than the Sun, despite only being 1.34 times more massive.

Also visible:

(1) U CrB *(7.66_m variable star)*

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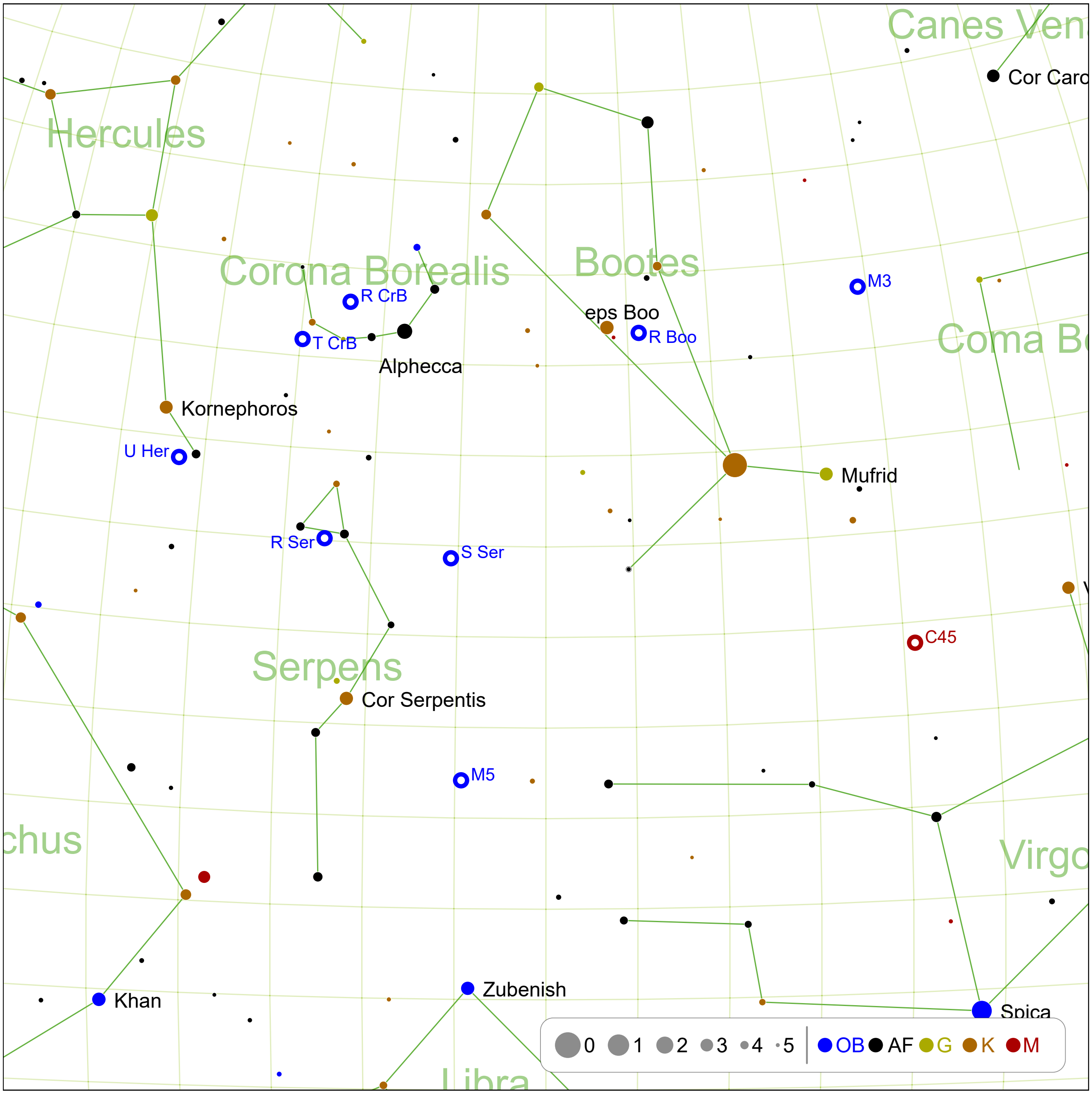
May: 15° North



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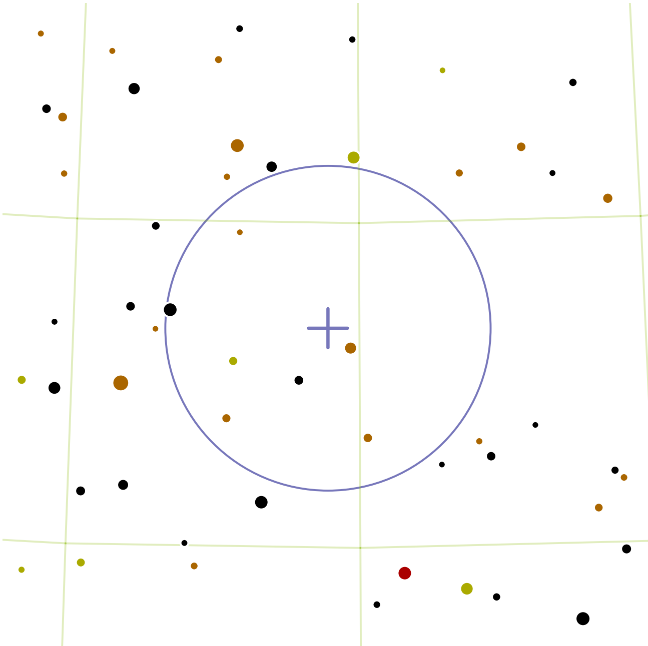
U Her: page 216 | R Ser: page 216 | S Ser: page 217 | C45: page 217
M5: page 218



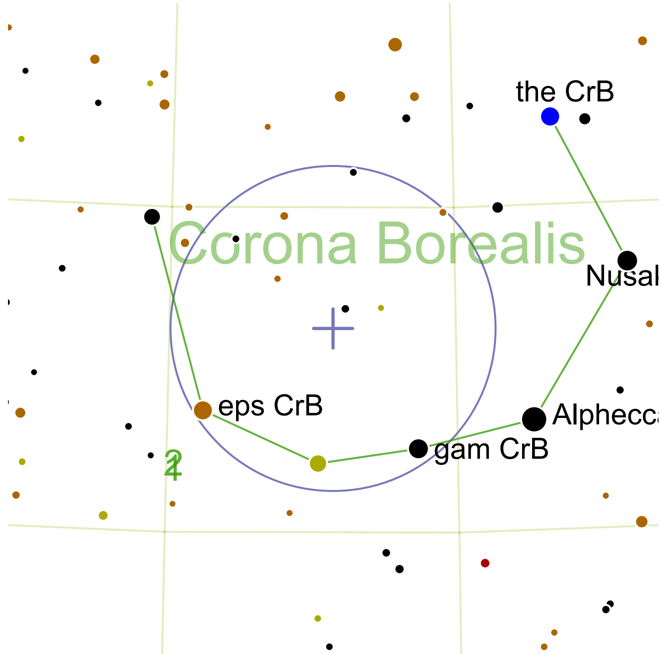
M3

RA: 205.55° | 13h 42.2' — DEC: 28.38° | 28° 23'

M3 (NGC 5272) is a magnitude 6.2 globular cluster. Angular size is 16.2'.

Just short of halfway from Arcturus to Cor Caroli.

A naked-eye object under perfect conditions, M3 was discovered by Charles Messier in 1764. It is an atypical globular cluster as it is quite far from the galactic center and the galactic plane. it also has an unusually large number of variable stars.



R CrB

RA: 237.14° | 15h 48.57' — DEC: 28.16° | 28° 9'

R CrB (HD 141527) is a magnitude 5.71 variable star. Magnitude ranges from 14.8 to 5.71 (Δ mag. 9.1).

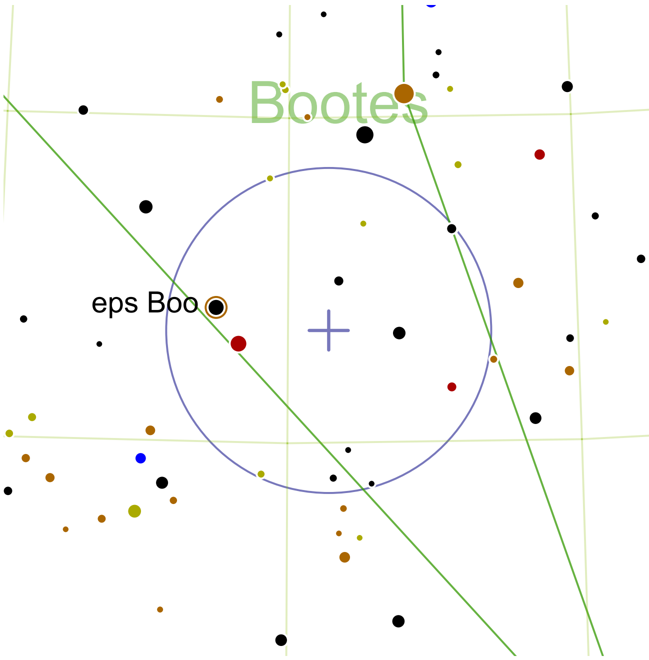
Halfway between Izar in Bootes and Zeta Herculis, slightly closer to Zeta.

The prototype of R Cor Bor variables, this yellow supergiant is usually 6th magnitude, but fades by several magnitudes at irregular intervals. It is believed the star is emitting carbon that condenses around the star, temporarily obscuring it from sight.

Also visible:

(1) T CrB *(2.0$_m$ variable star)*

(2) T CrB *(2.3$_m$ carbon star)*



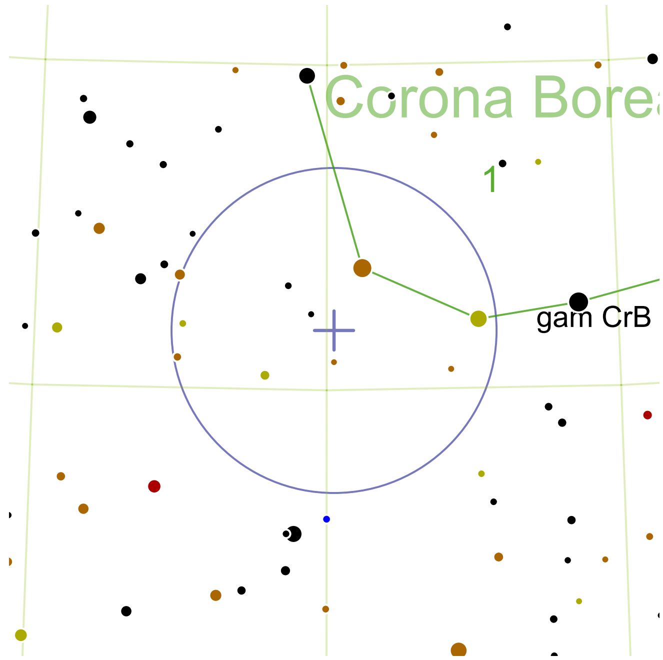
R Boo

RA: 219.3° | 14h 37.19' — DEC: 26.74° | 26° 44'

R Boo (HD 128609) is a magnitude 6.2 variable star. Magnitude ranges from 13.1 to 6.2 (Δ mag. 6.9) with a period of 223d.

1.7° W from mag.2.7 eps Boo.

This Mira-type variable is nearly 6,000 times brighter than the Sun, and has a radius 475 times larger. For comparison, half a degree east is tiny SAO 83440 (HD 128609), which is magnitude 8.55.



T CrB

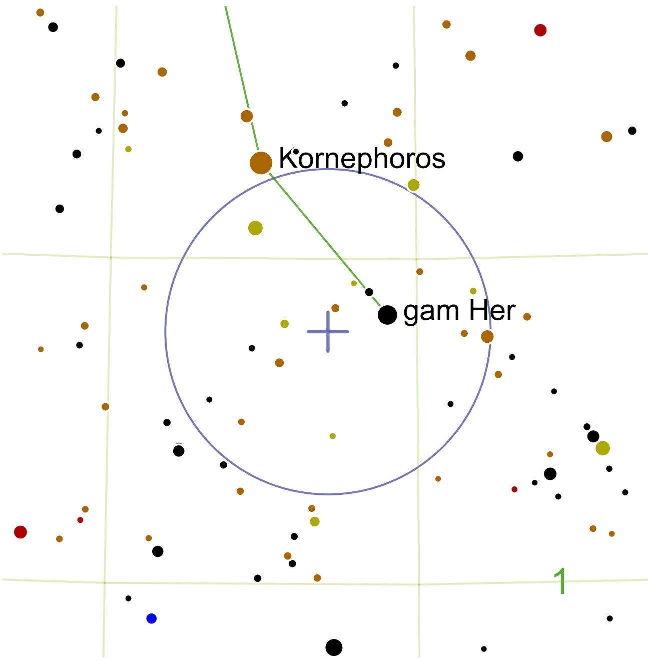
RA: 239.88° | 15h 59.5' — DEC: 25.92° | 25° 55'

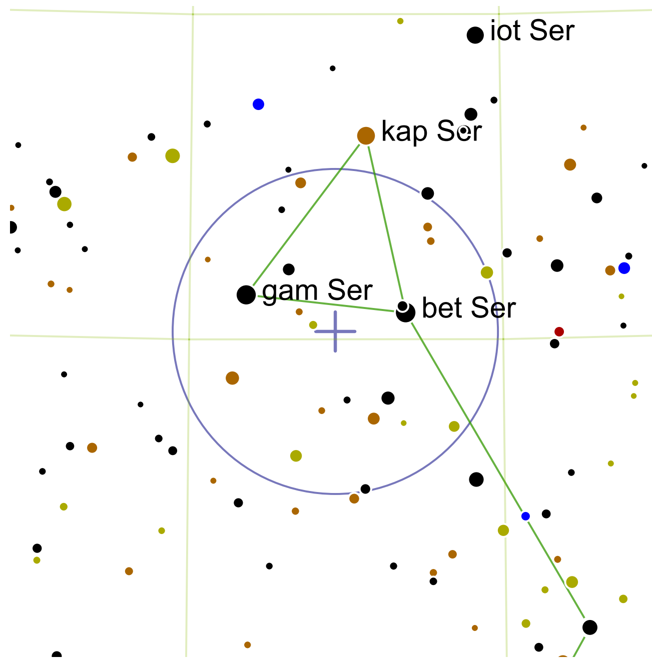
T CrB (HD 143454) is a magnitude 2.0 variable star. Magnitude ranges from 10.8 to 2.0 (Δ mag. 8.8) with a period of 80y.

3.7° E from mag.3.93 gam CrB.

This cataclysmic variable is a recurring nova, occasionally surging to magnitude 2.0. Two outbursts are recorded, in 1866 and 1946.

Also visible:
(1) R CrB *(5.71$_m$ variable star)*





U Her

RA: 246.45° | 16h 25.79' — DEC: 18.89° | 18° 54'

U Her (HD 148206) is a magnitude 6.4 variable star. Magnitude ranges from 13.4 to 6.4 (Δ mag. 7.0) with a period of 406d.

0.9° SEE from mag.3.79 gam Her.

This pulsating variable star is orange-red and is roughly 1,860 light-years from Earth. Compare this star to magnitude 7.0 SAO 102152 (HD 148128), half a degree north.

Also visible:

(1) GCl 38 *(14.74$_m$ globular cluster)*

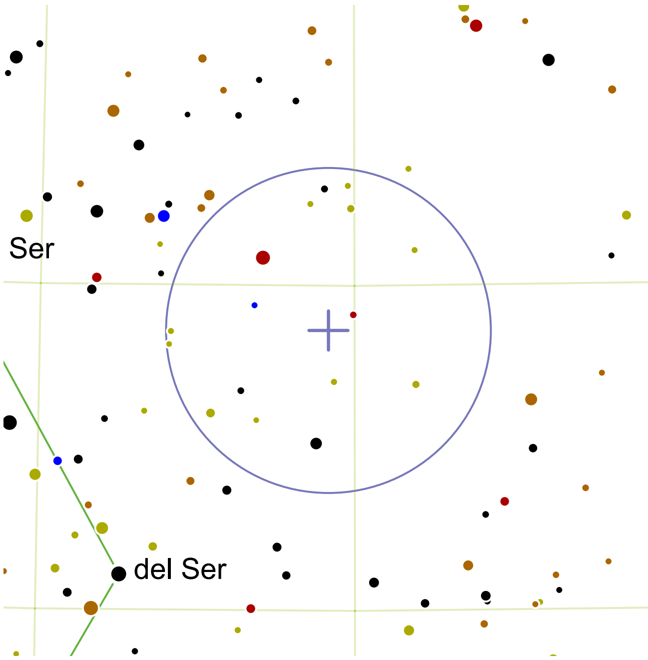
R Ser

RA: 237.67° | 15h 50.69' — DEC: 15.13° | 15° 8'

R Ser (HD 141850) is a magnitude 5.16 variable star. Magnitude ranges from 14.4 to 5.16 (Δ mag. 9.2) with a period of 356d.

1.1° SEE from mag.3.74 bet Ser.

This Mira-type star was first shown to be variable by Karl Ludwig Harding in 1826. It spends only one third of its cycle brighter than magnitude 8.0. It is roughly 930 light-years distant.

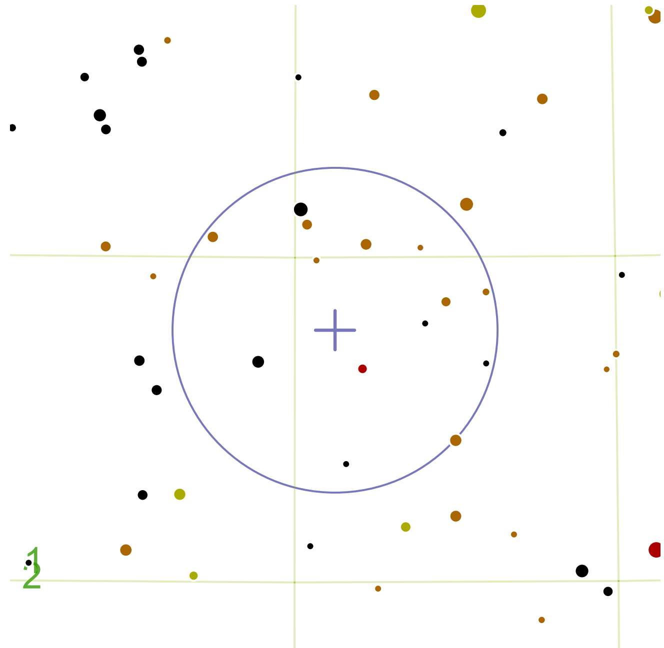


S Ser

RA: 230.41° | 15h 21.65' — DEC: 14.31° | 14° 19'

S Ser (HD 136695) is a magnitude 7.0 variable star. Magnitude ranges from 14.1 to 7.0 (Δ mag. 7.1) with a period of 372d.

6.0° W from mag.3.74 bet Ser.



C45

RA: 204.38° | 13h 37.5' — DEC: 8.88° | 8° 53'

C45 (NGC 5248) is a magnitude 10.2 spiral galaxy. Angular size is 6x4'.

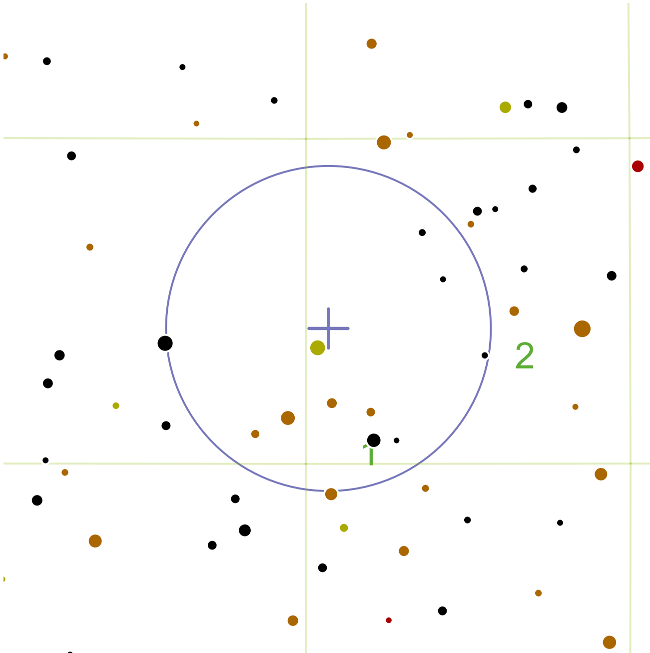
Slightly north-west of a point midway between Spica and Arcturus.

The arms of this galaxy are rich with young star clusters, while deep photographic images reveal delicate dust lanes woven deep into the core. This galaxy is a challenging target for small telescopes.

Also visible:

(1) NGC 5363 *(11.05$_m$ irregular galaxy)*

(2) NGC 5364 *(11.17$_m$ barred spiral galaxy)*



M5

RA: 229.65° | 15h 18.6' — DEC: 2.08° | 2° 5'

M5 (NGC 5904) is a magnitude 5.6 globular cluster. Angular size is 17.4'.

7.7° SW from mag.2.75 Cor Serpentis.

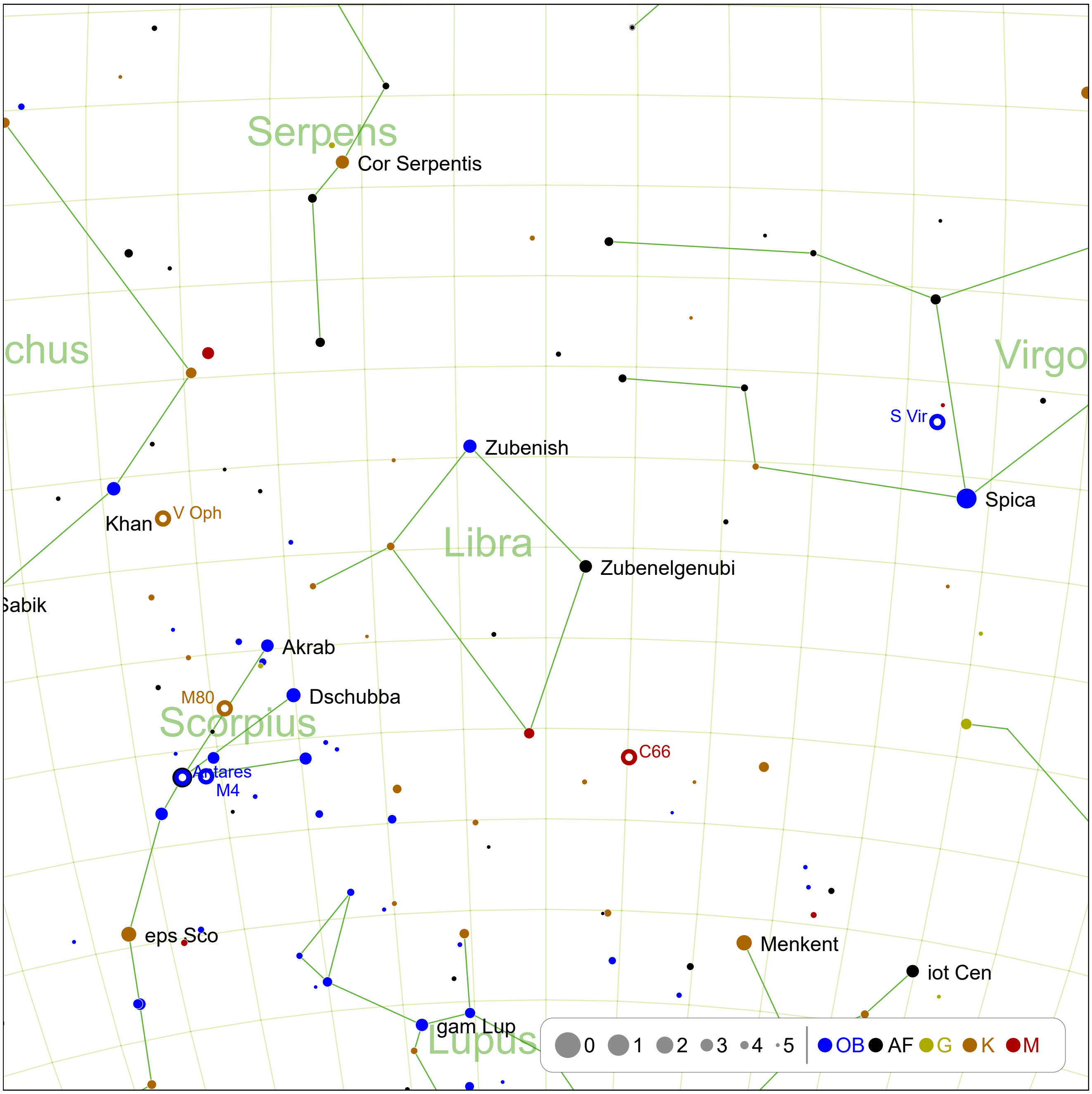
This globular cluster was discovered by Gottfried Kirch in 1702. Its member stars are as bright as magnitude 10.6, so they can be resolved by smaller telescopes. William Herschel counted roughly 200 stars in 1791. Over 200 years later, how many can you count?

Also visible:

(1) Palomar 5 *(11.75$_m$ globular cluster)*

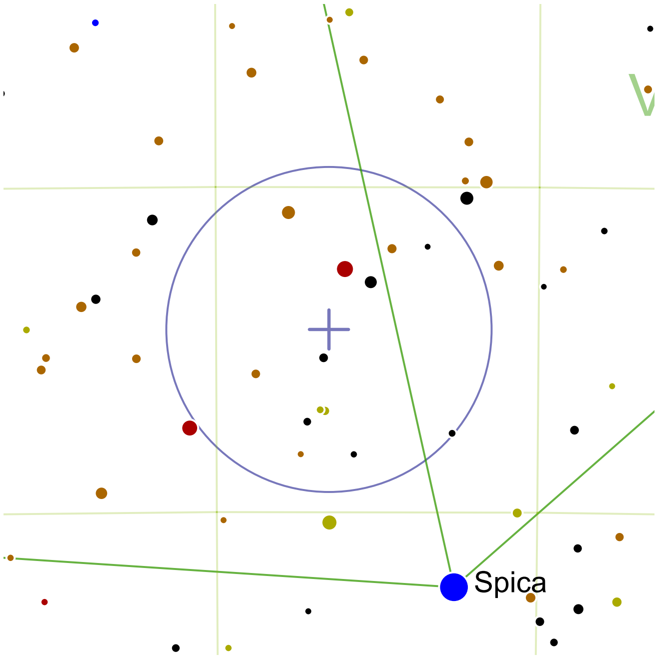
(2) NGC 5846 *(11.05$_m$ elliptical galaxy)*

May: -15° South



S Vir: page 220 | V Oph: page 220 | M80: page 221 | C66: page 221

M4: page 222 | Antares: page 222



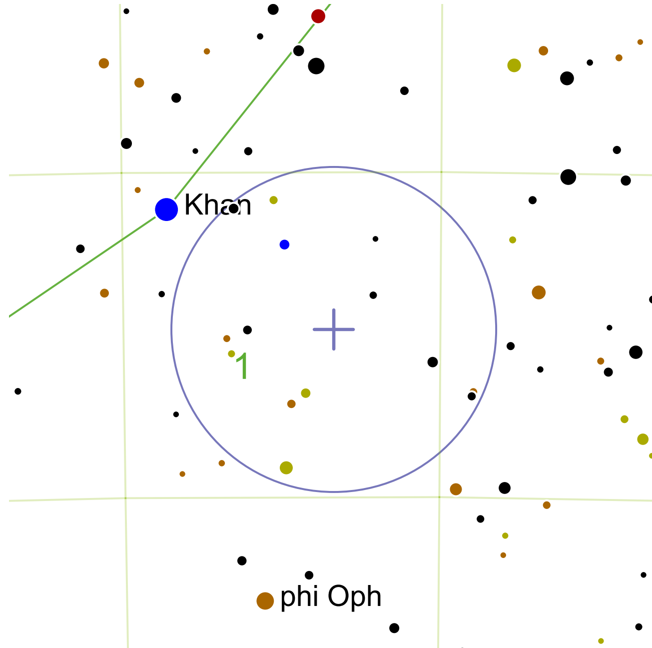
S Vir

RA: 203.25° | 13h 33.0' — DEC: -7.19° | -7° 11'

S Vir (HD 117833) is a magnitude 6.3 variable star. Magnitude ranges from 13.2 to 6.3 (Δ mag. 6.9) with a period of 375d.

4.4° NNE from mag.1.21 Spica.

This moderately red pulsating variable star is roughly 2,380 light-years from Earth.



V Oph

RA: 246.68° | 16h 26.72' — DEC: -12.43° | -12° 25'

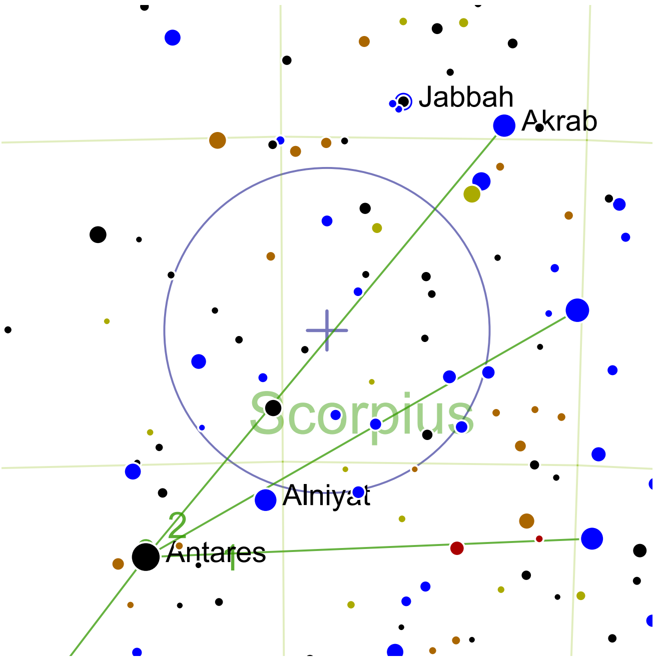
V Oph (HD 148182) is a magnitude 7.3 variable star. Magnitude ranges from 11.6 to 7.3 (Δ mag. 4.3) with a period of 297d.

3.1° SW from mag.2.7 Khan.

This deeply red carbon star (B-V color index: 3.41) has spectral type C-N4. Messier 107 is two degrees to the southwest.

Also visible:

(1) M107 *(7.9$_m$ globular cluster)*



M80

RA: 244.25° | 16h 17.0' — DEC: -22.98° | -22° 58'

M80 (NGC 6093) is a magnitude 7.3 globular cluster. Angular size is 10'.

2.7° NNW from mag.3.08 Alniyat.

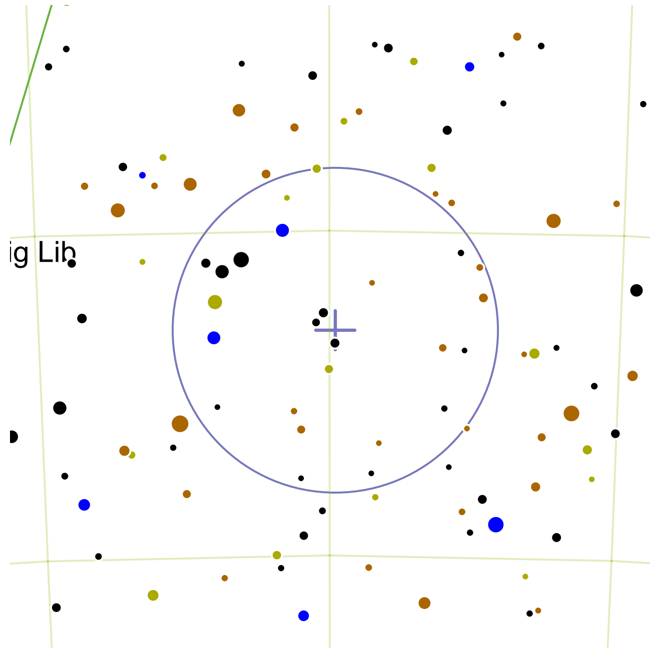
This is one of the densest globular clusters in our galaxy, and is particularly rich in "blue stragglers", old stars that have been made hotter and bluer through collisions or close interactions with other cluster members.

Also visible:

(1) M4 *(5.6$_m$ globular cluster)*

(2) NGC 6144 *(9.01$_m$ globular cluster)*

(3) Antares *(0.9$_m$ carbon star)*



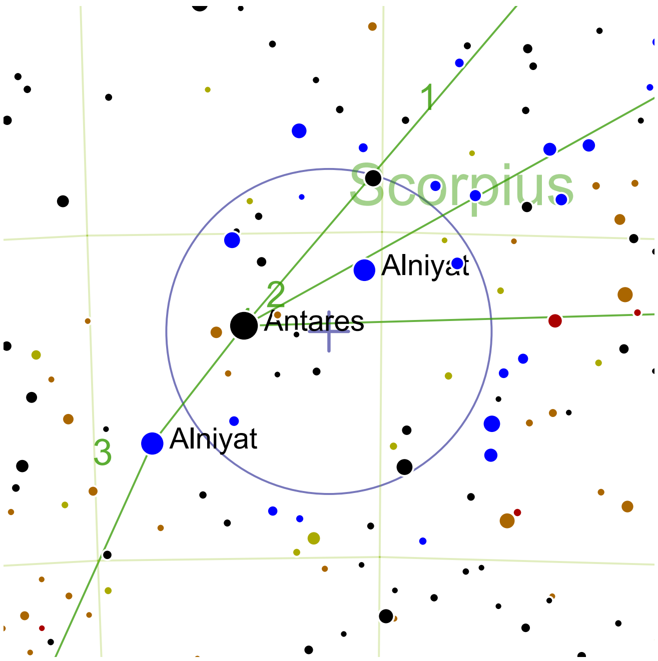
C66

RA: 219.9° | 14h 39.6' — DEC: -26.53° | -26° 31'

C66 (NGC 5694) is a magnitude 10.2 globular cluster. Angular size is 3.6'.

5.6° SWW from mag.3.41 sig Lib.

One of the most distant globular clusters associated with our galaxy, Caldwell 66 may be on a hyperbolic path that will cause it to escape the gravity well of the Milky Way.



M4

RA: 245.9° | 16h 23.6' — DEC: -26.53° | -26° 31'

M4 (NGC 6121) is a magnitude 5.6 globular cluster. Angular size is 26.3'.

1.0° SSE from mag.3.08 Alniyat.

This globular cluster was the first to be resolved into individual stars (the brightest being magnitude 10.8). It is also bright enough to be seen by the naked eye under ideal conditions.

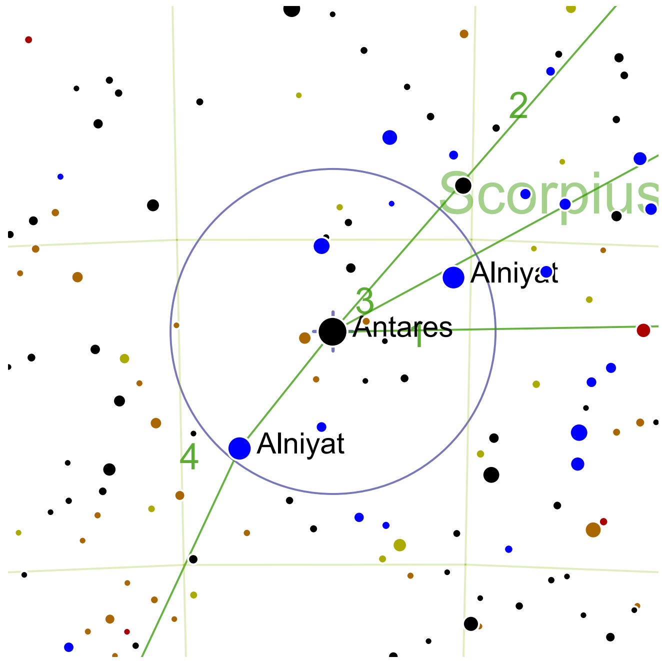
Also visible:

(1) M80 *(7.3$_m$ globular cluster)*

(2) NGC 6144 *(9.01$_m$ globular cluster)*

(3) ESO452-SC11 *(12.0$_m$ globular cluster)*

(4) Antares *(0.9$_m$ carbon star)*



Antares

RA: 247.35° | 16h 29.39' — DEC: -26.43° | -26° 25'

A fiercely brilliant and intensely red primary with a very close, bright, blue or green companion.

0.0° NWW from mag.1.22 148479.

Antares means the "rival of Mars" as this star's color competes with that of the Red Planet. This is a gravitationally bound binary system about 550 light-years from Earth. Antares is fairly red (B-V color index: 1.86).

Also visible:

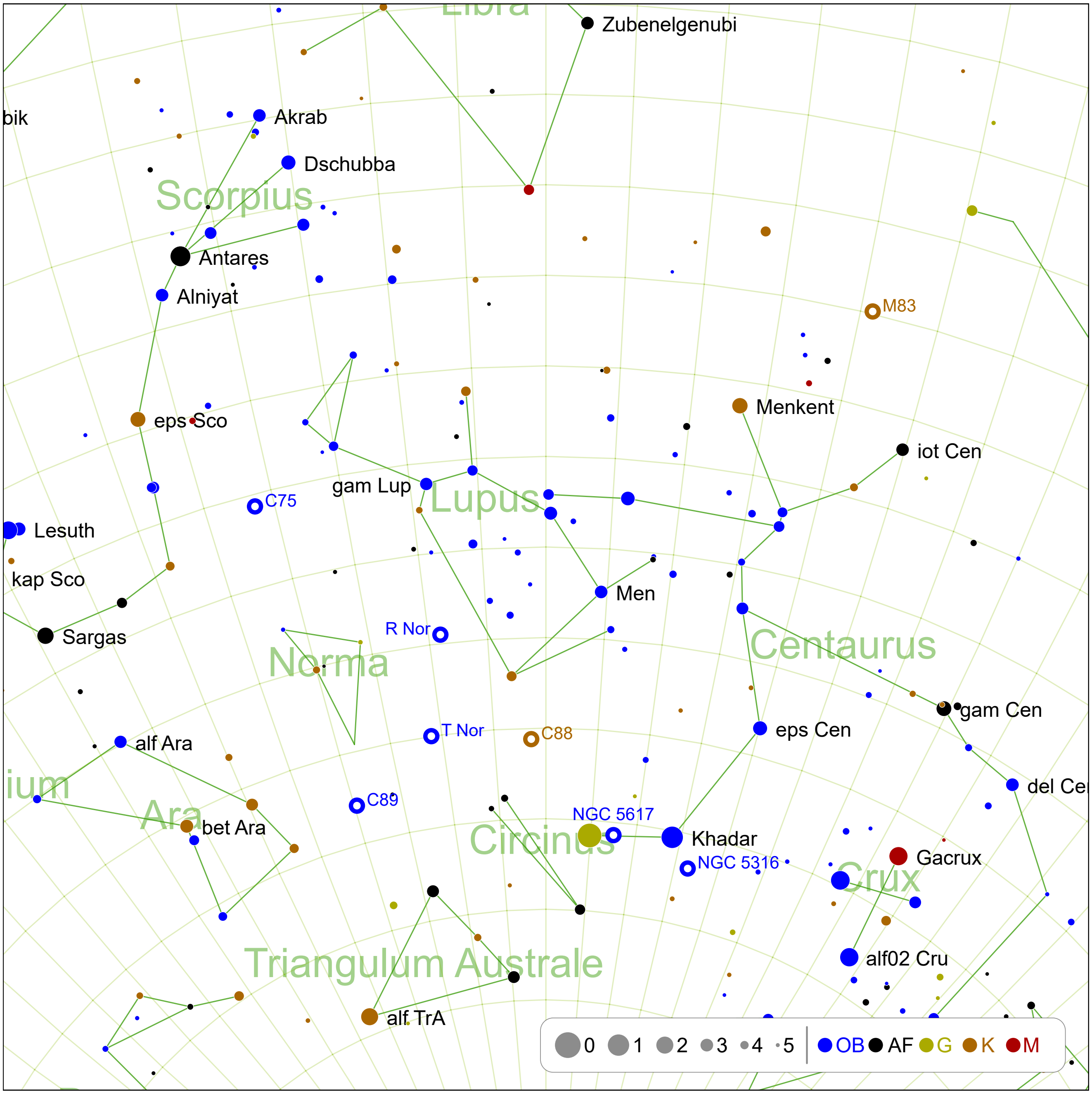
(1) M4 *(5.6$_m$ globular cluster)*

(2) M80 *(7.3$_m$ globular cluster)*

(3) NGC 6144 *(9.01$_m$ globular cluster)*

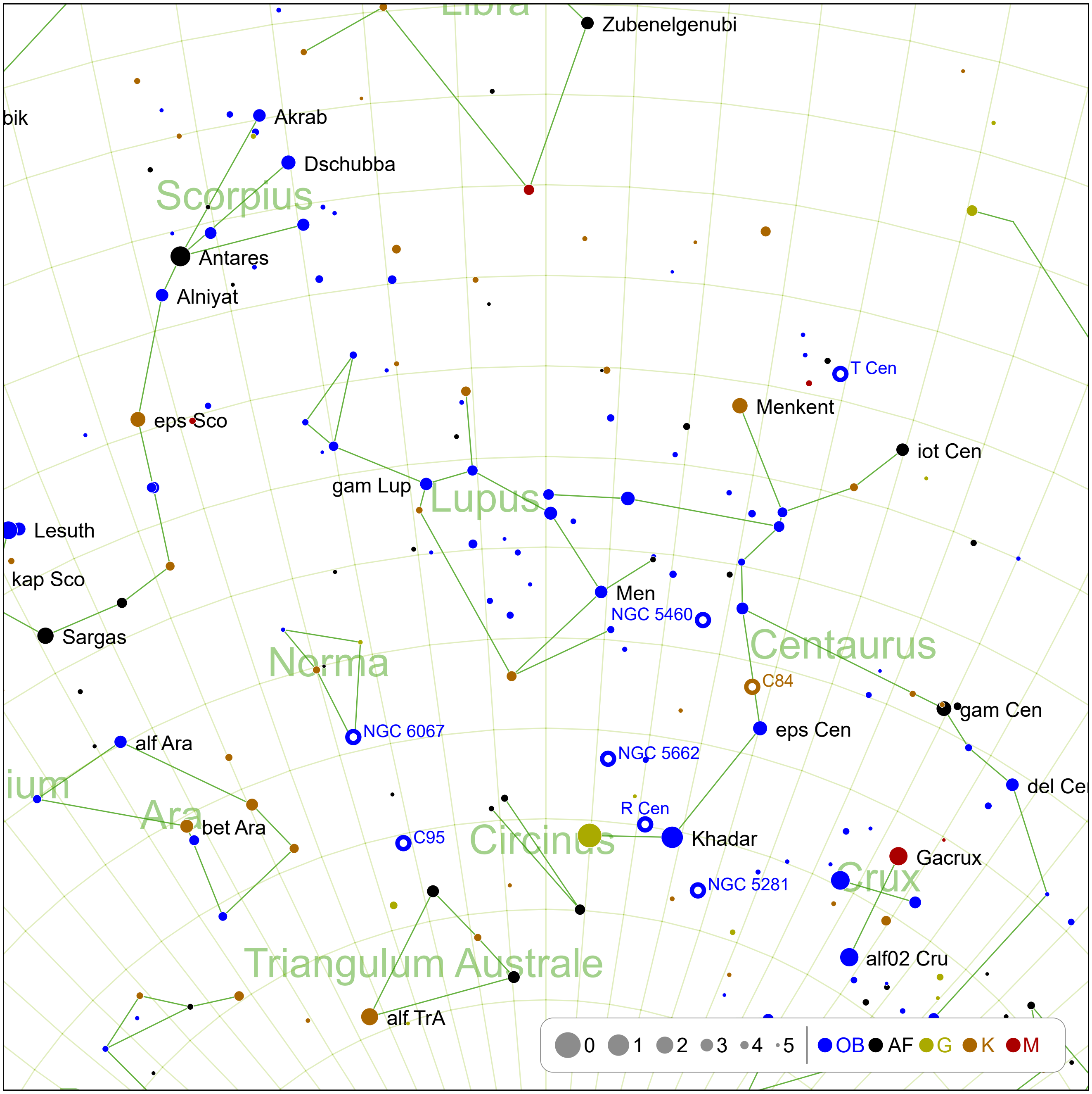
(4) ESO452-SC11 *(12.0$_m$ globular cluster)*

May: -45° South (1)

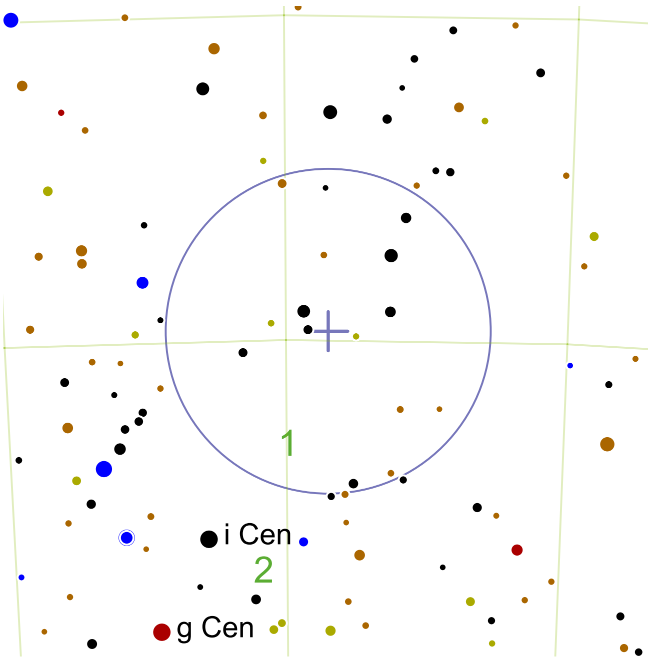


M83: page 225 C75: page 225 R Nor: page 226 T Nor: page 226
C88: page 227 C89: page 227 NGC 5617: page 228 NGC 5316: page 228

May: -45° South (2)



T Cen: page 229 | NGC 5460: page 229 | C84: page 230 | NGC 6067: page 230
NGC 5662: page 231 | R Cen: page 231 | C95: page 232 | NGC 5281: page 232



M83

RA: 204.25° | 13h 37.0' — DEC: -29.87° | -29° 51'

M83 (Southern Pinwheel, NGC 5236) is a magnitude 7.6 spiral galaxy. Angular size is 11x10'.

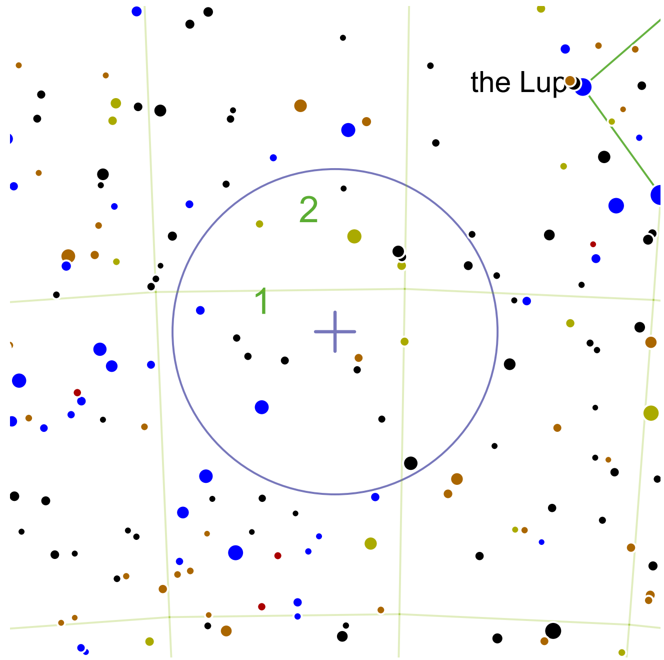
7.2° SWW from mag.3.48 pi. Hya.

This southerly barred spiral galaxy was discovered by Nicolas-Louis de Lacaille in 1752 from a site in South Africa. Only 15 million light-years away, it is one of the best examples of a barred spiral galaxy in our skies.

Also visible:

(1) NGC 5253 *(10.87$_m$ irregular galaxy)*

(2) T Cen *(5.5$_m$ variable star)*



C75

RA: 246.4° | 16h 25.6' — DEC: -40.67° | -40° 39'

C75 (NGC 6124) is a magnitude 5.8 open cluster. Angular size is 29'.

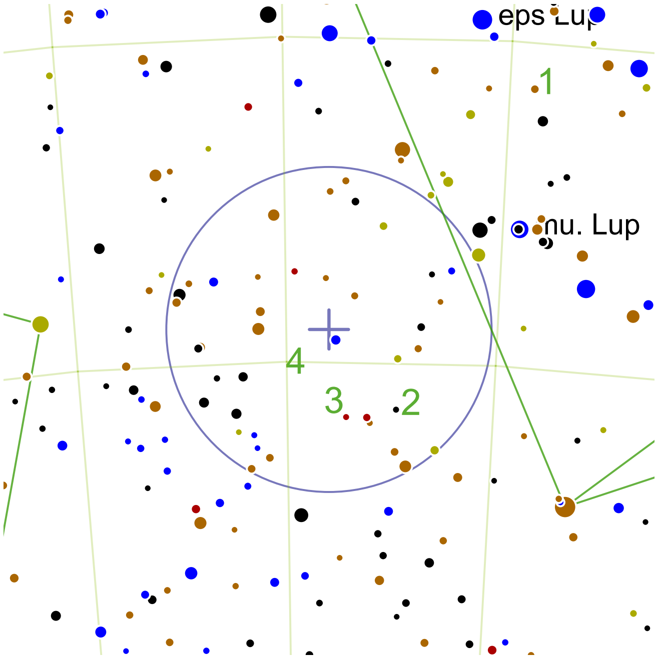
5.4° SEE from mag.3.61 eta Lup.

A bright and rich open cluster, with many blue and red members.

Also visible:

(1) NGC 6153 *(11.0$_m$ planetary nebula)*

(2) NGC 6139 *(8.99$_m$ globular cluster)*



R Nor

RA: 233.99° | 15h 35.95' — DEC: -49.51° | -49° 29'

R Nor (HD 138743) is a magnitude 6.5 variable star. Magnitude ranges from 13.9 to 6.5 (Δ mag. 7.4) with a period of 508d.

Position Zet Lup on the south-western edge of the finder circle; R Nor is on the north-eastern edge.

A long period variable located 1,896 light-years from Earth with a stately period of over 500 days.

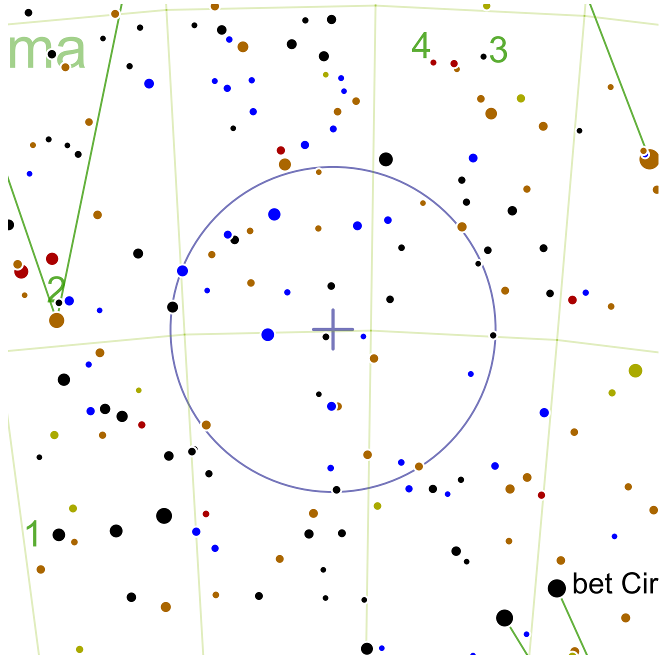
Also visible:

(1) NGC 5882 *(10.0_m planetary nebula)*

(2) NGC 5927 *(8.01_m globular cluster)*

(3) NGC 5946 *(9.61_m globular cluster)*

(4) ESO224-8 *(14.0_m globular cluster)*



T Nor

RA: 236.02° | 15h 44.06' — DEC: -54.99° | -54° 58'

T Nor (HD 140041) is a magnitude 6.2 variable star. Magnitude ranges from 13.6 to 6.2 (Δ mag. 7.4) with a period of 241d.

Just over one finder circle south east of Zet Lup.

A long-period pulsating variable, the star is 3,623 light-years from Earth.

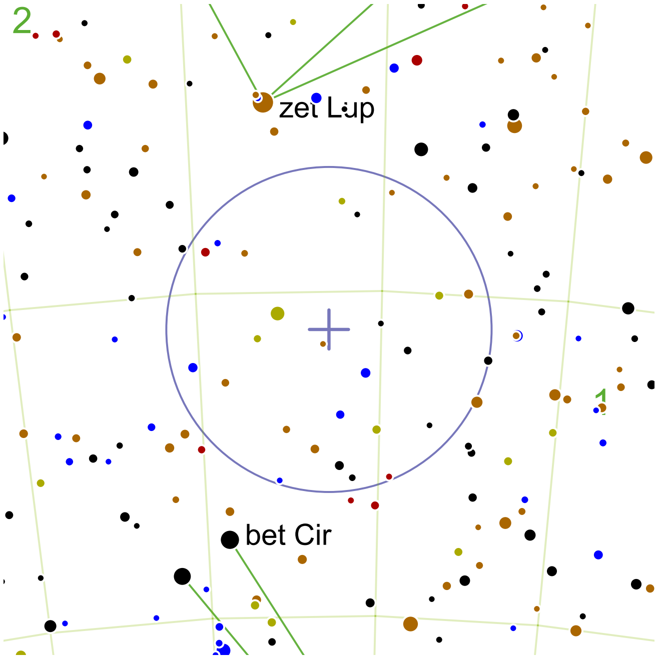
Also visible:

(1) C89 *(5.4_m open cluster)*

(2) NGC 6067 *(5.6_m open cluster)*

(3) NGC 5927 *(8.01_m globular cluster)*

(4) NGC 5946 *(9.61_m globular cluster)*



C88

RA: 226.43° | 15h 5.7' — DEC: -55.6° | -55° 35'

C88 (NGC 5823) is a magnitude 7.9 open cluster. Angular size is 10'.

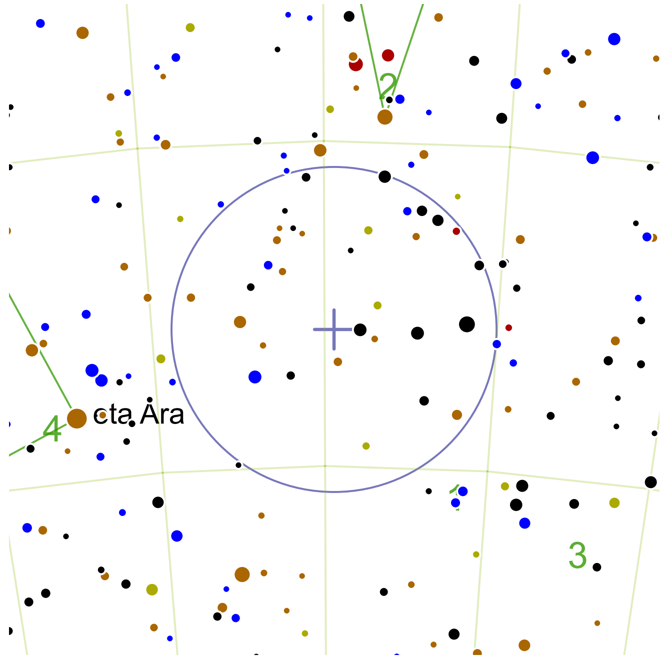
3.6° SSW from mag.3.5 zet Lup.

Discovered by James Dunlop in 1826.

Also visible:

(1) NGC 5662 *(5.5$_m$ open cluster)*

(2) NGC 5946 *(9.61$_m$ globular cluster)*



C89

RA: 244.73° | 16h 18.89' — DEC: -57.9° | -57° 53'

C89 (S Norma Cluster, NGC 6087) is a magnitude 5.4 open cluster. Angular size is 12'.

4.1° NWW from mag.3.68 eta Ara.

A naked-eye open cluster composed of about 40 stars. Very similar to the nearby Caldwell 95.

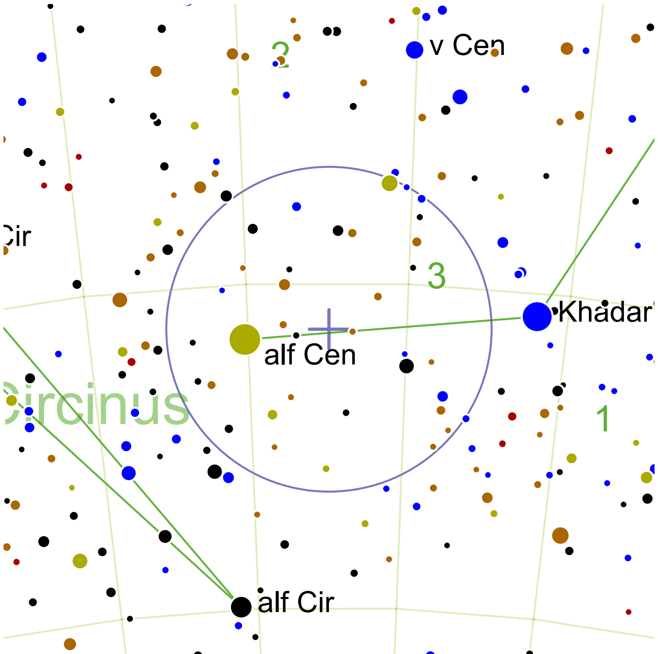
Also visible:

(1) C95 *(5.1$_m$ open cluster)*

(2) NGC 6067 *(5.6$_m$ open cluster)*

(3) NGC 5979 *(12.0$_m$ planetary nebula)*

(4) NGC 6221 *(10.66$_m$ barred spiral galaxy)*



NGC 5617

RA: 217.45° | 14h 29.79' — DEC: -60.72° | -60° 42'

NGC 5617 is a magnitude 6.3 open cluster. Angular size is 10'.

1.3° W from mag.1.7 alf Cen.

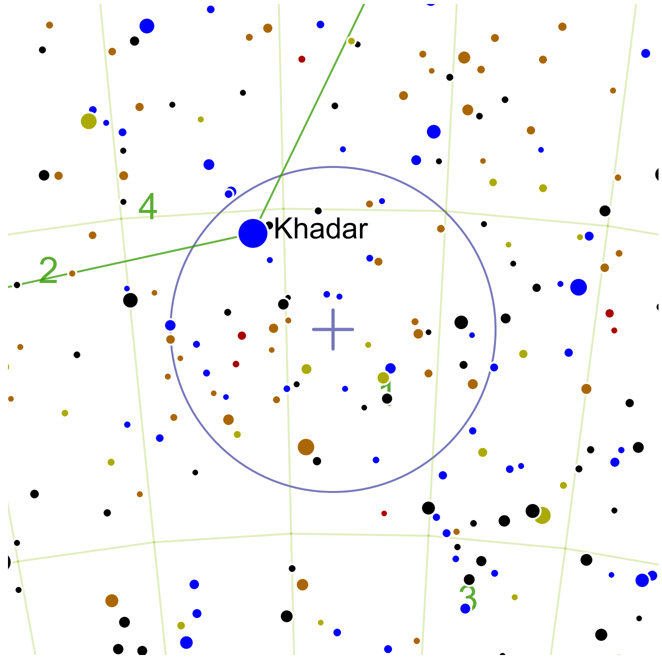
At low powers, this bright open cluster is in the same field as the famous double star Alpha Centauri, which lies one degree to the southeast. The cluster is estimated to be 82 million years old.

Also visible:

(1) NGC 5316 *(6.0$_m$ open cluster)*

(2) NGC 5662 *(5.5$_m$ open cluster)*

(3) R Cen *(5.3$_m$ variable star)*



NGC 5316

RA: 208.48° | 13h 53.89' — DEC: -61.87° | -61° 51'

NGC 5316 is a magnitude 6.0 open cluster. Angular size is 14'.

1.9° SW from mag.0.86 Khadar.

This bright and rich cluster shares the finder circle with Beta Centauri, and open cluster NGC 5281 (magnitude 5.9) and IC 4291 (magnitude 9.7). Its brightest star is magnitude 9.4, and the cluster is around 100 million years old.

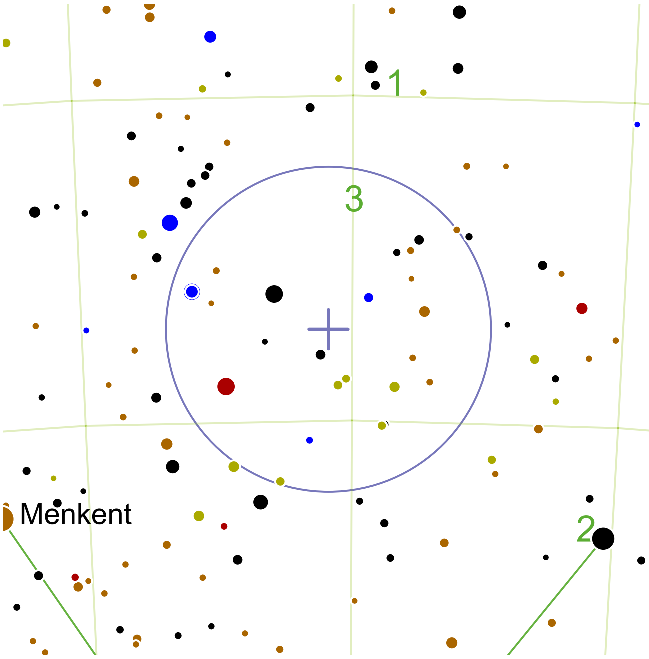
Also visible:

(1) NGC 5281 *(5.9$_m$ open cluster)*

(2) NGC 5617 *(6.3$_m$ open cluster)*

(3) NGC 5189 *(10.0$_m$ planetary nebula)*

(4) R Cen *(5.3$_m$ variable star)*



T Cen

RA: 205.44° | 13h 41.75' — DEC: -33.6° | -33° 35'

T Cen (HD 119090) is a magnitude 5.5 variable star. Magnitude ranges from 9.0 to 5.5 (Δ mag. 3.5) with a period of 90.44d.

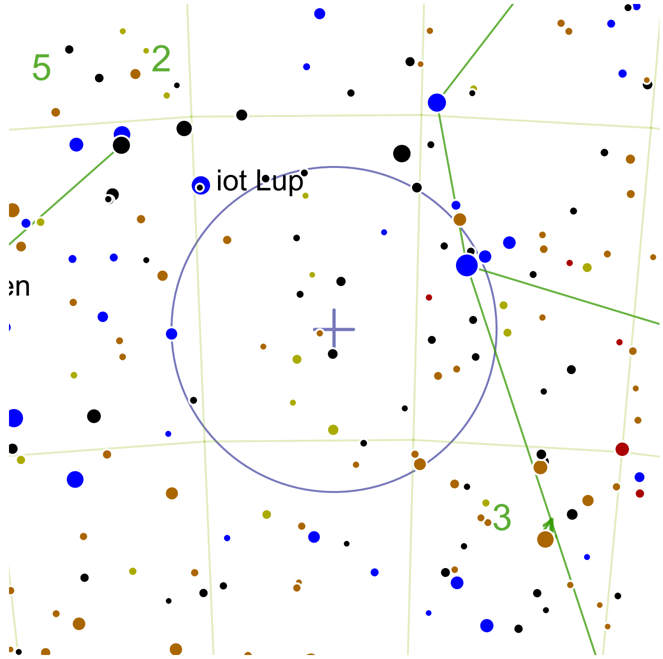
5.3° NE from mag.2.91 iot Cen.

Also visible:

(1) M83 *(7.6_m spiral galaxy)*

(2) NGC 5102 *(10.35_m lenticular galaxy)*

(3) NGC 5253 *(10.87_m irregular galaxy)*



NGC 5460

RA: 211.9° | 14h 7.6' — DEC: -48.32° | -48° 18'

NGC 5460 is a magnitude 5.6 open cluster. Angular size is 25'.

2.2° SEE from mag.3.06 zet Cen.

A bright, loose cluster with an estimated age of 160 million years. It is roughly 2,350 light-years distant.

Also visible:

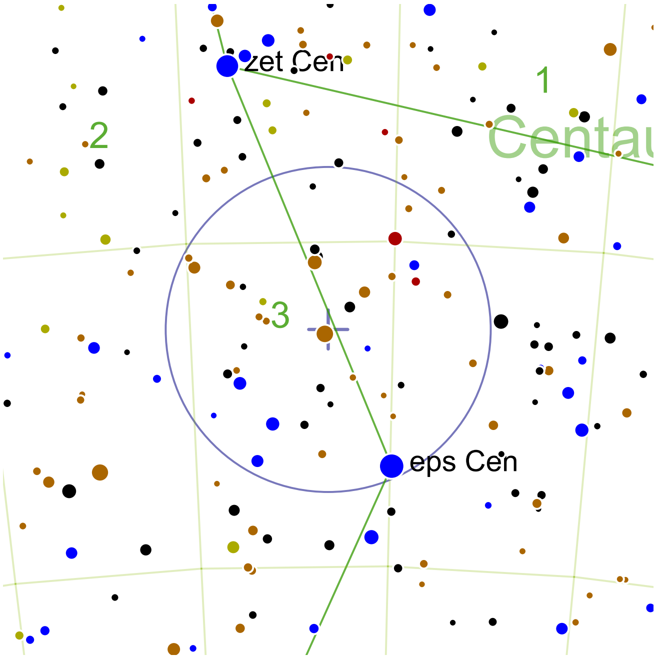
(1) C84 *(7.6_m globular cluster)*

(2) IC 4406 *(10.5_m planetary nebula)*

(3) NGC 5307 *(11.5_m planetary nebula)*

(4) NGC 5286 *(7.34_m globular cluster)*

(5) NGC 5643 *(10.74_m spiral galaxy)*



C84

RA: 206.6° | 13h 46.39' — DEC: -51.37° | -51° 21'

C84 (NGC 5286) is a magnitude 7.6 globular cluster. Angular size is 9'.

2.3° NNE from mag.2.56 eps Cen.

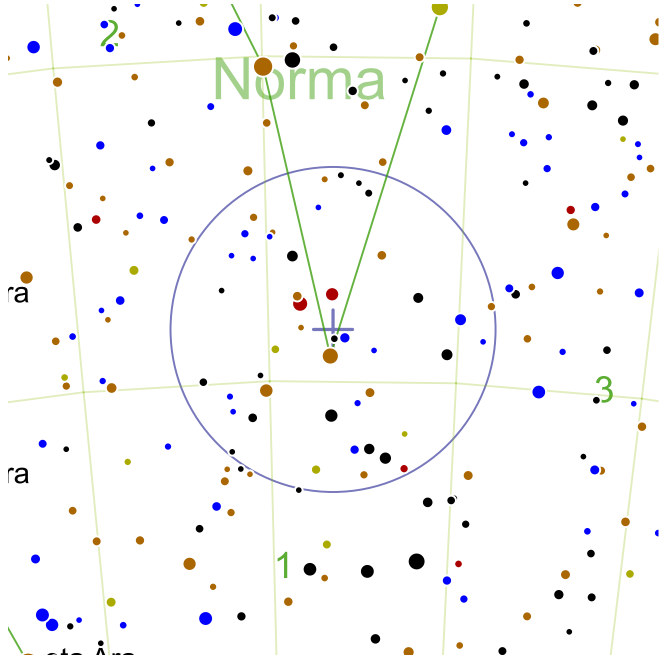
This impressive globular cluster has been identified recently as being part of the Gaia Sausage - an arc of stars and globular clusters with anomalous orbits. This grouping of orbits was discovered by the Gaia space telescope and it is surmised that 8-11 billion years ago a substantial galaxy of 50 billion solar masses merged with the Milky Way.

Also visible:

(1) C80 *(3.6_m globular cluster)*

(2) NGC 5460 *(5.6_m open cluster)*

(3) NGC 5307 *(11.5_m planetary nebula)*



NGC 6067

RA: 243.3° | 16h 13.2' — DEC: -54.22° | -54° 12'

NGC 6067 is a magnitude 5.6 open cluster. Angular size is 13'.

6.7° W from mag.3.06 zet Ara.

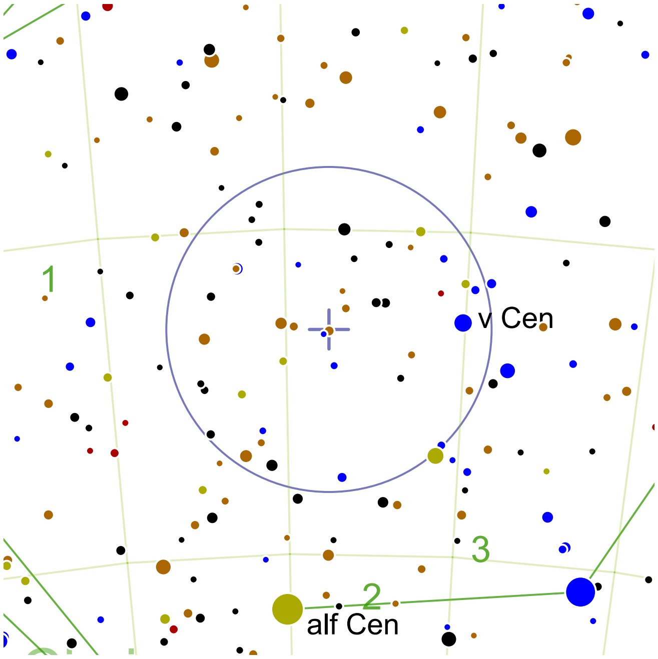
Described by John Herschel as "a most superbly rich and large cluster" is around 102 million years old with a mass of 893 solar masses.

Also visible:

(1) C89 *(5.4_m open cluster)*

(2) NGC 6167 *(6.7_m open cluster)*

(3) T Nor *(6.2_m variable star)*



NGC 5662

RA: 218.8° | 14h 35.2' — DEC: -56.55° | -56° 32'

NGC 5662 is a magnitude 5.5 open cluster. Angular size is 12'.

4.3° N from mag.1.7 alf Cen.

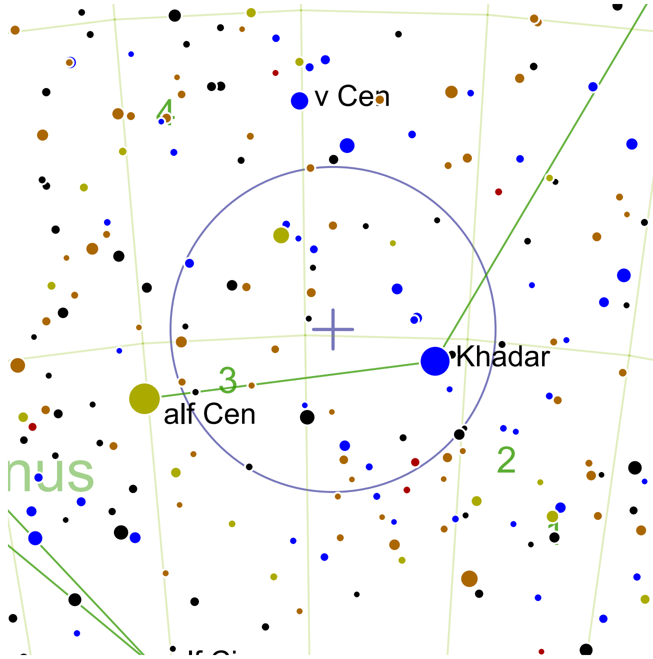
93 million years old, this bright open cluster comprises 348 solar masses.

Also visible:

(1) C88 *(7.9$_m$ open cluster)*

(2) NGC 5617 *(6.3$_m$ open cluster)*

(3) R Cen *(5.3$_m$ variable star)*



R Cen

RA: 214.14° | 14h 16.57' — DEC: -59.91° | -59° 54'

R Cen (HD 124601) is a magnitude 5.3 variable star. Magnitude ranges from 11.8 to 5.3 (Δ mag. 6.5) with a period of 546d.

1.6° NEE from mag.0.86 Khadar.

A Mira-type variable with an unusual light curve: until recently the curve was double-peaked but this has now reverted to a normal single peak. The period altered around 1950 from 550 days to approximately 500 days. It is theorized a helium flash (in which the helium layer ignites to form carbon) might have caused the abnormalities.

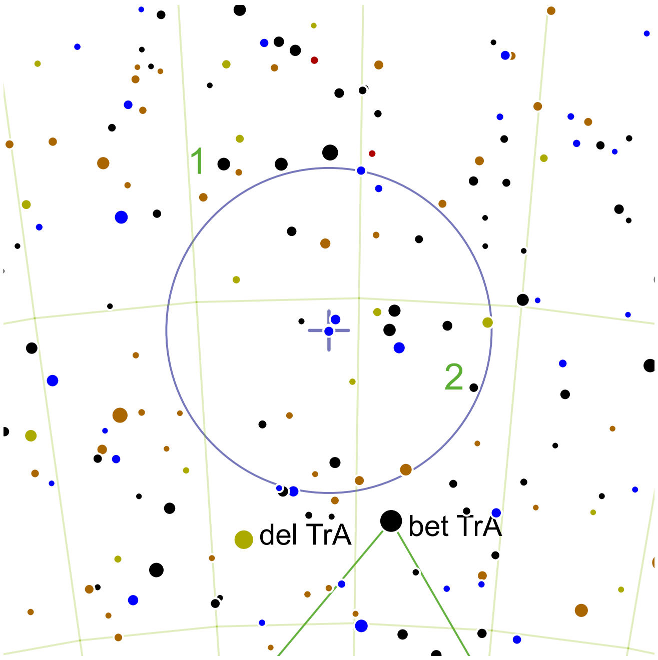
Also visible:

(1) NGC 5281 *(5.9$_m$ open cluster)*

(2) NGC 5316 *(6.0$_m$ open cluster)*

(3) NGC 5617 *(6.3$_m$ open cluster)*

(4) NGC 5662 *(5.5$_m$ open cluster)*



C95

RA: 240.93° | 16h 3.7' — DEC: -60.5° | -60° 29'

C95 (NGC 6025) is a magnitude 5.1 open cluster. Angular size is 12'.

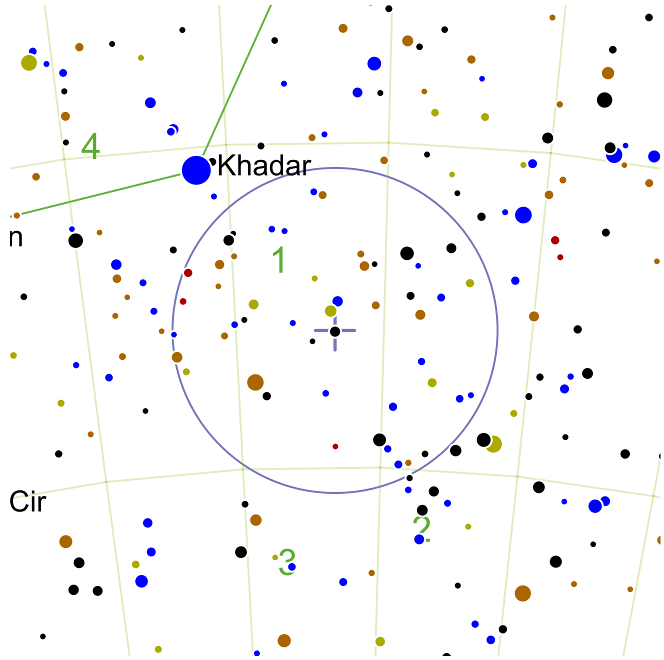
Draw a line from Hadar through Rigil Kentaurus, and extend it two further lengths.

Another of the bright southern hemisphere naked-eye clusters, Caldwell 95 is 2,700 light-years from Earth.

Also visible:

(1) C89 *(5.4$_m$ open cluster)*

(2) NGC 5979 *(12.0$_m$ planetary nebula)*



NGC 5281

RA: 206.65° | 13h 46.6' — DEC: -62.9° | -62° 53'

NGC 5281 is a magnitude 5.9 open cluster. Angular size is 5'.

3.2° SW from mag.0.86 Khadar.

A small open cluster dominated by a few bright stars. The cluster is 45 million years old, and is 4,200 light-years distant.

Also visible:

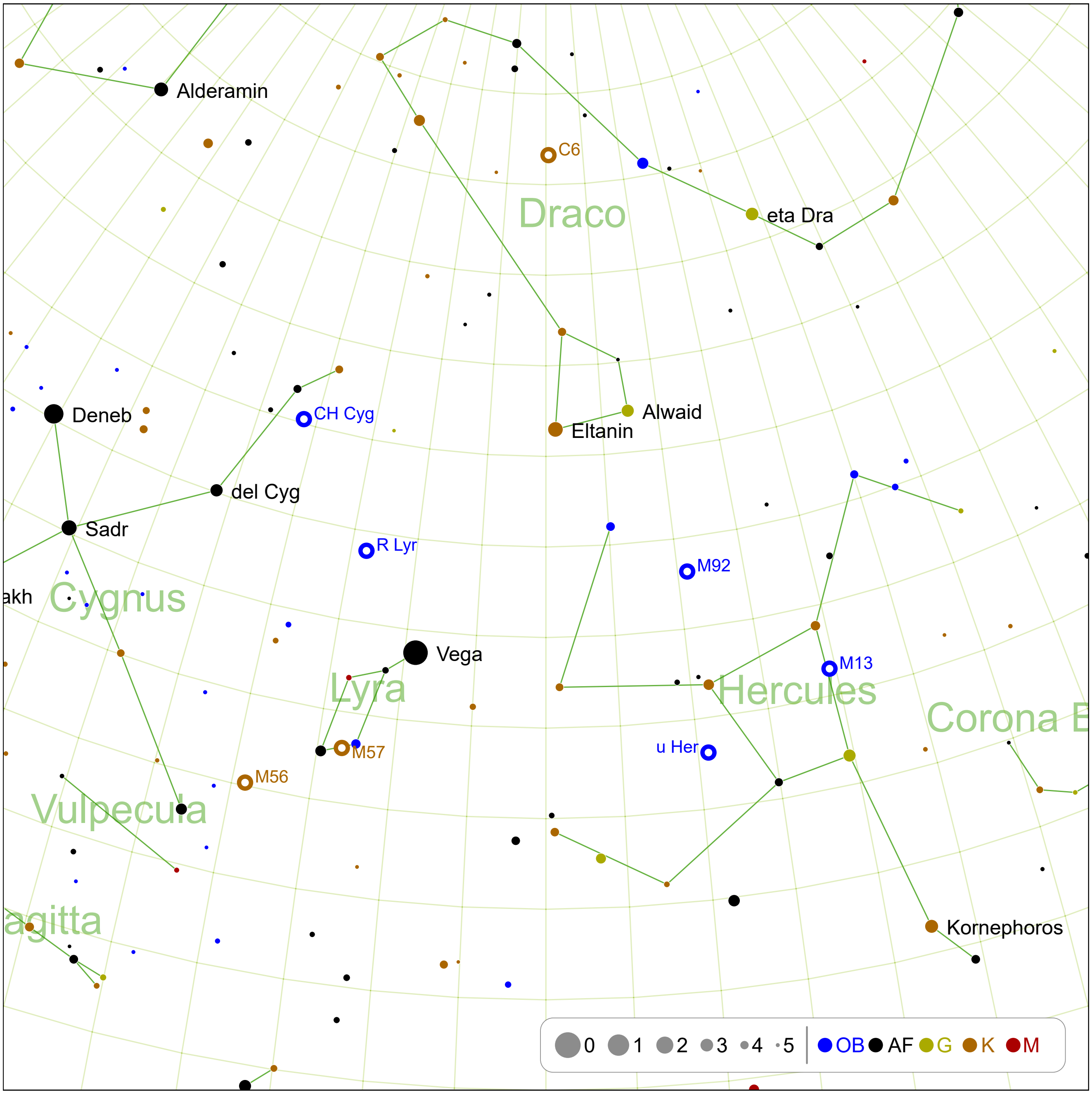
(1) NGC 5316 *(6.0$_m$ open cluster)*

(2) NGC 5189 *(10.0$_m$ planetary nebula)*

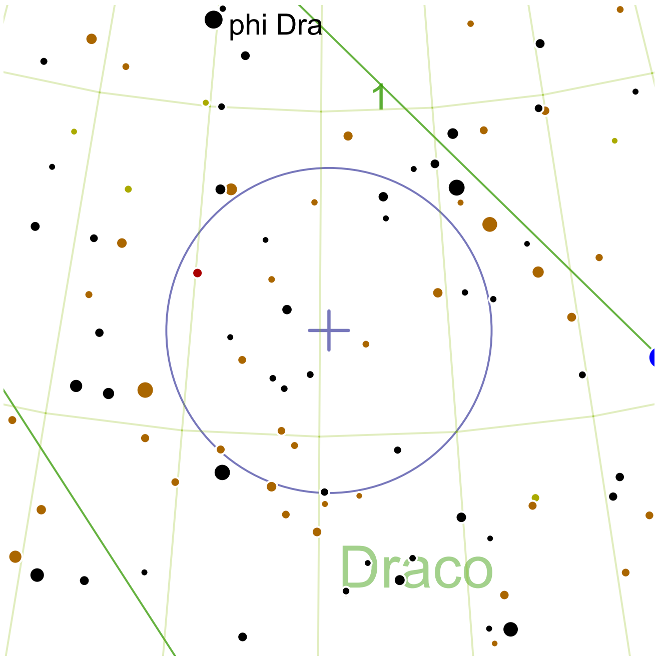
(3) NGC 5315 *(11.5$_m$ planetary nebula)*

(4) R Cen *(5.3$_m$ variable star)*

July: 45° North



C6: page 234 CH Cyg: page 234 R Lyr: page 235 M92: page 235
M13: page 236 M57: page 236 u Her: page 237 M56: page 237



C6

RA: 269.65° | 17h 58.59' — DEC: 66.63° | 66° 38'

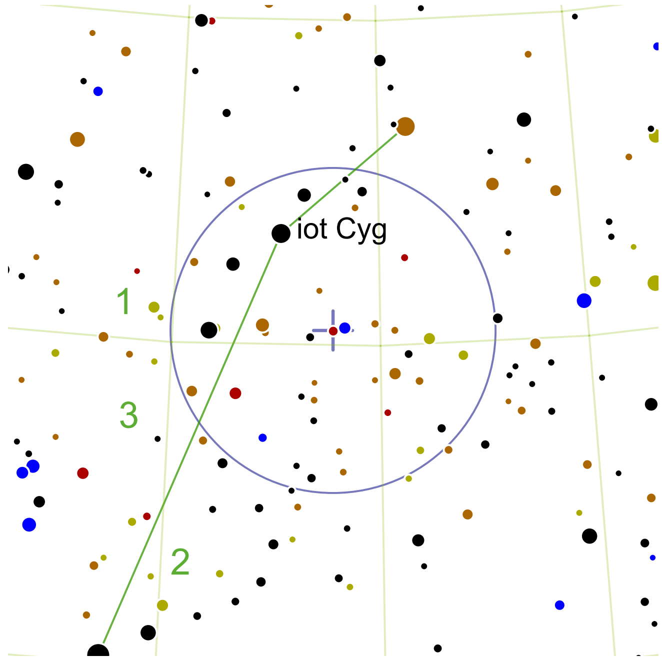
C6 (Cat's Eye Nebula, NGC 6543) is a magnitude 8.8 planetary nebula. Angular size is 0.3'.

Draw a line between Delta and Zeta Draconis (Altais and Aldhibah respectively), and another line from Polaris to Gamma Draconis (Eltanin, the brightest star in Draco); C6 is at the intersection of these lines.

A fiercely bright and well-defined planetary nebula, unmistakable once found. The central star of the nebula may be a very close binary system. The complex structures in the nebula may have been caused by jets emanating from an accretion disk arising from mass transfer between the binary components.

Also visible:

(1) NGC 6503 *(10.91$_m$ spiral galaxy)*



CH Cyg

RA: 291.14° | 19h 24.55' — DEC: 50.24° | 50° 14'

CH Cyg (HD 182917) is a magnitude 5.6 variable star. Magnitude ranges from 8.49 to 5.6 (Δ mag. 2.9).

1.6° SSW from mag.3.94 iot Cyg.

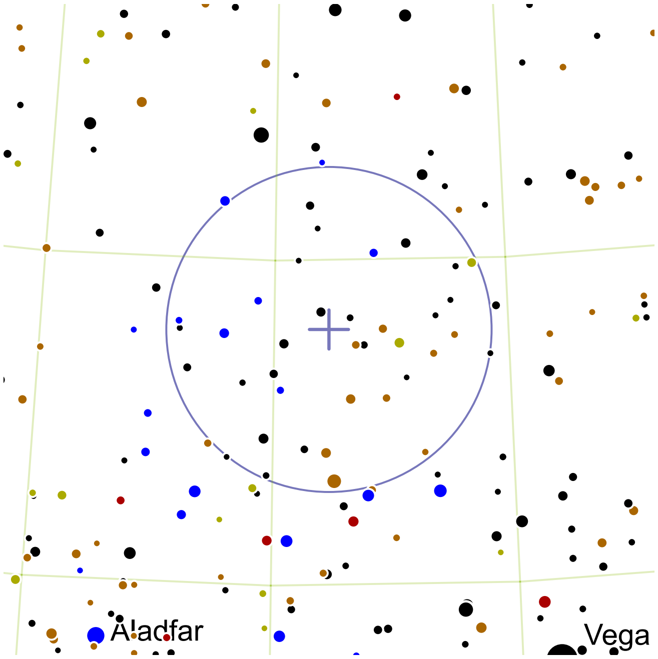
The closest symbiotic binary system to Earth (roughly 957 light-years distant), where a white dwarf siphons off the outer layers of a nearby red giant. The white dwarf and its accretion disk and jets are the brighter component of the system, but the two components cannot be resolved visually.

Also visible:

(1) C15 *(9.8$_m$ planetary nebula)*

(2) NGC 6811 *(6.8$_m$ open cluster)*

(3) RT Cyg *(6.0$_m$ variable star)*



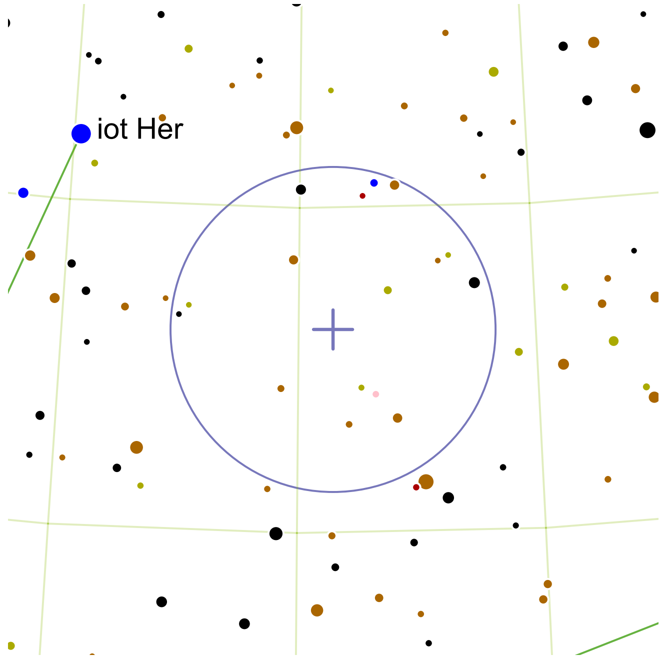
R Lyr

RA: 283.83° | 18h 55.33' — DEC: 43.95° | 43° 57'

R Lyr (HD 175865) is a magnitude 3.88 variable star. Magnitude ranges from 5.0 to 3.88 (Δ mag. 1.1) with a period of 46d.

6.2° NNE from mag.0.14 Vega.

This brilliant red giant shines brilliantly in the near infrared, where it outshines nearby Vega. R Lyrae is only 298 light-years from Earth.



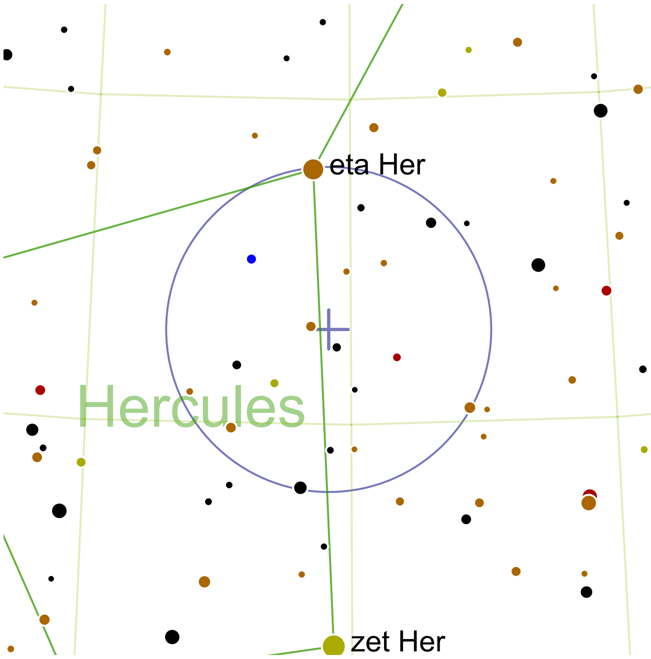
M92

RA: 259.27° | 17h 17.09' — DEC: 43.13° | 43° 8'

M92 (NGC 6341) is a magnitude 6.4 globular cluster. Angular size is 11'.

Take the northern edge of the keystone asterism in Hercules, and focus on a point to the north forming an equilateral triangle with this edge. M92 is slightly to the east of this point.

One of the brighter northern globular clusters, this ancient cluster contains about 330,000 tightly packed stars. The cluster contains very few elements heavier than helium, indicating the cluster formed from gas that had not been modified greatly by previous generations of stars. The age is estimated at around 11 billion years.



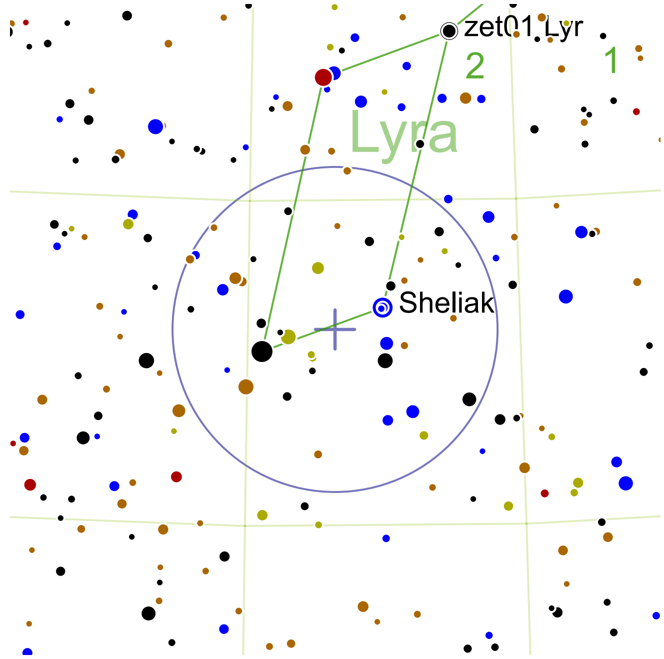
M13

RA: 250.43° | 16h 41.7' — DEC: 36.47° | 36° 28'

M13 (Great Hercules Globular, NGC 6205) is a magnitude 5.8 globular cluster. Angular size is 17'.

Located on the western edge of the distinctive quad of four stars at the heart of Hercules, known as the keystone asterism.

The Great Globular Cluster in Hercules is far behind the brighter globulars of the southern hemisphere, but it is bright enough to be barely visible to the naked eye from a dark site. With a mass of 600,000 Suns it is quite large. Telescopes with an aperture of 100 mm can begin to resolve the stars in this cluster.



M57

RA: 283.4° | 18h 53.59' — DEC: 33.03° | 33° 2'

M57 (Ring Nebula, NGC 6720) is a magnitude 8.8 planetary nebula. Angular size is 1.4x1.0'.

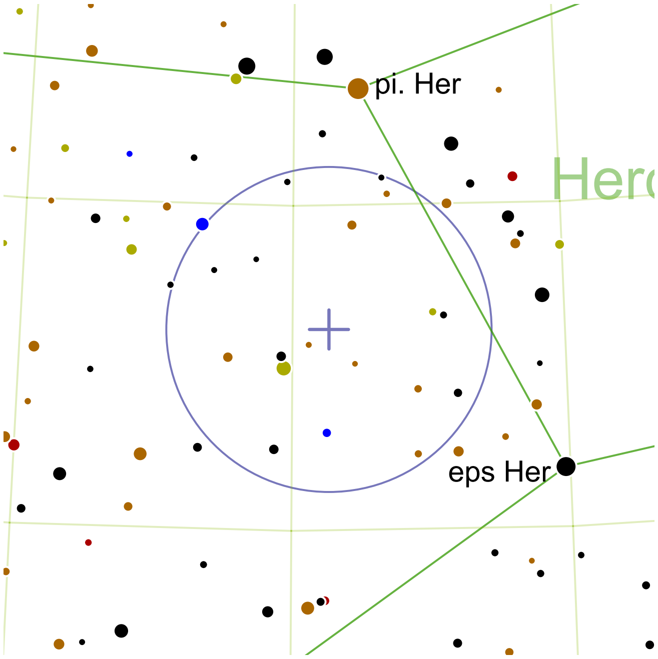
Roughly a degree south and east of the lovely double and variable star Sheliak.

Formed from the gas ejected from a red giant as it progressed to its white dwarf stage of life, M57 forms a perfect smoke ring even in a smaller telescope. It has a high surface brightness and stand up well to light pollution.

Also visible:

(1) T Lyr *(7.5_m carbon star)*

(2) HK Lyr *(8.5_m carbon star)*

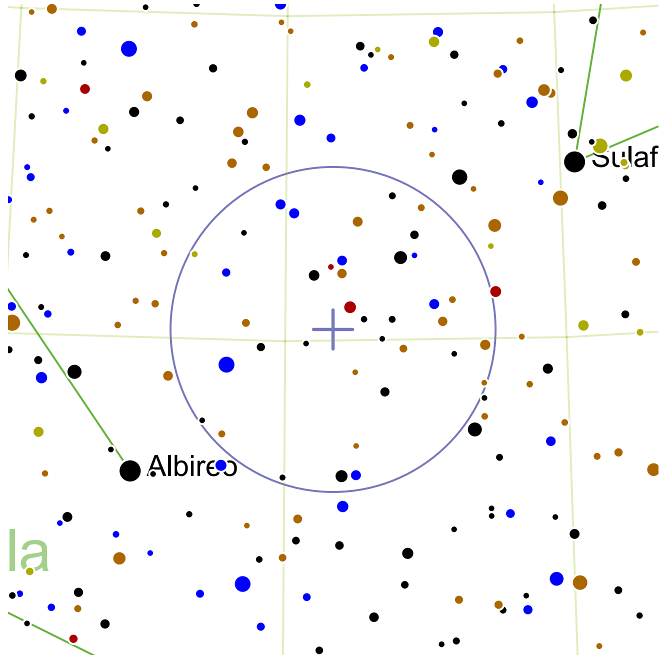


u Her

RA: 259.33° | 17h 17.32' — DEC: 33.1° | 33° 6'

u Her (HD 156633) is a magnitude 4.69 variable star. Magnitude ranges from 5.37 to 4.69 (Δ mag. 0.7) with a period of 2.05103d.

3.7° S from mag.3.36 pi. Her.



M56

RA: 289.15° | 19h 16.59' — DEC: 30.18° | 30° 11'

M56 (NGC 6779) is a magnitude 8.3 globular cluster. Angular size is 7'.

You can find M56 midway between the famous double star Albireo (the head of Cygnus the swan) and Sulafat (the star of the Lyra quadrilateral that lies furthest from Vega). Alternately, put Albireo on the SE edge of a finder circle, and M56 is on the NW edge.

With a distance of 32,900 light-years, the stars in this globular cluster can only be resolved with telescopes with at least 200 mm aperture. The brightest stars in this cluster are 13th magnitude.

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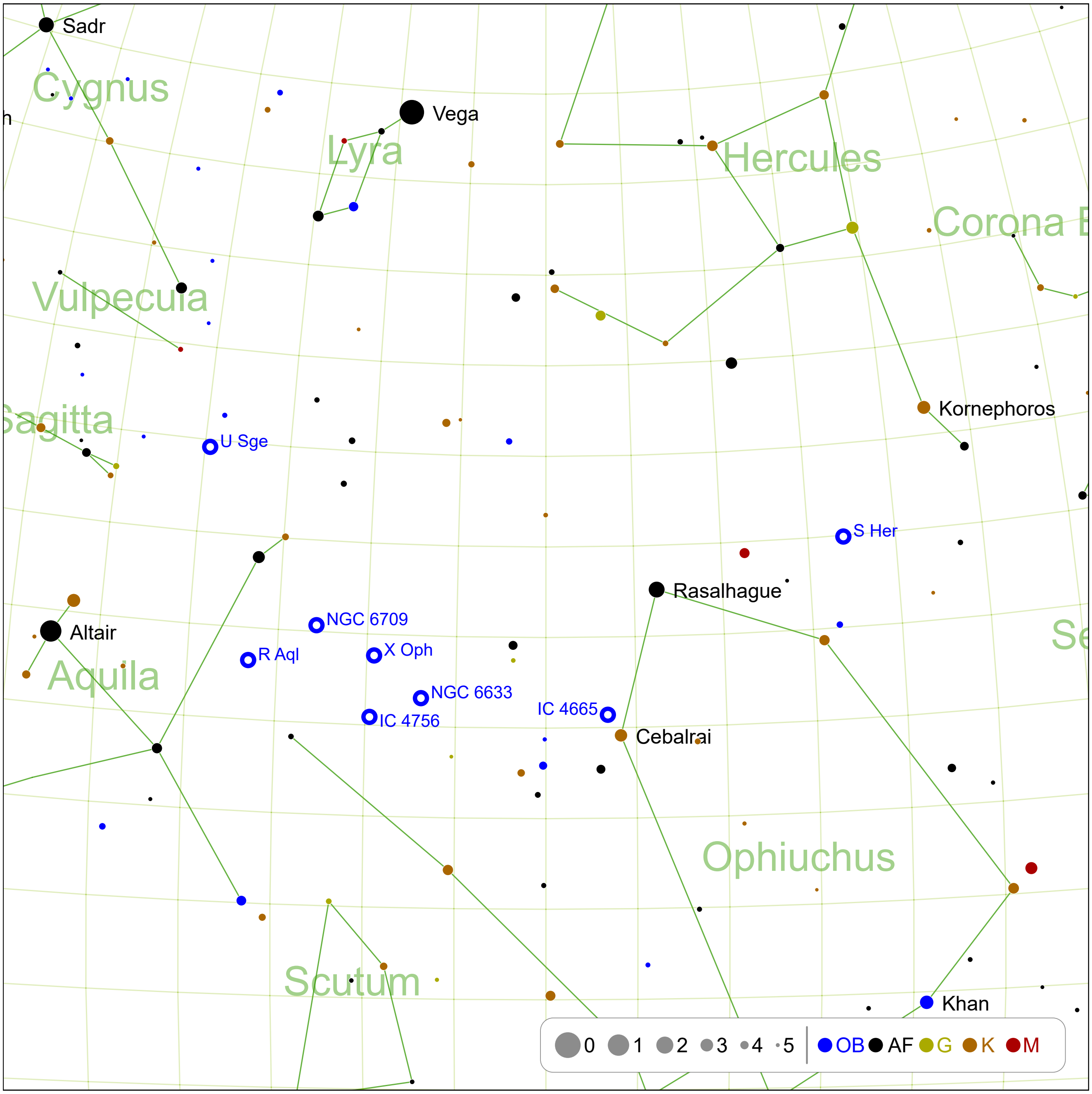
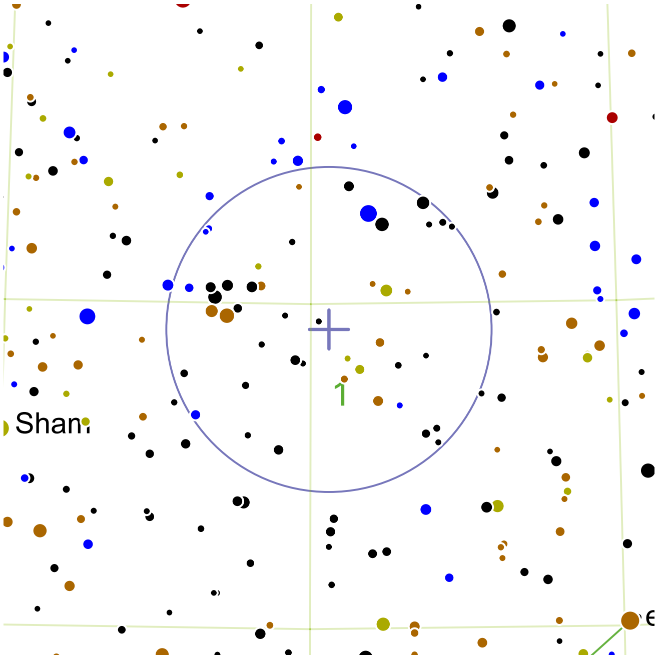
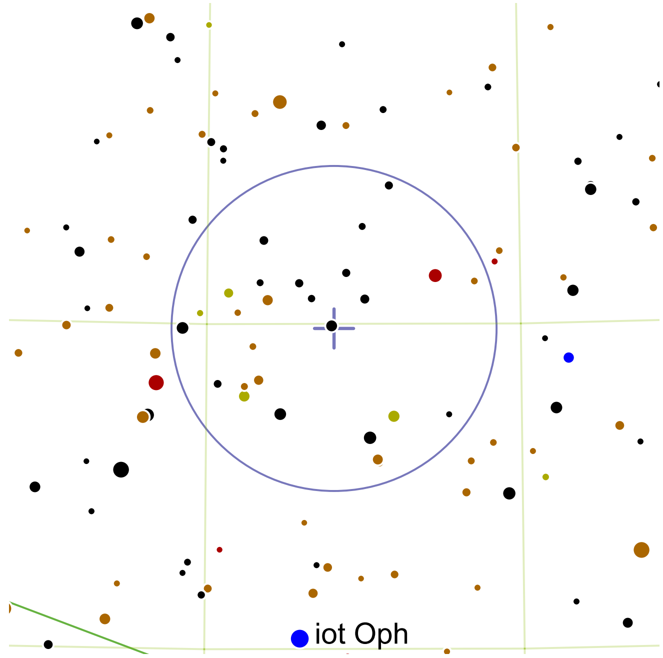
July: 15° North



U Sge: page 240
R Aql: page 242
S Her: page 240
NGC 6633: page 242
NGC 6709: page 241
IC 4665: page 243
X Oph: page 241
IC 4756: page 243





U Sge

RA: 289.7° | 19h 18.8' — DEC: 19.61° | 19° 37'

U Sge (HD 181182) is a magnitude 6.45 variable star. Magnitude ranges from 9.28 to 6.45 (Δ mag. 2.8) with a period of 3.38062d.

6.5° NNE from mag.3.02 zet Aql.

Located within two degrees of the Coathanger asterism, this eclipsing binary system consists of a blue B-type main sequence star and a yellow G-type giant. The blue primary used to be the smaller and fainter component, but it has absorbed the outer layers of its companion as it expanded into its giant phase.

Also visible:

(1) Palomar 10 *(13.22_m globular cluster)*

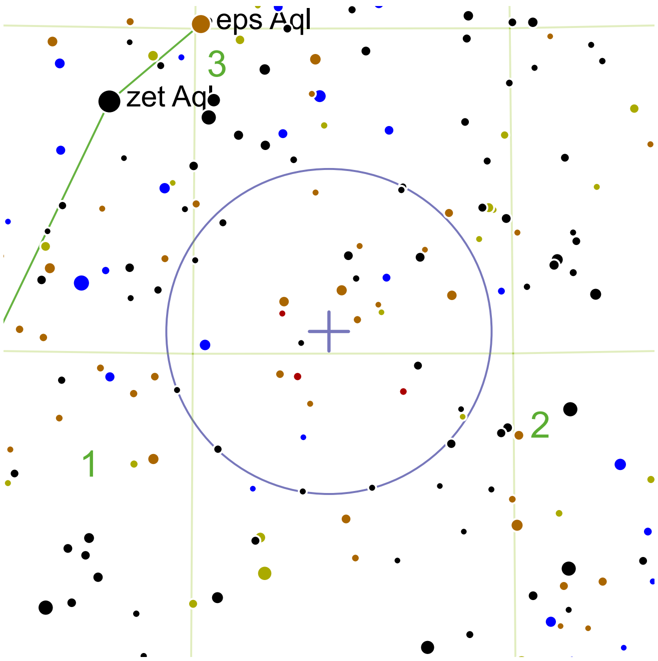
S Her

RA: 252.97° | 16h 51.89' — DEC: 14.94° | 14° 57'

S Her (HD 152276) is a magnitude 6.4 variable star. Magnitude ranges from 13.8 to 6.4 (Δ mag. 7.4) with a period of 307d.

5.5° W from mag.3.48 Rasalgethi.

This pulsating red giant star is roughly 1,553 light years from Earth.



NGC 6709

RA: 282.88° | 18h 51.5' — DEC: 10.35° | 10° 21'

NGC 6709 is a magnitude 6.7 open cluster. Angular size is 13'.

4.8° SW from mag.3.02 zet Aql.

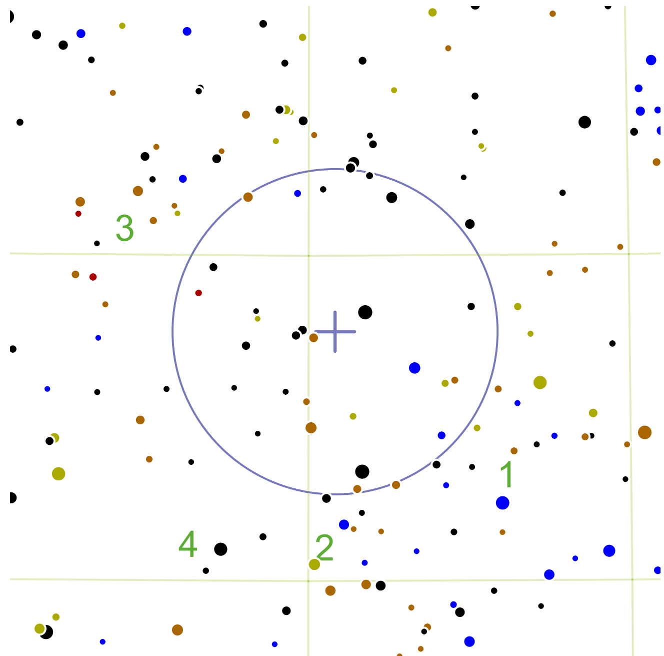
This moderately rich cluster it is 141 million years old and is approximately 3,510 light-years distant.

Also visible:

(1) R Aql *(5.5$_m$ variable star)*

(2) X Oph *(5.9$_m$ variable star)*

(3) UV Aql *(8.6$_m$ carbon star)*



X Oph

RA: 279.59° | 18h 38.35' — DEC: 8.83° | 8° 50'

X Oph (HD 172171) is a magnitude 5.9 variable star. Magnitude ranges from 9.2 to 5.9 (Δ mag. 3.3) with a period of 329d.

7.6° E from mag.3.73 72 Oph.

This Mira-type variable has a smaller range in brightness and a relatively luminous minimum brightness because it is actually a binary system and the light of the non-variable component dominates. The pair are separated by 0.5" so splitting them is almost impossible, and was first resolved with the 36" Lick Refractor in 1900.

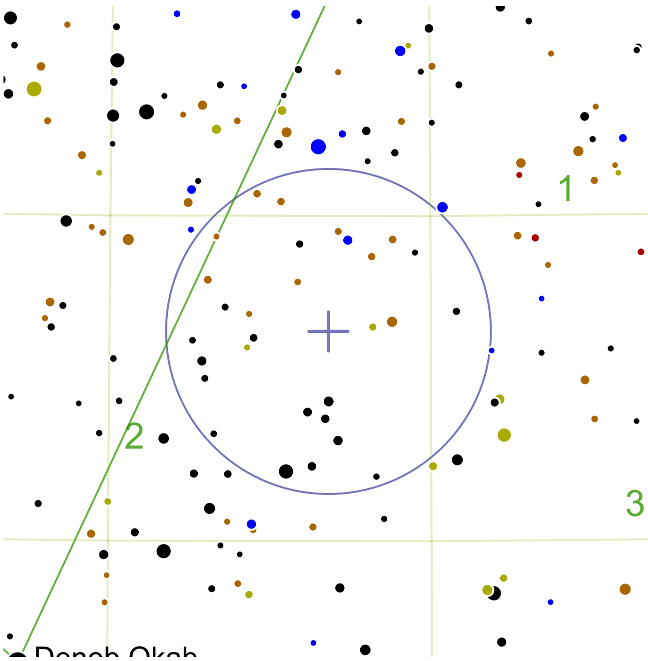
Also visible:

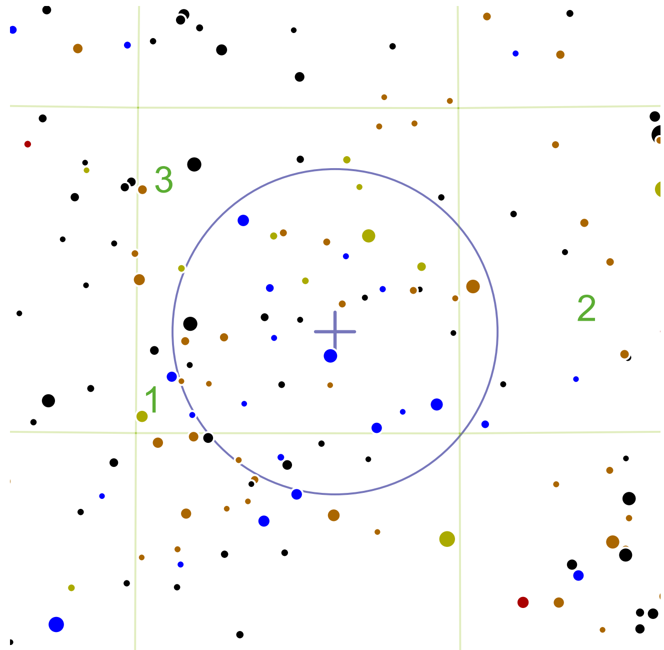
(1) NGC 6633 *(4.6$_m$ open cluster)*

(2) IC 4756 *(5.0$_m$ open cluster)*

(3) NGC 6709 *(6.7$_m$ open cluster)*

(4) DR Ser *(8.4$_m$ carbon star)*





R Aql

RA: 286.59° | 19h 6.37' — DEC: 8.23° | 8° 14'

R Aql (HD 177940) is a magnitude 5.5 variable star. Magnitude ranges from 12.0 to 5.5 (Δ mag. 6.5) with a period of 284d.

5.6° S from mag.3.02 zet Aql.

This Mira-type variable has a faint magnitude 11.45 optical companion (separation 78.2"; position angle 300°). R Aql is roughly 1376 light-years distant.

Also visible:

(1) NGC 6709 *(6.7_m open cluster)*

(2) NGC 6781 *(12.0_m planetary nebula)*

(3) DR Ser *(8.4_m carbon star)*

NGC 6633

RA: 276.93° | 18h 27.7' — DEC: 6.57° | 6° 34'

NGC 6633 is a magnitude 4.6 open cluster. Angular size is 27'.

5.8° SEE from mag.3.73 72 Oph.

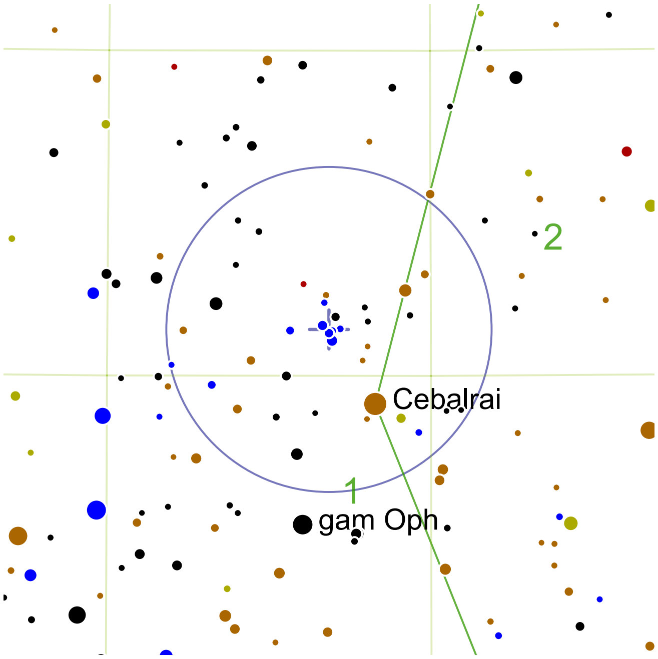
This bright cluster is roughly as large as the Moon. It is relatively old at 660 million years and is about 1,000 light years distant.

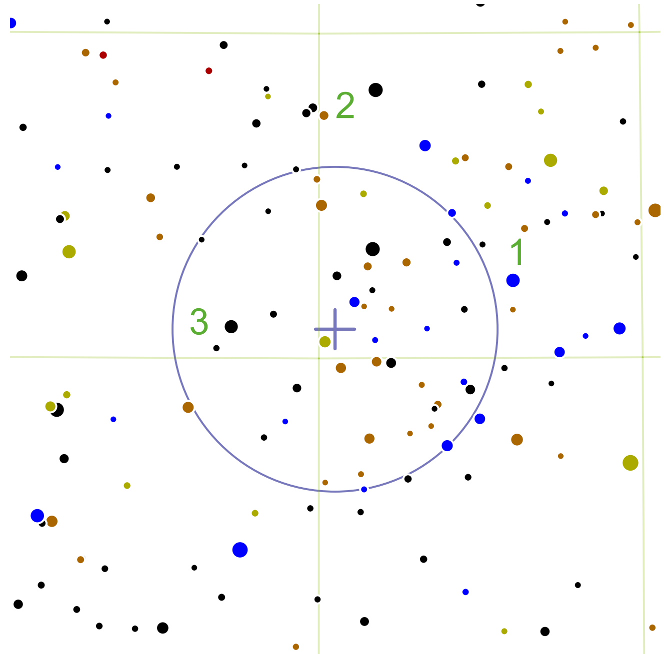
Also visible:

(1) IC 4756 *(5.0_m open cluster)*

(2) NGC 6572 *(8.5_m planetary nebula)*

(3) X Oph *(5.9_m variable star)*





IC 4665

RA: 266.58° | 17h 46.29' — DEC: 5.72° | 5° 43'

IC 4665 is a magnitude 4.2 open cluster. Angular size is 41'.

1.3° NNE from mag.2.94 Cebalrai.

A very large and scattered cluster. Probably due its disorganized and scattered nature, it was overlooked in the NGC catalog.

Also visible:

(1) NGC 6426 *(11.01$_m$ globular cluster)*

(2) NGC 6384 *(11.14$_m$ barred spiral galaxy)*

IC 4756

RA: 279.75° | 18h 39.0' — DEC: 5.45° | 5° 27'

IC 4756 is a magnitude 5.0 open cluster. Angular size is 52'.

8.8° SEE from mag.3.73 72 Oph.

Also known as Graff's Cluster, this large and bright cluster is roughly 1,300 light-years from the Earth.

Also visible:

(1) NGC 6633 *(4.6$_m$ open cluster)*

(2) X Oph *(5.9$_m$ variable star)*

(3) DR Ser *(8.4$_m$ carbon star)*

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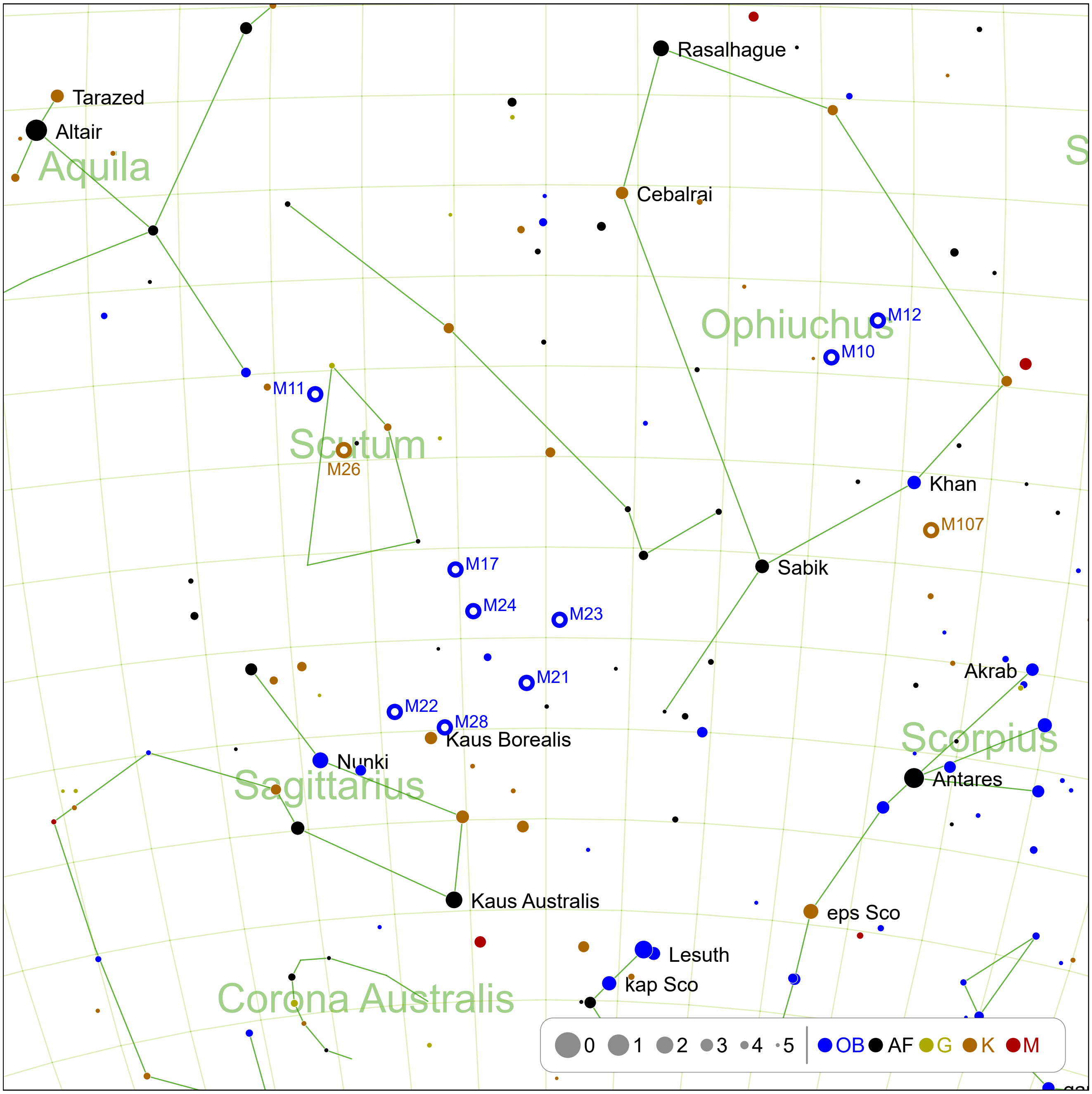
July: -15° South (1)



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M26: page 248
M107: page 249
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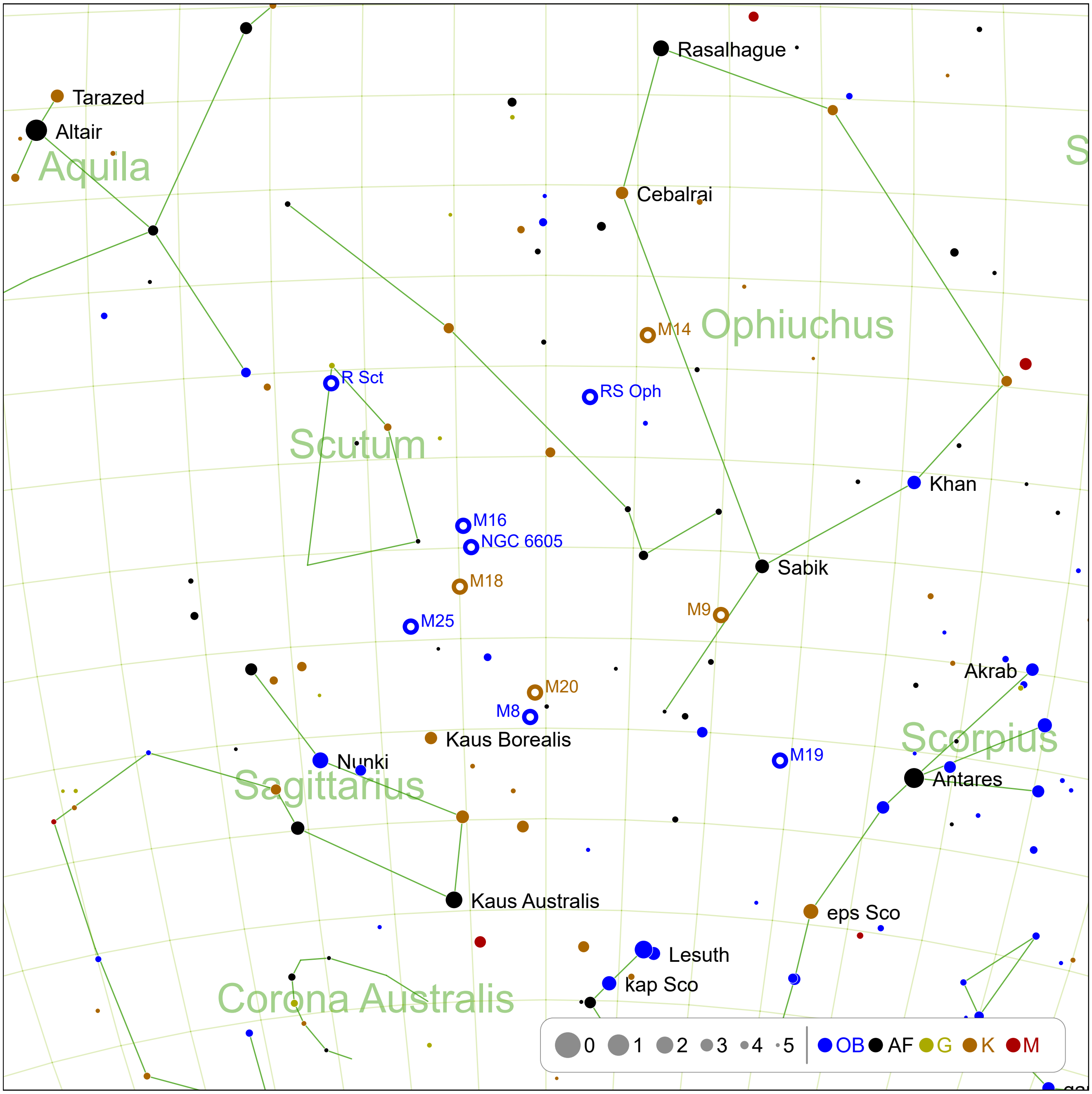
M23: page 250
M21: page 251
M22: page 251
M28: page 252

July: -15° South (2)



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R Sct: page 253
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M16: page 254
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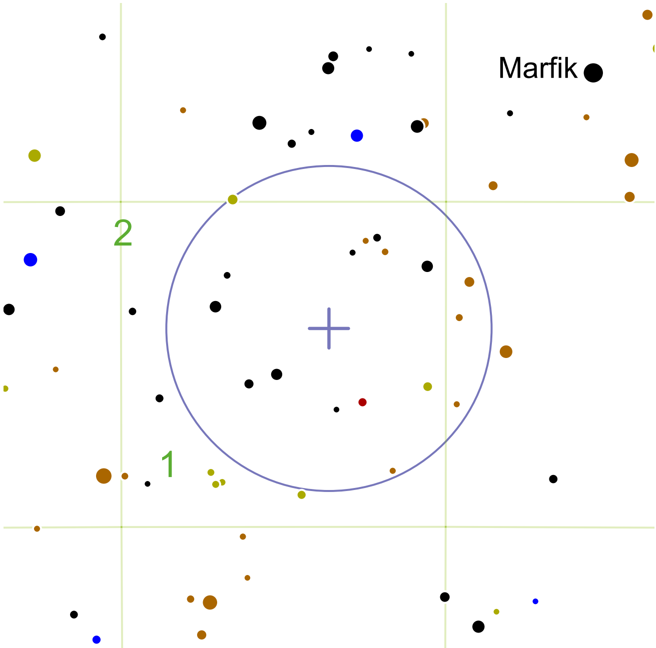


M12

RA: 251.8° | 16h 47.2' — DEC: -1.95° | -1° 56'

M12 (NGC 6218) is a magnitude 6.7 globular cluster. Angular size is 15'.

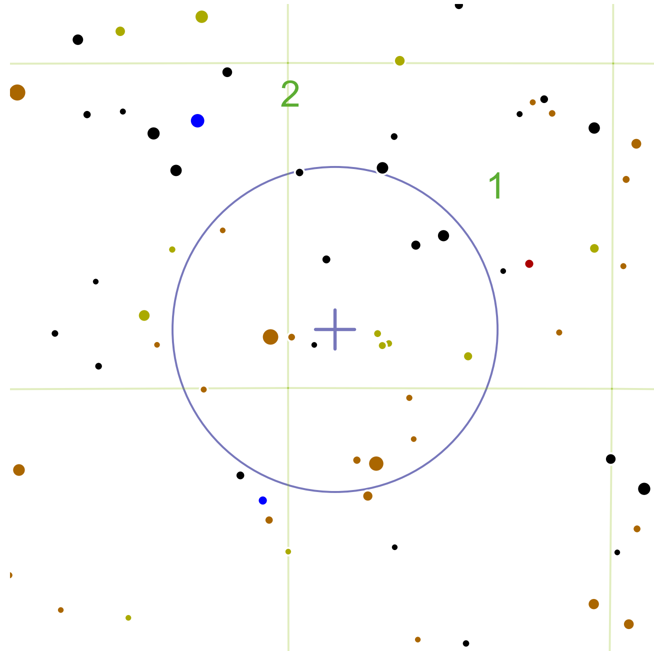
Somewhat west of the midpoint between Rasalhague and Antares.

The stars in this globular cluster can only be resolved in larger telescopes (from around 200 mm aperture) as the brightest stars are 12th magnitude. M12 is quite loosely packed for a globular cluster and is also lacking in low mass stars - it is believed these may have been stripped away by the cluster having moved through a denser region of the Milky Way.

Also visible:

(1) M10 *(6.6$_m$ globular cluster)*

(2) GCl 50 *(14.0$_m$ globular cluster)*



M10

RA: 254.28° | 16h 57.1' — DEC: -4.1° | -4° 5'

M10 (NGC 6254) is a magnitude 6.6 globular cluster. Angular size is 15'.

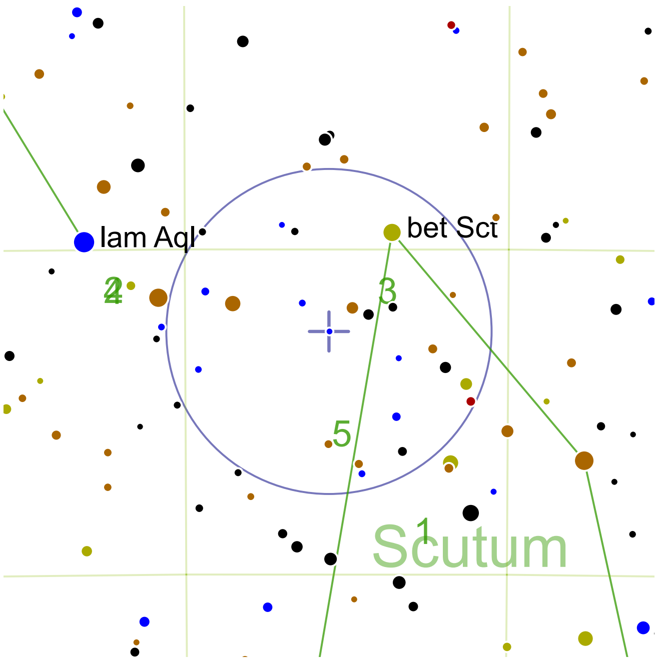
Halfway between Rasalhague and Antares.

A bright globular cluster, relatively close at a distance of 14,300 light-years. Because of its relative closeness, stars in this cluster can be resolved in smaller instruments. The cluster is not particularly large for a globular: it has a mass of 225,000 Suns.

Also visible:

(1) M12 *(6.7$_m$ globular cluster)*

(2) GCl 50 *(14.0$_m$ globular cluster)*



M11

RA: 282.77° | 18h 51.09' — DEC: -6.27° | -6° 15'

M11 (Wild Duck Cluster, NGC 6705) is a magnitude 6.3 open cluster. Angular size is 14'.

One third of the distance from Altair to Antares.

Amongst the most massive open clusters known with 11,000 solar masses and a large radius of 95 light-years. From a dark site this object can be seen by the naked eye, but it is also in a thick part of the Milky Way, so the background can be confusing.

Also visible:

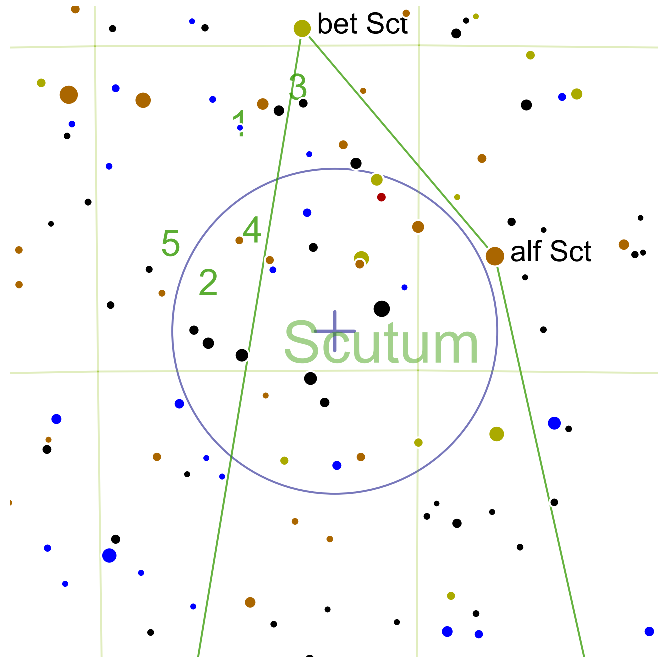
(1) M26 *(8.0$_m$ open cluster)*

(2) V Aql *(6.6$_m$ variable star)*

(3) R Sct *(4.2$_m$ variable star)*

(4) V Aql *(6.6$_m$ carbon star)*

(5) S Sct *(7.3$_m$ carbon star)*



M26

RA: 281.3° | 18h 45.2' — DEC: -9.4° | -9° 23'

M26 (NGC 6694) is a magnitude 8.0 open cluster. Angular size is 15'.

6.8° SW from mag.3.55 lam Aql.

A fairly faint and sparse cluster with a busy background, this cluster can be a challenge to pick out. It is distinguished by a drop in stellar density in its core - the opposite of normal clusters, which have their greatest density at the center.

Also visible:

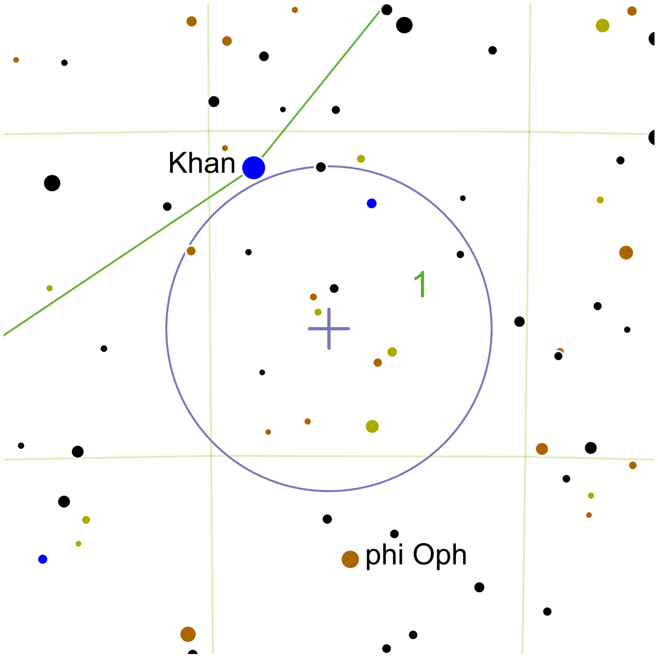
(1) M11 *(6.3$_m$ open cluster)*

(2) NGC 6712 *(8.1$_m$ globular cluster)*

(3) R Sct *(4.2$_m$ variable star)*

(4) S Sct *(7.3$_m$ carbon star)*

(5) T Sct *(8.9$_m$ carbon star)*



M107

RA: 248.13° | 16h 32.5' — DEC: -13.05° | -13° 2'

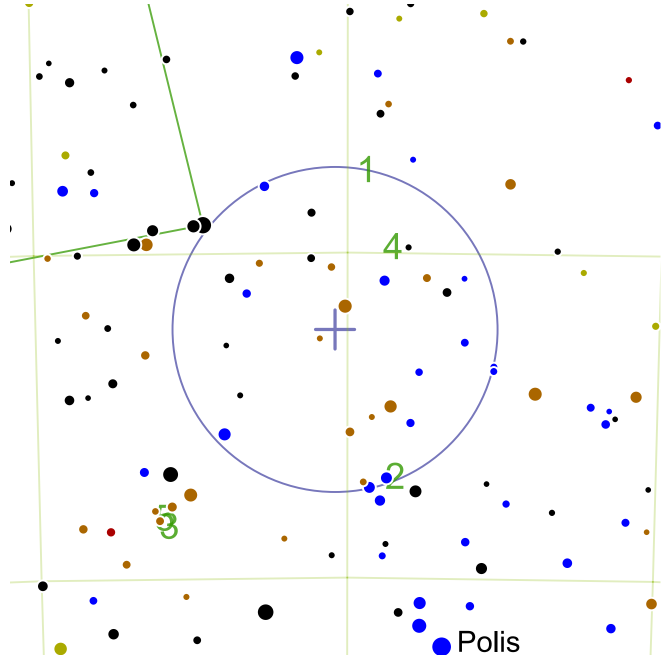
M107 (NGC 6171) is a magnitude 7.9 globular cluster. Angular size is 10'.

2.7° SSW from mag.2.7 Khan.

This is a sparser and looser globular cluster, first observed by Pierre Méchain in April 1782. It lies at a distance of 21,000 light years. M107 is the last-discovered object in the Messier catalog.

Also visible:

(1) V Oph *(7.3$_m$ variable star)*



M17

RA: 275.2° | 18h 20.79' — DEC: -16.18° | -16° 10'

M17 (Omega Nebula, NGC 6618) is a magnitude 7.0 diffuse nebula. Angular size is 11'.

Halfway between Altair and Antares (slightly closer to Antares).

A bright, rich star-forming region nestled in the richest regions of the Milky Way, the Omega Nebula is estimated to have a mass of 800 Suns. The cloud is illuminated by the one million year young open cluster NGC 6618.

Also visible:

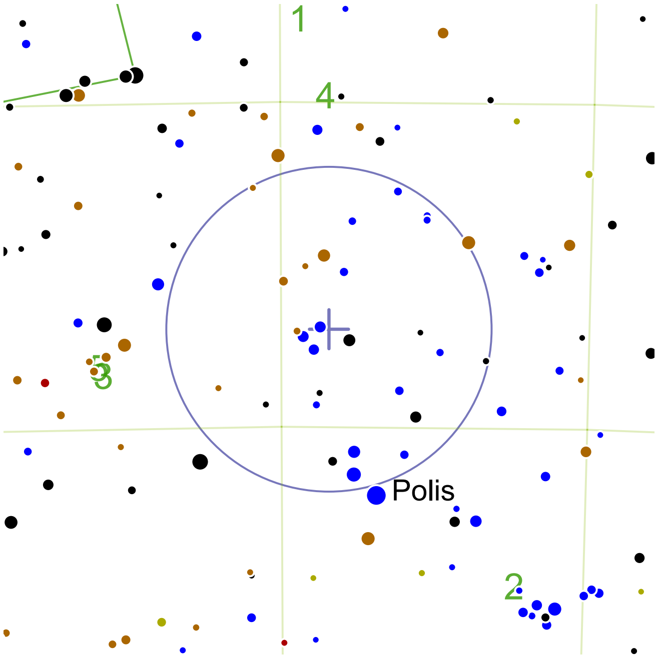
(1) M16 *(6.4$_m$ open cluster)*

(2) M24 *(4.6$_m$ star cloud)*

(3) M25 *(6.5$_m$ open cluster)*

(4) NGC 6605 *(6.0$_m$ open cluster)*

(5) U Sgr *(6.28$_m$ variable star)*



M24

RA: 274.23° | 18h 16.9' — DEC: -18.5° | -18° 29'

M24 (Sagittarius Star Cloud, IC 4715) is a magnitude 4.6 star cloud. Angular size is 90'.

Halfway between Altair and Antares (slightly closer to Antares).

This Messier object is simply a dense region of the Milky Way. Best viewed with binoculars at a dark site, which enable a good overview of the many thousands of stars.

Also visible:

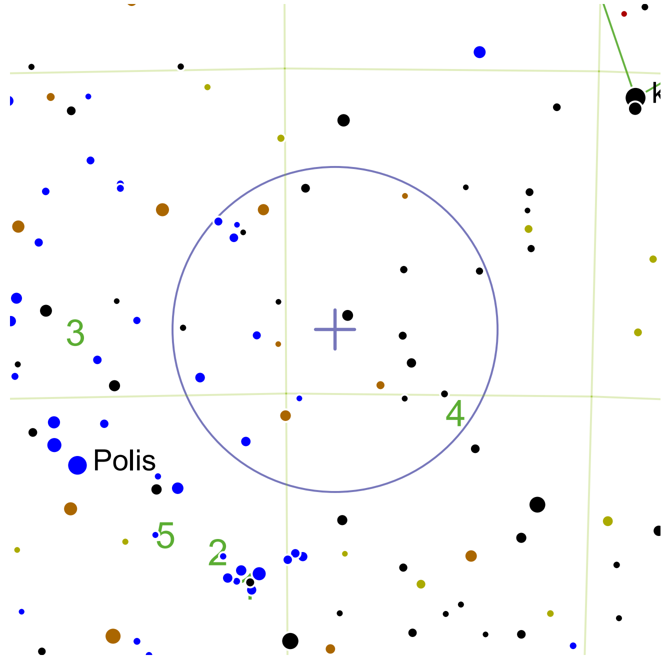
(1) M16 *(6.4_m open cluster)*

(2) M21 *(6.5_m open cluster)*

(3) M25 *(6.5_m open cluster)*

(4) NGC 6605 *(6.0_m open cluster)*

(5) U Sgr *(6.28_m variable star)*



M23

RA: 269.2° | 17h 56.79' — DEC: -19.02° | -19° 0'

M23 (NGC 6494) is a magnitude 6.9 open cluster. Angular size is 27'.

Slightly south of a point one third of the distance from Antares to Altair.

Consisting of many tiny points of light scattered over the area of a full Moon, it has a mass of 1,200 Suns or more. It is quite old for an open cluster at 330 million years.

Also visible:

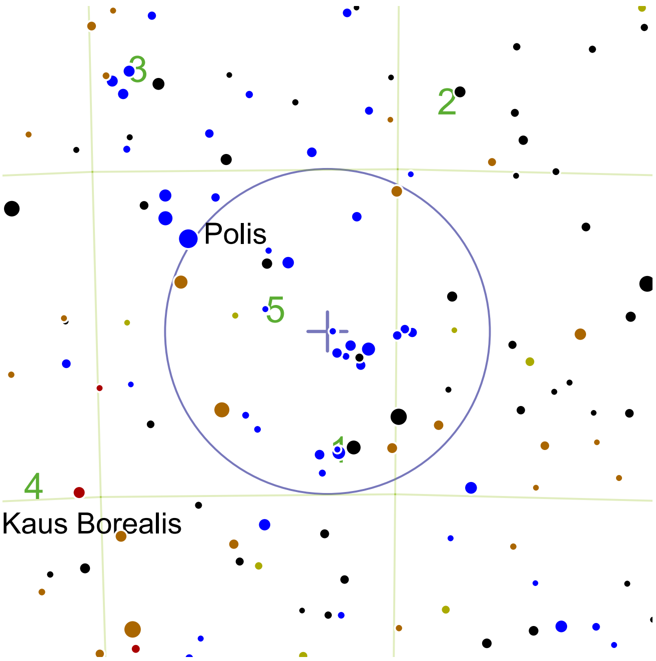
(1) M20 *(9.0_m diffuse nebula)*

(2) M21 *(6.5_m open cluster)*

(3) NGC 6567 *(11.5_m planetary nebula)*

(4) NGC 6440 *(9.2_m globular cluster)*

(5) VX Sgr *(6.52_m variable star)*



M21

RA: 271.15° | 18h 4.59' — DEC: -22.5° | -22° 29'

M21 (NGC 6531) is a magnitude 6.5 open cluster. Angular size is 13'.

Forms an equilateral triangle with Antares and Sargas in Scorpius's tail.

This reasonably bright open cluster has the mass of nearly 800 Suns but only has a few bright members with the remaining stars much smaller and dimmer, resulting in a relatively sparse but quite tightly packed cluster.

Also visible:

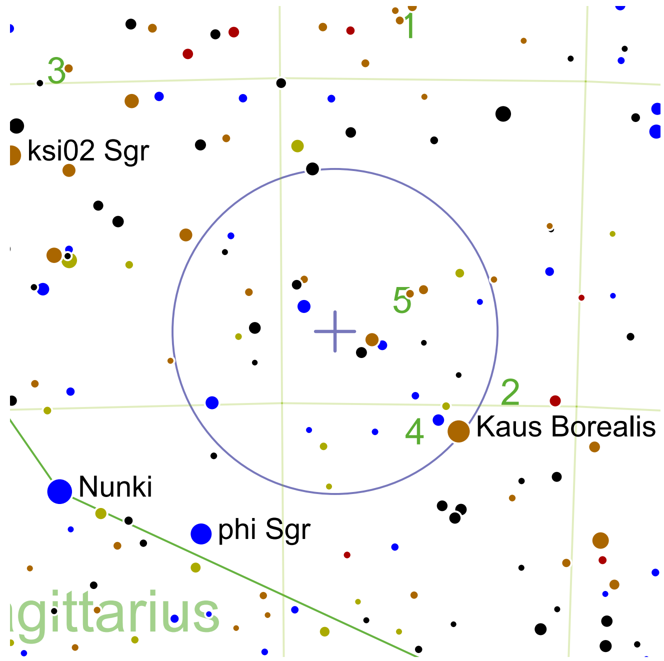
(1) M8 *(6.0_m diffuse nebula)*

(2) M23 *(6.9_m open cluster)*

(3) M24 *(4.6_m star cloud)*

(4) M28 *(6.8_m globular cluster)*

(5) VX Sgr *(6.52_m variable star)*



M22

RA: 279.1° | 18h 36.4' — DEC: -23.9° | -23° 53'

M22 (Sagittarius Cluster, NGC 6656) is a magnitude 5.1 globular cluster. Angular size is 24'.

2.4° NE from mag.2.94 Kaus Borealis.

This very bright globular cluster is an easy spot with the naked eye for those with dark skies. Its stars are also quite bright at 11th magnitude, due to its relatively close distance of only 10,600 light-years. It was discovered in 1665 by Abraham Ihle.

Also visible:

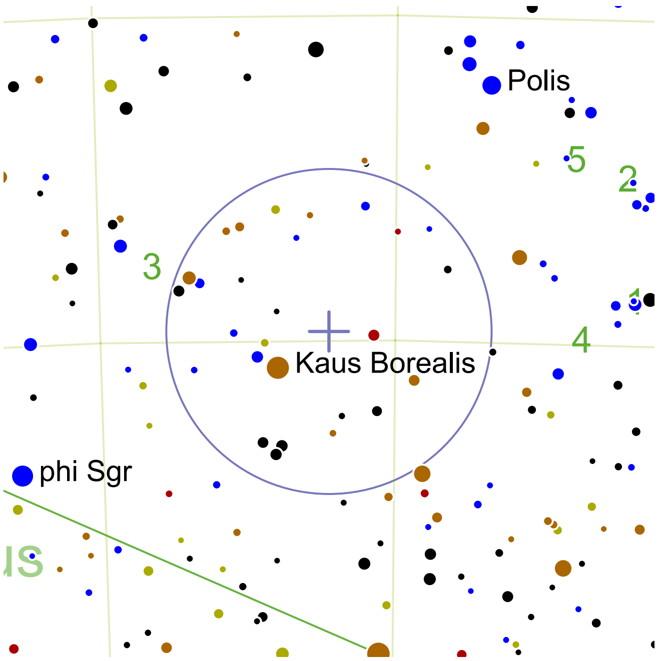
(1) M25 *(6.5_m open cluster)*

(2) M28 *(6.8_m globular cluster)*

(3) NGC 6716 *(6.9_m open cluster)*

(4) NGC 6638 *(9.02_m globular cluster)*

(5) NGC 6642 *(9.13_m globular cluster)*



M28

RA: 276.13° | 18h 24.5' — DEC: -24.87° | -24° 51'

M28 (NGC 6626) is a magnitude 6.8 globular cluster. Angular size is 11'.

0.9° NW from mag.2.94 Kaus Borealis.

The stars in the globular cluster begin to be resolved with a telescope aperture of around 150 mm. M28 contains 11 millisecond pulsars. These are old neutron stars that have been given fresh impetus from infalling matter from a companion star.

Also visible:

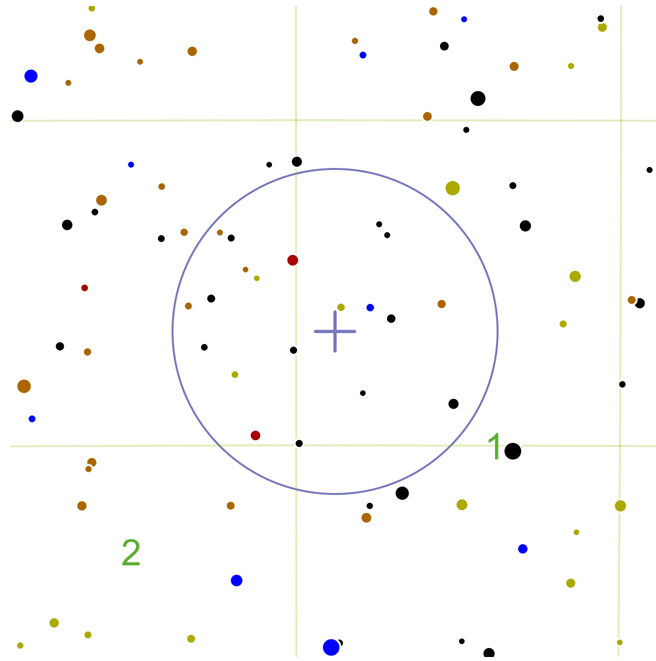
(1) M8 *(6.0$_m$ diffuse nebula)*

(2) M21 *(6.5$_m$ open cluster)*

(3) M22 *(5.1$_m$ globular cluster)*

(4) NGC 6544 *(7.77$_m$ globular cluster)*

(5) VX Sgr *(6.52$_m$ variable star)*



M14

RA: 264.4° | 17h 37.59' — DEC: -3.25° | -3° 14'

M14 (NGC 6402) is a magnitude 7.6 globular cluster. Angular size is 12'.

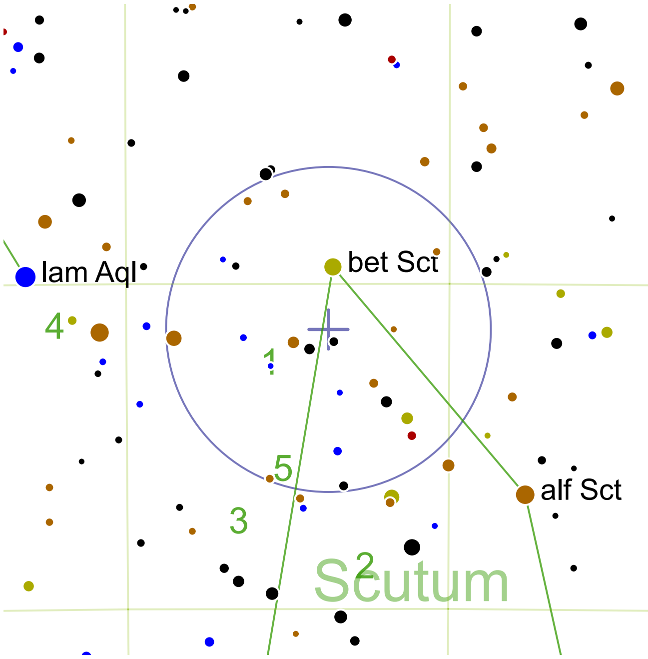
Draw a line from Antares through Sabik, and extend it an equal distance.

Although nearly twice the mass of M13, M14 is also 50% more distant and closer to the galactic plane and its obscuring dust, so overall it is much fainter. The brightest stars in this cluster only shine at magnitude 14. Three degrees southwest of M13 is a faint globular cluster, NGC 6366 (magnitude 9.5).

Also visible:

(1) NGC 6366 *(9.2$_m$ globular cluster)*

(2) RS Oph *(4.3$_m$ variable star)*



R Sct

RA: 281.87° | 18h 47.48' — DEC: -5.71° | -5° 41'

R Sct (HD 173819) is a magnitude 4.2 variable star. Magnitude ranges from 8.6 to 4.2 (Δ mag. 4.4) with a period of 146.5d.

4.7° W from mag.3.55 lam Aql.

The brightest of the RV Tauri class of variables, R Sct is marked by a long, highly irregular period with extreme minima. It is about 4,000 light-years distant.

Also visible:

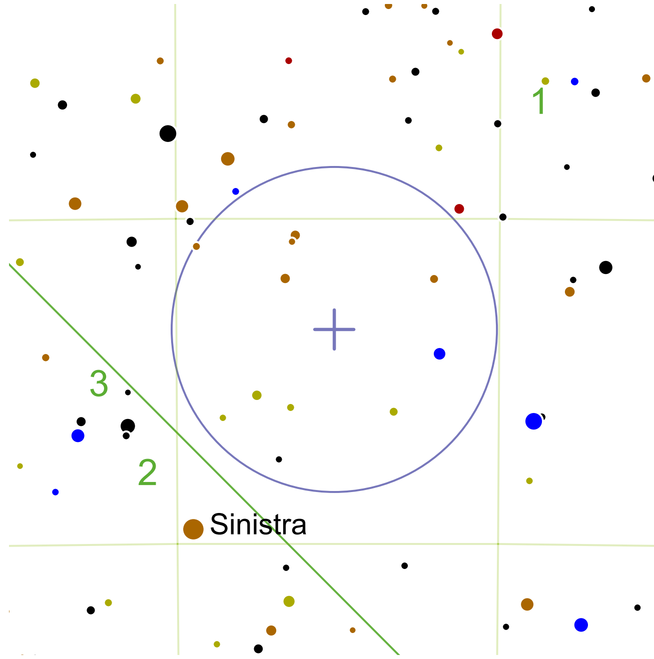
(1) M11 *(6.3$_m$ open cluster)*

(2) M26 *(8.0$_m$ open cluster)*

(3) NGC 6712 *(8.1$_m$ globular cluster)*

(4) V Aql *(6.6$_m$ carbon star)*

(5) S Sct *(7.3$_m$ carbon star)*



RS Oph

RA: 267.55° | 17h 50.21' — DEC: -6.71° | -6° 41'

RS Oph (HD 162214) is a magnitude 4.3 variable star. Magnitude ranges from 12.5 to 4.3 (Δ mag. 8.2).

3.7° NW from mag.3.5 Sinistra.

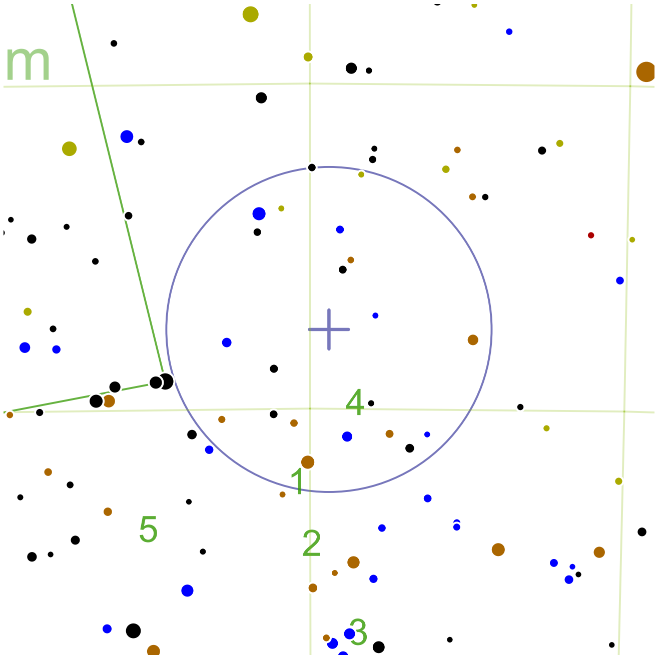
A recurrent nova system, RS Oph is usually magnitude 12.5 but has erupted to magnitude 5 in 1898, 1933, 1958, 1967, 1985, 2006 and 2021. It appears the system is binary consisting of a white dwarf accreting matter from a nearby red giant. Approximately every 15 years sufficient matter builds up on the white dwarf to cause a runaway fusion reaction.

Also visible:

(1) M14 *(7.6$_m$ globular cluster)*

(2) NGC 6517 *(10.23$_m$ globular cluster)*

(3) NGC 6539 *(9.33$_m$ globular cluster)*



M16

RA: 274.7° | 18h 18.79' — DEC: -13.78° | -13° 46'

M16 (Eagle Nebula, NGC 6611) is a magnitude 6.4 open cluster. Angular size is 7'.

Halfway between Altair and Antares (slightly closer to Antares).

This bright, rich star-forming region is the site of the Hubble Space Telescope's iconic Pillars of Creation photograph. The open cluster illuminating the gas cloud is NGC 6611. The brightest member of this extremely young cluster is HD 168076, a binary system with a total mass of 100 Suns and the luminosity of a million Suns.

Also visible:

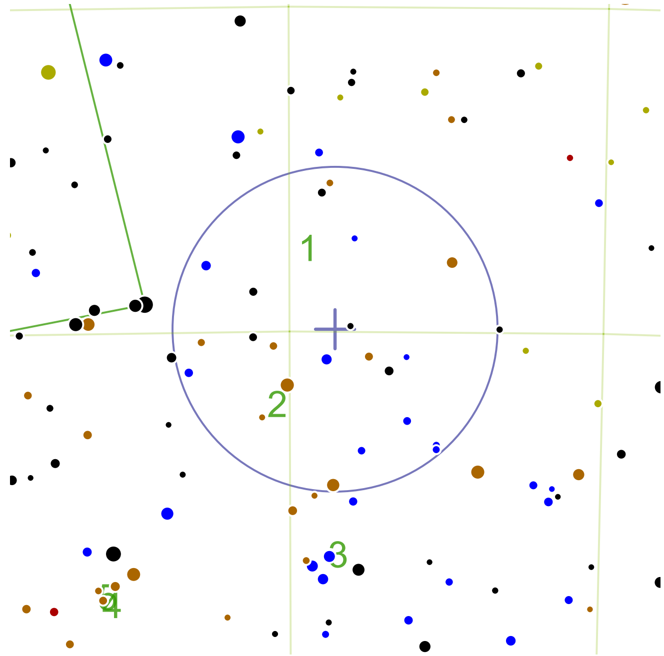
(1) M17 *(7.0_m diffuse nebula)*

(2) M18 *(7.5_m open cluster)*

(3) M24 *(4.6_m star cloud)*

(4) NGC 6605 *(6.0_m open cluster)*

(5) SS Sgr *(9.0_m carbon star)*



NGC 6605

RA: 274.27° | 18h 17.09' — DEC: -14.97° | -14° 57'

NGC 6605 is a magnitude 6.0 open cluster. Angular size is 29'.

6.8° SE from mag.3.5 Sinistra.

Located between the Eagle and Omega Nebulae, this cluster is lost within a crowded field of stars.

Also visible:

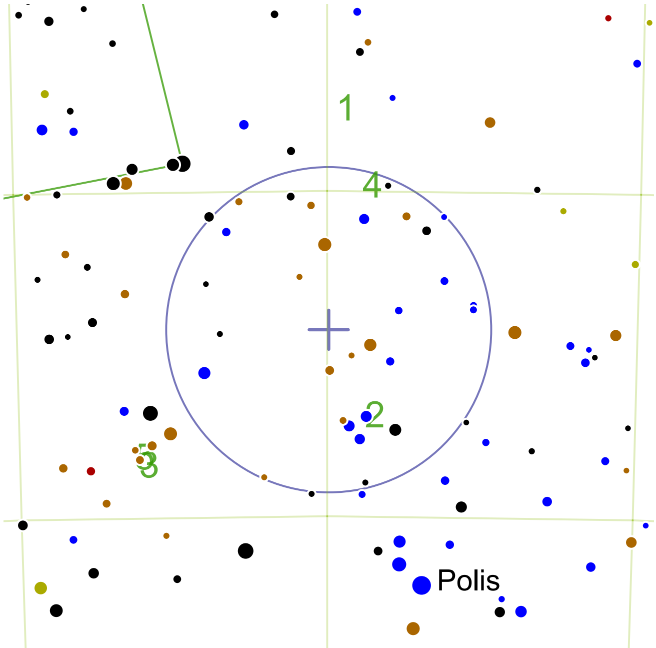
(1) M16 *(6.4_m open cluster)*

(2) M17 *(7.0_m diffuse nebula)*

(3) M24 *(4.6_m star cloud)*

(4) M25 *(6.5_m open cluster)*

(5) U Sgr *(6.28_m variable star)*



M18

RA: 274.98° | 18h 19.9' — DEC: -17.13° | -17° 7'

M18 (NGC 6613) is a magnitude 7.5 open cluster. Angular size is 9'.

Halfway between Altair and Antares (slightly closer to Antares).

This cluster is 4,250 light-years from Earth, with an estimated mass of 188 Suns and an age of 33 million years.

Also visible:

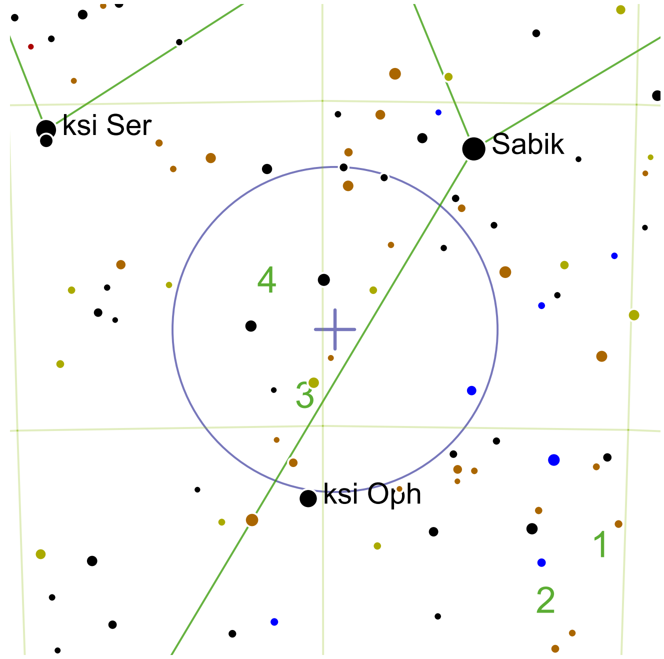
(1) M16 *(6.4_m open cluster)*

(2) M24 *(4.6_m star cloud)*

(3) M25 *(6.5_m open cluster)*

(4) NGC 6605 *(6.0_m open cluster)*

(5) U Sgr *(6.28_m variable star)*



M9

RA: 259.8° | 17h 19.2' — DEC: -18.52° | -18° 30'

M9 (NGC 6333) is a magnitude 7.7 globular cluster. Angular size is 9.3'.

3.5° SE from mag.2.63 Sabik.

A reasonably bright globular cluster accompanied by two other globular clusters: 1.3 degrees to the north-east is NGC 6356 and 1.3 degrees to the southeast is NGC 6342. The fact other globulars are in the same field of view is no coincidence: M9 is close to the galactic core so we view it through a thick section of the galactic halo. The mass of this cluster is 420,000 Suns.

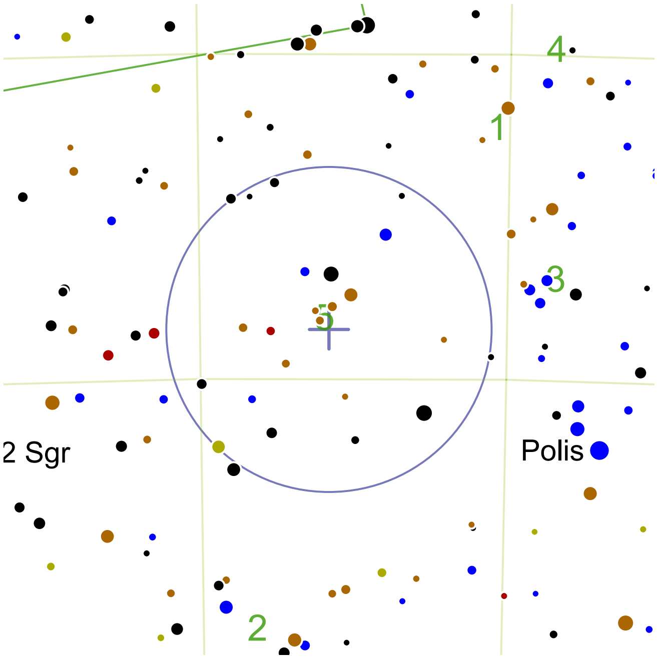
Also visible:

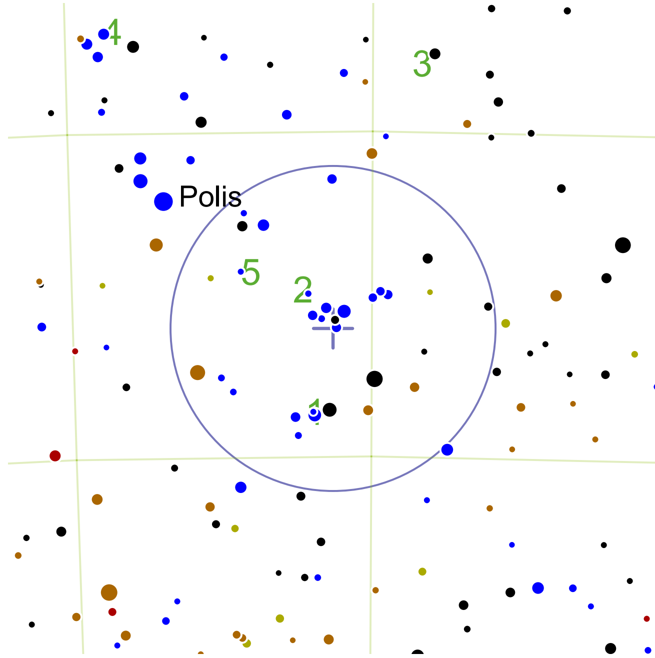
(1) IC 4634 *(11.0_m planetary nebula)*

(2) NGC 6287 *(9.35_m globular cluster)*

(3) NGC 6342 *(9.66_m globular cluster)*

(4) NGC 6356 *(8.25_m globular cluster)*





M25

RA: 277.9° | 18h 31.59' — DEC: -19.25° | -19° 14'

M25 (IC 4725) is a magnitude 6.5 open cluster. Angular size is 40'.

6.2° N from mag.2.94 Kaus Borealis.

Thirteen light years across and with a mass of nearly 2,000 Suns, this cluster is 2,000 light years from Earth and partially obscured by dust clouds.

Also visible:

(1) M17 *(7.0$_m$ diffuse nebula)*

(2) M22 *(5.1$_m$ globular cluster)*

(3) M24 *(4.6$_m$ star cloud)*

(4) NGC 6605 *(6.0$_m$ open cluster)*

(5) U Sgr *(6.28$_m$ variable star)*

M20

RA: 270.65° | 18h 2.59' — DEC: -23.03° | -23° 1'

M20 (Trifid Nebula, NGC 6514) is a magnitude 9.0 diffuse nebula. Angular size is 28'.

Forms an equilateral triangle with Antares and Sargas in Scorpius's tail.

The Trifid Nebula is divided into three apparent lobes by dark dust lanes. M20 combines an emission nebula, a reflection nebula, a star cluster and a dark nebula, resulting in a complex and fascinating object.

Also visible:

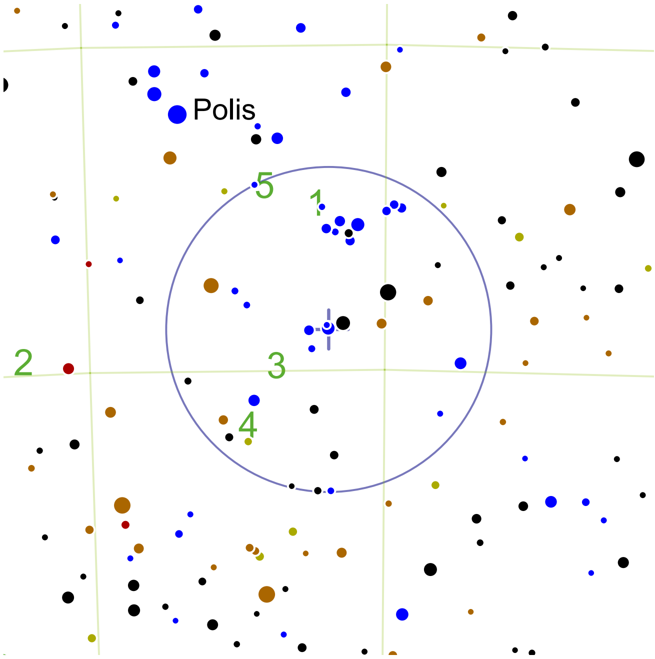
(1) M8 *(6.0$_m$ diffuse nebula)*

(2) M21 *(6.5$_m$ open cluster)*

(3) M23 *(6.9$_m$ open cluster)*

(4) M24 *(4.6$_m$ star cloud)*

(5) VX Sgr *(6.52$_m$ variable star)*



M8

RA: 270.95° | 18h 3.79' — DEC: -24.38° | -24° 22'

M8 (Lagoon Nebula, NGC 6523) is a magnitude 6.0 diffuse nebula. Angular size is 90x40'.

Travel from the scorpion's sting Shaula to Kaus Australis, turn right and continue an equal distance.

This star-forming region is one of only two such objects visible to the naked eye from northern latitudes. It spans 110 by 50 light-years. At its heart is the star cluster NGC 6530 (a dozen stars are visible with a small telescope, but it is believed that the cluster contains 2,768 stars. Of these over 300 are T Tauri variables, namely very young stars typically with an accretion disk. Most of the stars formed in the past two million years.

Also visible:

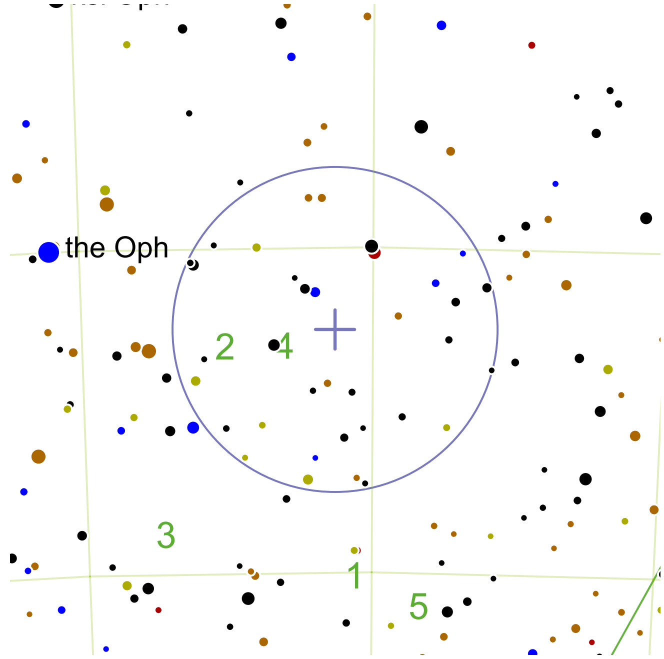
(1) M21 *(6.5_m open cluster)*

(2) M28 *(6.8_m globular cluster)*

(3) NGC 6544 *(7.77_m globular cluster)*

(4) NGC 6553 *(8.06_m globular cluster)*

(5) VX Sgr *(6.52_m variable star)*



M19

RA: 255.65° | 17h 2.6' — DEC: -26.27° | -26° 15'

M19 (NGC 6273) is a magnitude 6.8 globular cluster. Angular size is 14'.

4.5° SWW from mag.3.37 the Oph.

This globular appears to be slightly flattened, but this is only due to intervening dust obscuring one edge. In infrared images the cluster is perfectly spherical (infrared is not absorbed by dust).

Also visible:

(1) M62 *(6.5_m globular cluster)*

(2) NGC 6293 *(8.22_m globular cluster)*

(3) NGC 6304 *(8.22_m globular cluster)*

(4) BF Oph *(6.93_m variable star)*

(5) RR Sco *(5.0_m variable star)*

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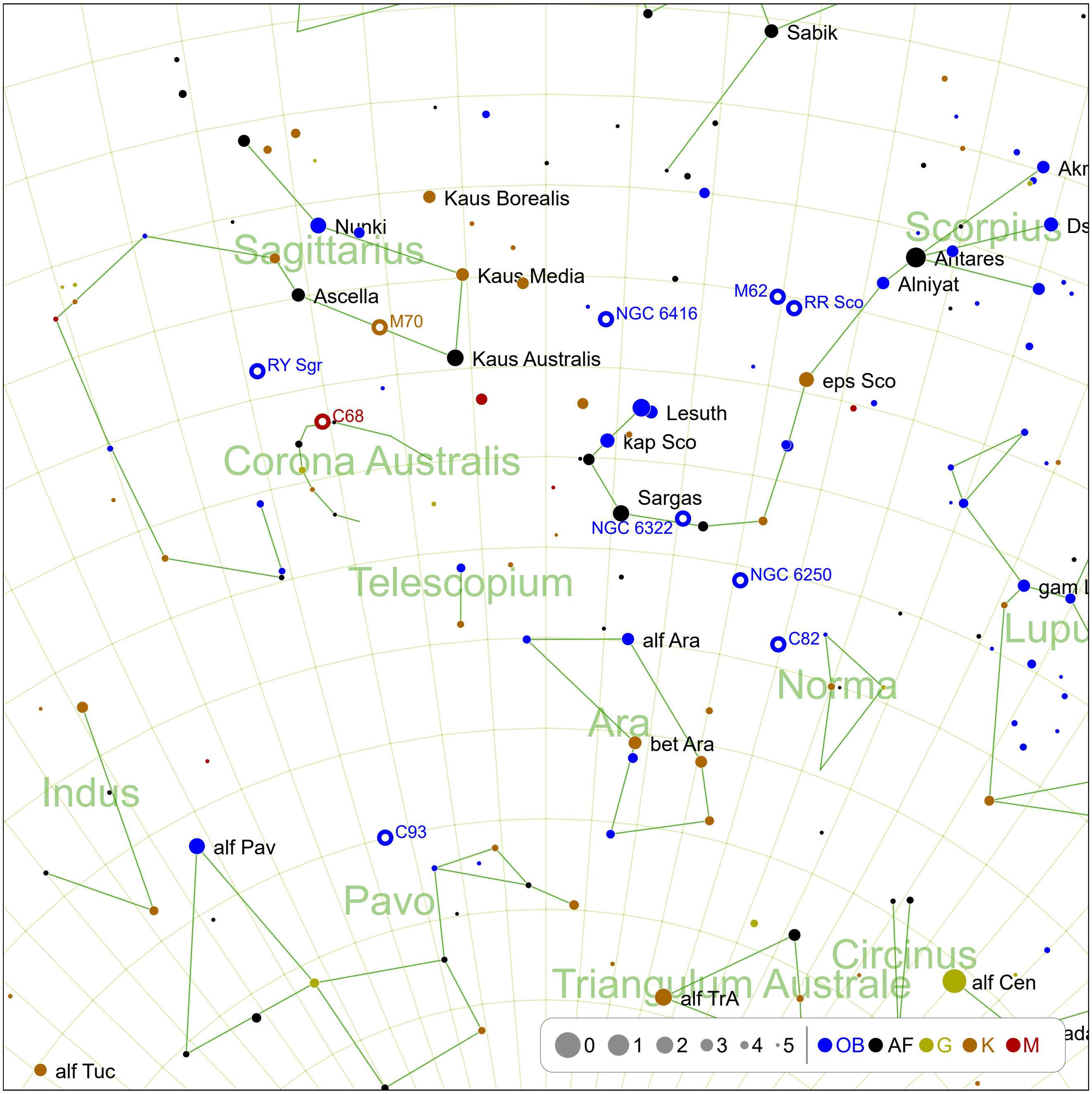
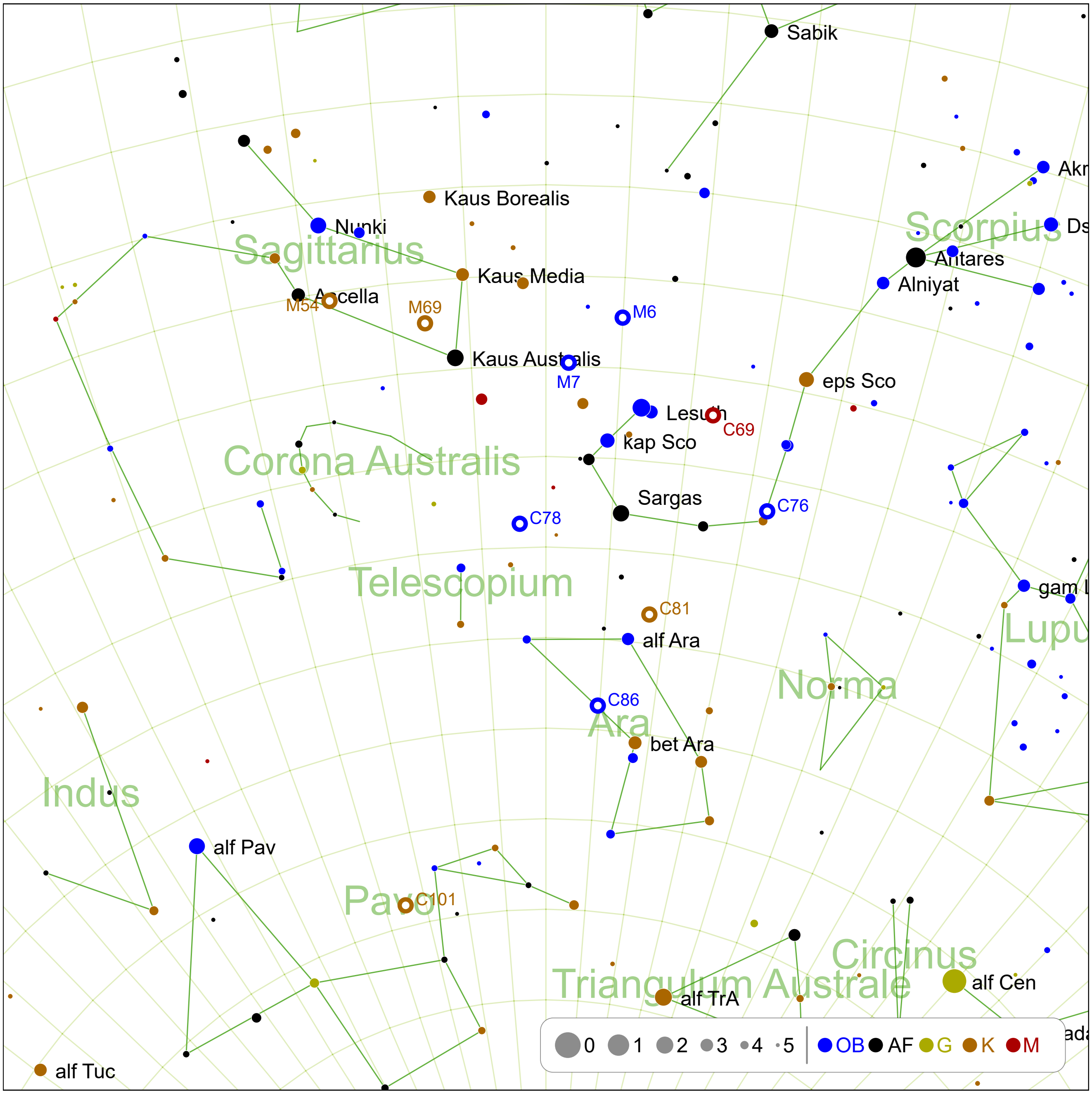
July: -45° South (1)

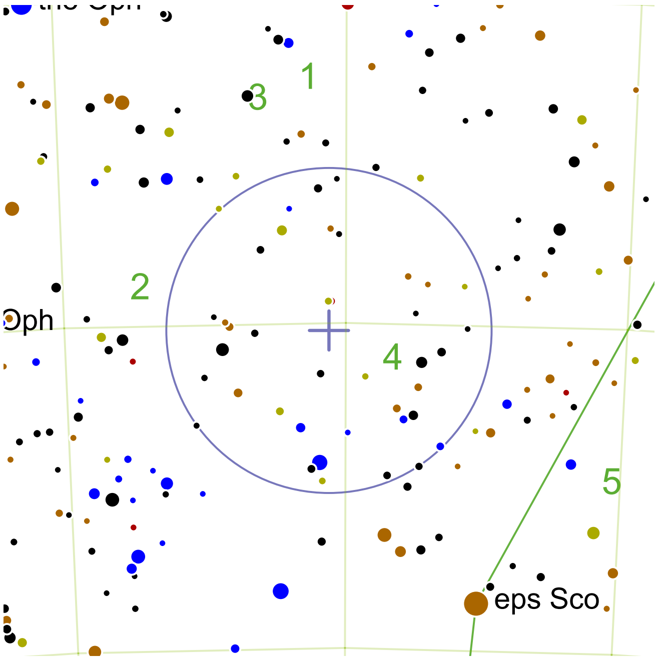


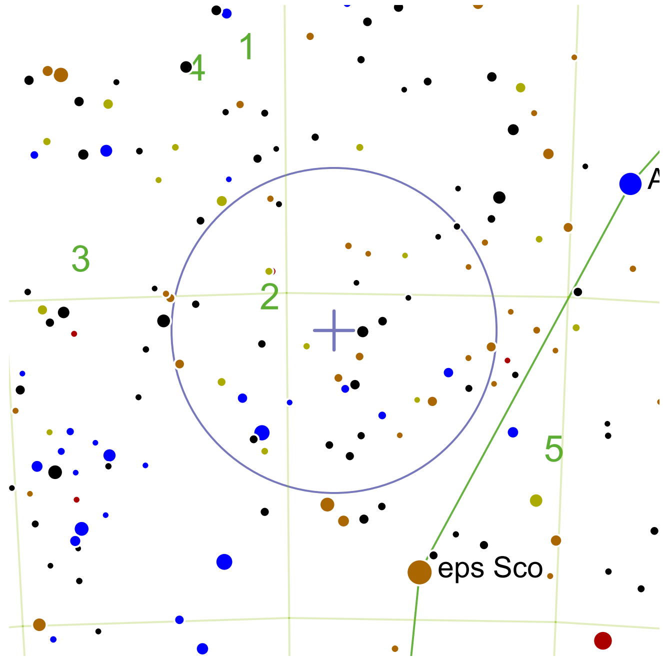
M62: page 261 | RR Sco: page 261 | NGC 6416: page 262 | M70: page 262
RY Sgr: page 263 | C68: page 263 | NGC 6322: page 264 | NGC 6250: page 264
C82: page 265 | C93: page 265

July: -45° South (2)



M54: page 266 | M6: page 266 | M69: page 267 | M7: page 267
C69: page 268 | C76: page 268 | C78: page 269 | C81: page 269
C86: page 270 | C101: page 270





M62

RA: 255.3° | 17h 1.2' — DEC: -30.12° | -30° 6'

M62 (NGC 6266) is a magnitude 6.5 globular cluster. Angular size is 14'.

4.7° NNE from mag.2.36 eps Sco.

This southern Messier is a relatively bright globular cluster, and is quite massive at 1.22 million solar masses. It is suspected to harbor an intermediate mass black hole, in the region of several thousand solar masses.

Also visible:

(1) M19 *(6.8$_m$ globular cluster)*

(2) NGC 6304 *(8.22$_m$ globular cluster)*

(3) BF Oph *(6.93$_m$ variable star)*

(4) RR Sco *(5.0$_m$ variable star)*

(5) SU Sco *(8.0$_m$ carbon star)*

RR Sco

RA: 254.16° | 16h 56.63' — DEC: -30.58° | -30° 34'

RR Sco (HD 152783) is a magnitude 5.0 variable star. Magnitude ranges from 12.4 to 5.0 (Δ mag. 7.4) with a period of 281d.

3.9° NNE from mag.2.36 eps Sco.

Just over a degree west of M62, this Mira-type variable is roughly 903 light-years from Earth.

Also visible:

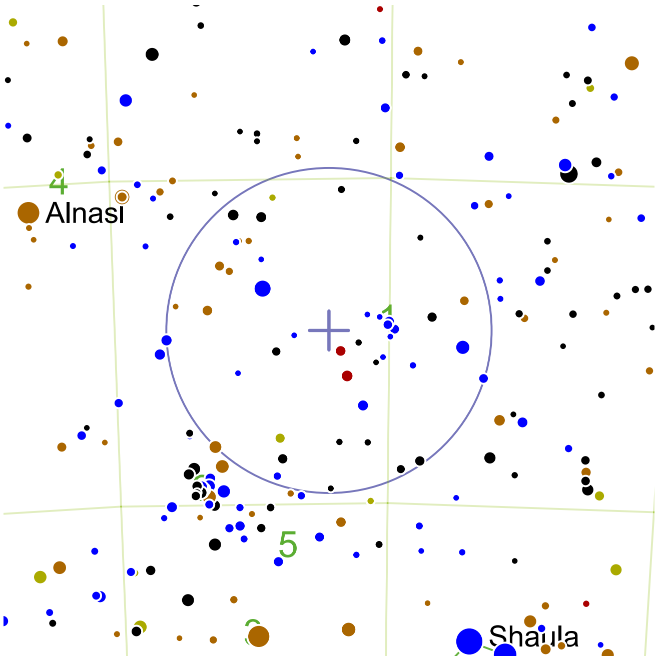
(1) M19 *(6.8$_m$ globular cluster)*

(2) M62 *(6.5$_m$ globular cluster)*

(3) NGC 6304 *(8.22$_m$ globular cluster)*

(4) BF Oph *(6.93$_m$ variable star)*

(5) SU Sco *(8.0$_m$ carbon star)*



NGC 6416

RA: 266.1° | 17h 44.4' — DEC: -32.35° | -32° 20'

NGC 6416 is a magnitude 5.7 open cluster. Angular size is 18'.

4.8° NNW from mag.3.25 G Sco.

Dwarfed by glittering M6, NGC 6416 is a bright cluster in its own right.

Also visible:

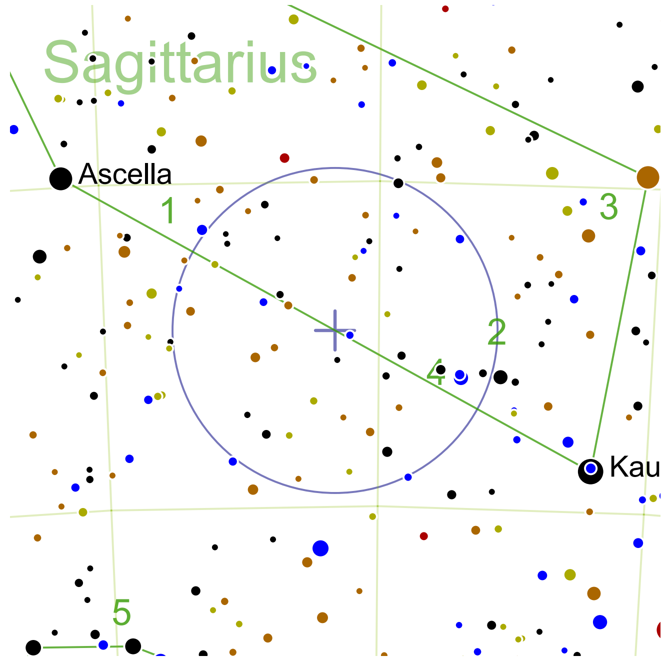
(1) M6 *(*4.2_m *open cluster)*

(2) M7 *(*3.3_m *open cluster)*

(3) NGC 6441 *(*7.15_m *globular cluster)*

(4) NGC 6522 *(*8.27_m *globular cluster)*

(5) SX Sco *(*8.5_m *carbon star)*



M70

RA: 280.8° | 18h 43.2' — DEC: -32.3° | -32° 17'

M70 (NGC 6681) is a magnitude 7.9 globular cluster. Angular size is 8'.

4.4° NEE from mag.1.95 Kaus Australis.

This cluster is close to M69 in size, luminosity and distance. In contrast to M69, M70 has a very dense core, having undergone "core collapse", where the more massive stars of the cluster have migrated closer to the center of the cluster. The cluster is approximately 29,400 light-years from Earth.

Also visible:

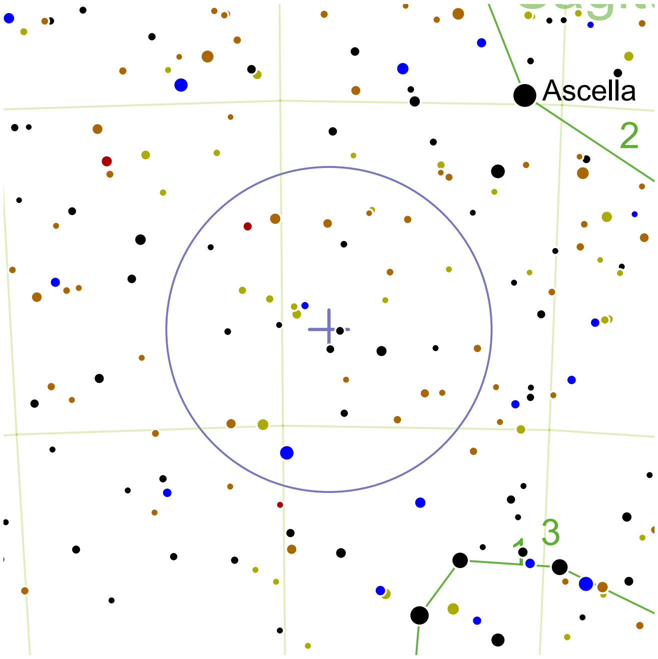
(1) M54 *(*7.6_m *globular cluster)*

(2) M69 *(*7.6_m *globular cluster)*

(3) NGC 6624 *(*7.87_m *globular cluster)*

(4) NGC 6652 *(*8.62_m *globular cluster)*

(5) NGC 6723 *(*7.01_m *globular cluster)*



RY Sgr

RA: 289.14° | 19h 16.54' — DEC: -33.52° | -33° 30'

RY Sgr (HD 180093) is a magnitude 5.8 variable star. Magnitude ranges from 14.0 to 5.8 (Δ mag. 8.2) with a period of Period.

4.6° SE from mag.2.71 Ascella.

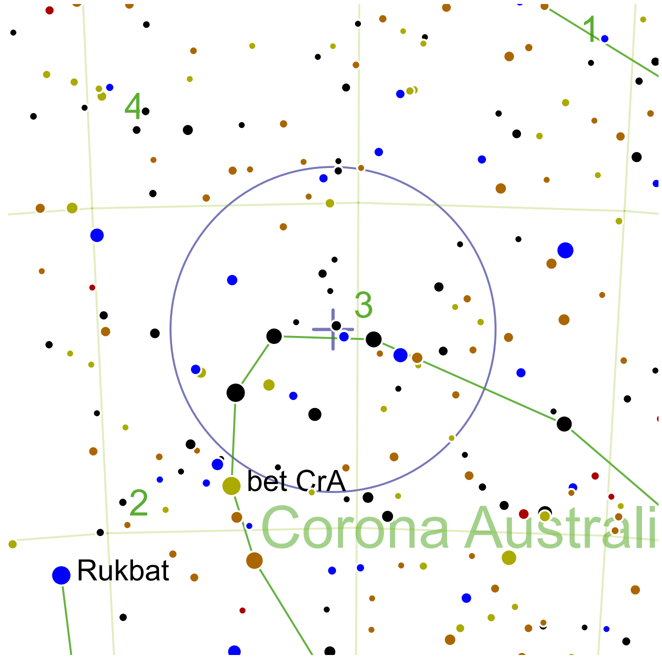
A member of the exceptionally rare R Corona Borealis class of variables, this star shows irregular, sudden and extreme drops in brightness. These stars are very deficient in hydrogen, and are believed to be the result of the merger of two white dwarfs.

Also visible:

(1) C68 *(9.7$_m$ bright nebula)*

(2) M54 *(7.6$_m$ globular cluster)*

(3) NGC 6723 *(7.01$_m$ globular cluster)*



C68

RA: 285.48° | 19h 1.9' — DEC: -36.95° | -36° 56'

C68 (NGC 6729) is a magnitude 9.7 bright nebula. Angular size is 1.0'.

7.0° S from mag.2.71 Ascella.

This bright reflection nebula is one of the closest star-forming regions to the Earth being only 400 light-years distant.

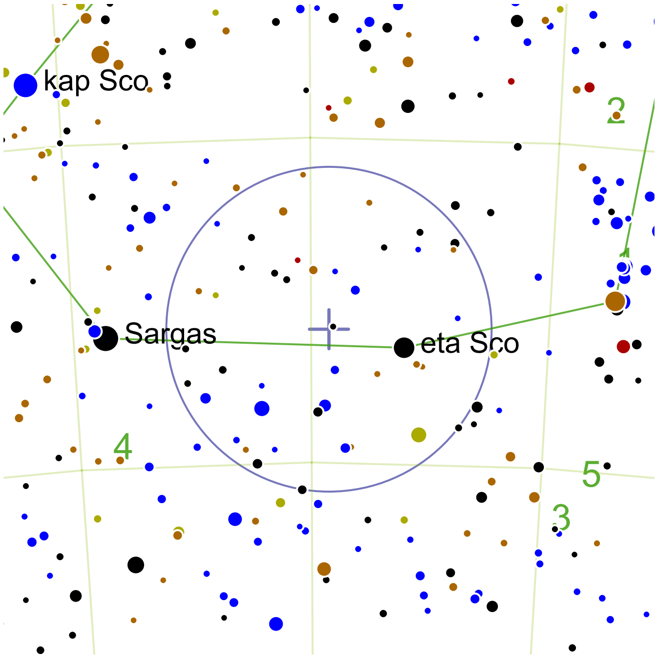
Also visible:

(1) M70 *(7.9$_m$ globular cluster)*

(2) IC 1297 *(9.8$_m$ planetary nebula)*

(3) NGC 6723 *(7.01$_m$ globular cluster)*

(4) RY Sgr *(5.8$_m$ variable star)*



NGC 6322

RA: 259.63° | 17h 18.5' — DEC: -42.95° | -42° 56'

NGC 6322 is a magnitude 6.0 open cluster. Angular size is 10'.

1.1° NEE from mag.3.44 eta Sco.

Also visible:

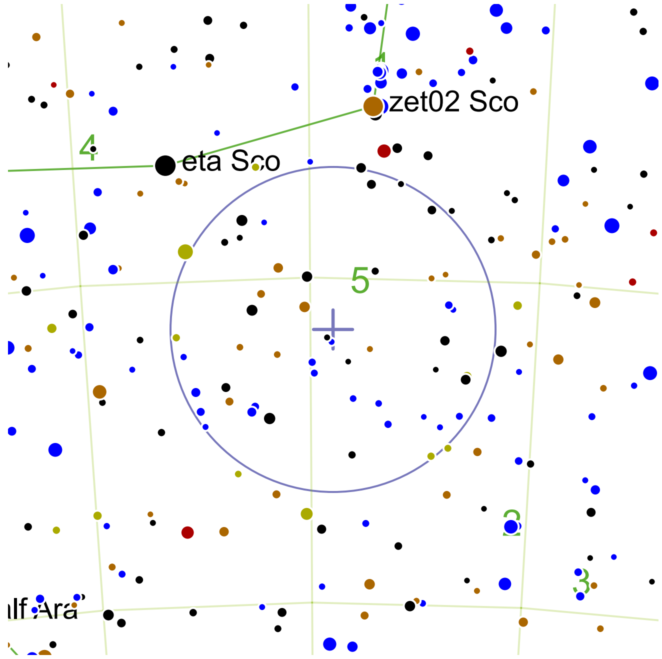
(1) C76 *(2.6$_m$ open cluster)*

(2) NGC 6242 *(6.4$_m$ open cluster)*

(3) NGC 6250 *(5.9$_m$ open cluster)*

(4) NGC 6388 *(6.72$_m$ globular cluster)*

(5) RS Sco *(6.2$_m$ variable star)*



NGC 6250

RA: 254.5° | 16h 58.0' — DEC: -45.8° | -45° 47'

NGC 6250 is a magnitude 5.9 open cluster. Angular size is 8'.

3.4° S from mag.3.75 zet02 Sco.

Aged at 14 million years, this bright, young cluster is about 2,820 light-years from Earth.

Also visible:

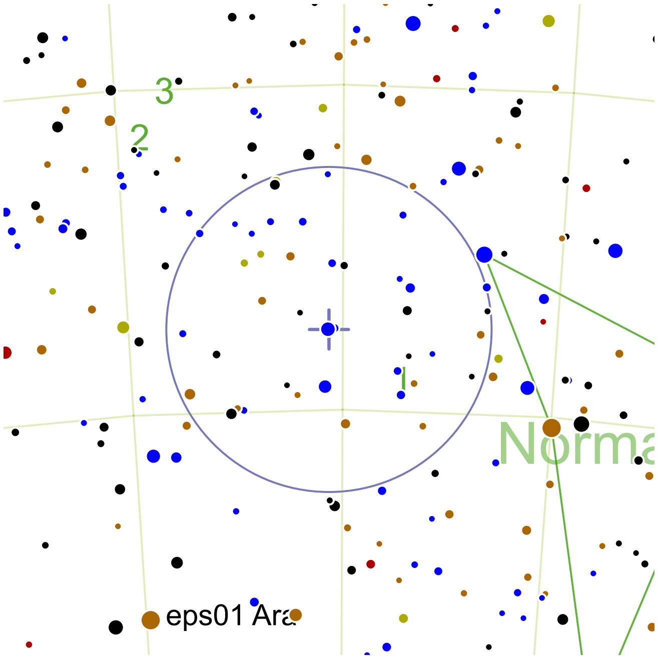
(1) C76 *(2.6$_m$ open cluster)*

(2) C82 *(5.2$_m$ open cluster)*

(3) NGC 6167 *(6.7$_m$ open cluster)*

(4) NGC 6322 *(6.0$_m$ open cluster)*

(5) RS Sco *(6.2$_m$ variable star)*



C82

RA: 250.33° | 16h 41.29' — DEC: -48.77° | -48° 45'

C82 (NGC 6193) is a magnitude 5.2 open cluster. Angular size is 15'.

6.8° SSW from mag.3.75 zet02 Sco.

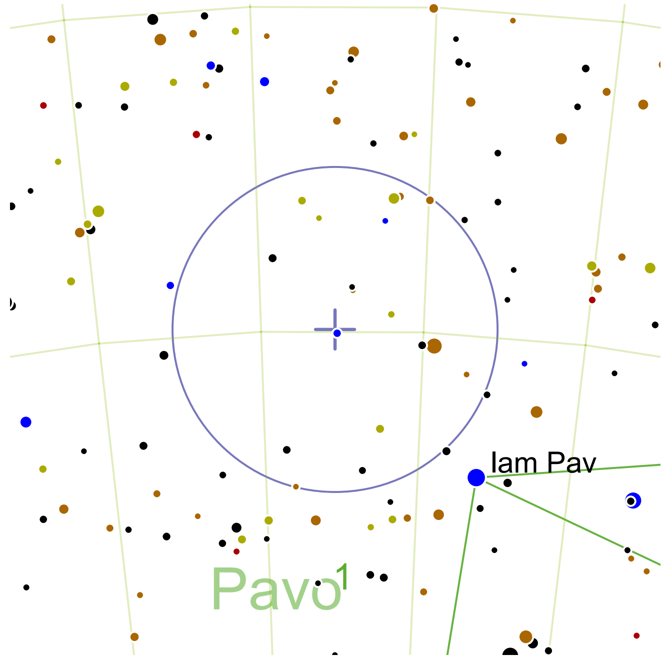
A bright open cluster, Caldwell 82 contains two O-type stars. These rare, immense stars have very short lives ending in supernovae, indicating that this cluster is very young.

Also visible:

(1) NGC 6167 *(6.7$_m$ open cluster)*

(2) NGC 6250 *(5.9$_m$ open cluster)*

(3) RS Sco *(6.2$_m$ variable star)*



C93

RA: 287.73° | 19h 10.9' — DEC: -59.98° | -59° 58'

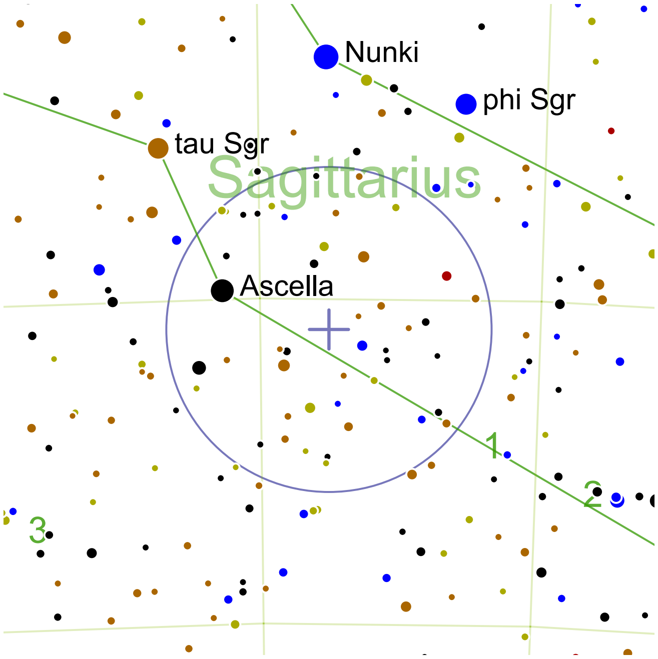
C93 (Pavo Globular Cluster, NGC 6752) is a magnitude 5.4 globular cluster. Angular size is 20'.

8.9° NW from mag.3.64 del Pav.

This globular cluster holds over 100,000 stars in a 100 light-year sphere.

Also visible:

(1) C101 *(9.0$_m$ barred spiral galaxy)*



M54

RA: 283.77° | 18h 55.09' — DEC: -30.48° | -30° 28'

M54 (NGC 6715) is a magnitude 7.6 globular cluster. Angular size is 9'.

1.7° SWW from mag.2.71 Ascella.

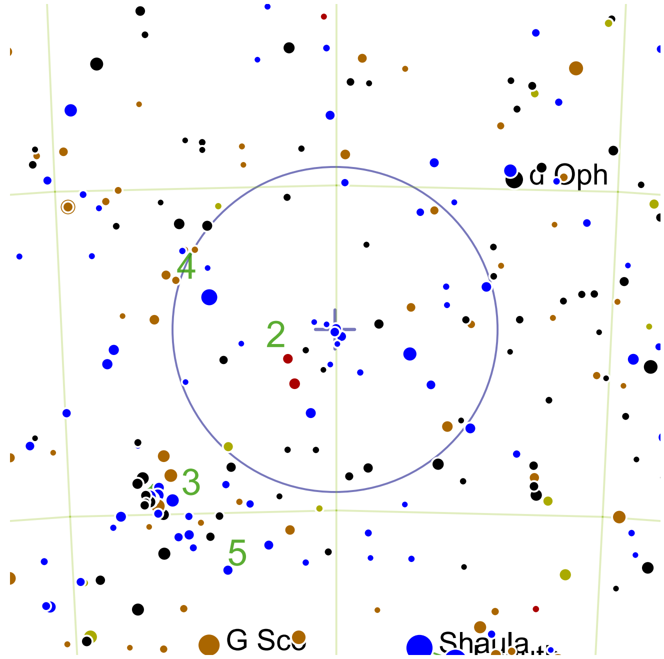
This large globular cluster is very distant at over 87,000 light-years, and it belongs to a different galaxy - the Sagittarius Dwarf Elliptical Galaxy (SagDEG). At its great distance, it is not possible to resolve the stars in this cluster. The cluster is exceptionally dense, with enhanced surface brightness in its core. There is debate as to whether M54 is a true globular cluster or is in fact SagDEG's core.

Also visible:

(1) M70 *(7.9$_m$ globular cluster)*

(2) NGC 6652 *(8.62$_m$ globular cluster)*

(3) RY Sgr *(5.8$_m$ variable star)*



M6

RA: 265.02° | 17h 40.09' — DEC: -32.22° | -32° 12'

M6 (Butterfly Cluster, NGC 6405) is a magnitude 4.2 open cluster. Angular size is 25'.

5.0° NNE from mag.1.71 Shaula.

A bright, naked-eye cluster rich with many stars of varying brightness. The brightest star in this cluster is BM Scorpii, varying semi-regularly between magnitude 5.5 and 7.0 over a period of roughly 800 days.

Also visible:

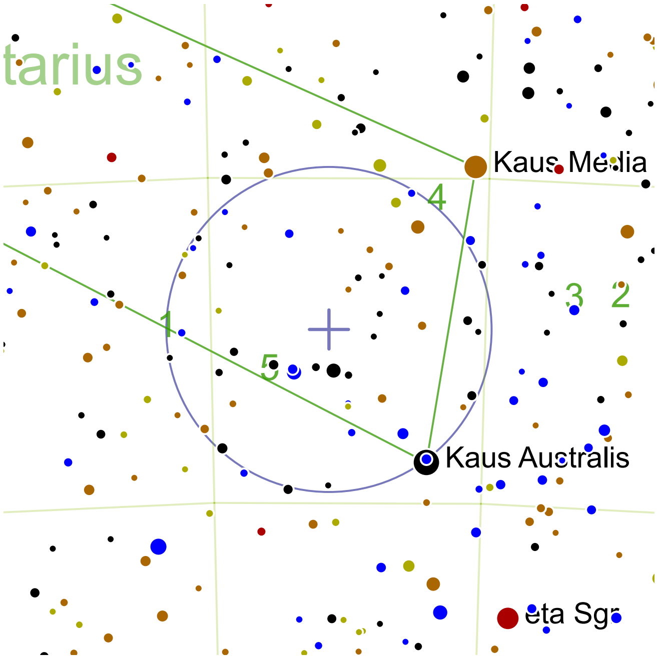
(1) M7 *(3.3$_m$ open cluster)*

(2) NGC 6416 *(5.7$_m$ open cluster)*

(3) NGC 6453 *(10.08$_m$ globular cluster)*

(4) Terzan 6 *(13.85$_m$ globular cluster)*

(5) SX Sco *(8.5$_m$ carbon star)*



M69

RA: 277.85° | 18h 31.4' — DEC: -32.35° | -32° 20'

M69 (NGC 6637) is a magnitude 7.6 globular cluster. Angular size is 7'.

2.5° NE from mag.1.95 Kaus Australis.

This is a very metal-rich globular cluster meaning the gas that formed the cluster was enriched by heavier elements ejected by previous generations of stars. With Messier 69 centered in the finder scope, another globular is just over a degree to the southeast (NGC 6637, mag. 8.3), while Messier 70 is 2.5 degrees due east.

Also visible:

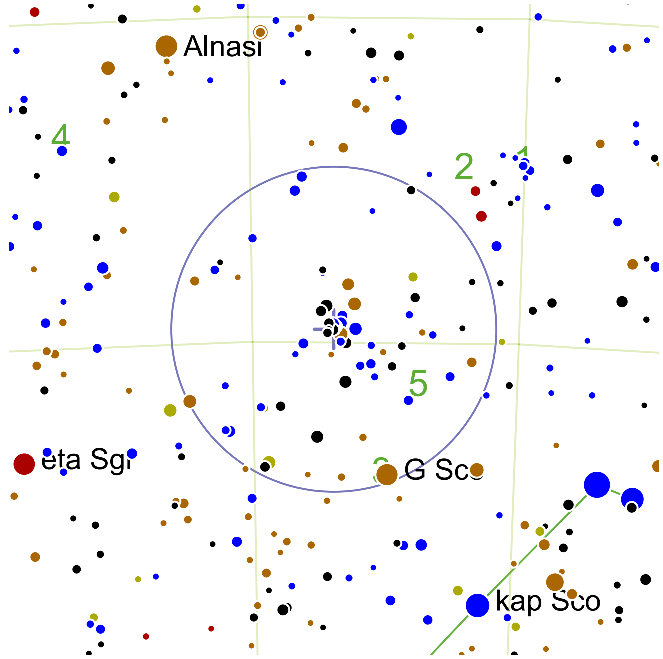
(1) M70 *(7.9$_m$ globular cluster)*

(2) NGC 6558 *(9.26$_m$ globular cluster)*

(3) NGC 6569 *(8.55$_m$ globular cluster)*

(4) NGC 6624 *(7.87$_m$ globular cluster)*

(5) NGC 6652 *(8.62$_m$ globular cluster)*



M7

RA: 268.48° | 17h 53.9' — DEC: -34.82° | -34° 48'

M7 (Ptolemy's Cluster, NGC 6475) is a magnitude 3.3 open cluster. Angular size is 80'.

2.3° NNE from mag.3.25 G Sco.

The Messier object furthest south, M7 was first described 130 AD by Ptolemy. Giovanni Batista Hodierna counted 30 stars in 1654. The cluster spans 25 light-years and lies at a distance of nearly 1,000 light-years.

Also visible:

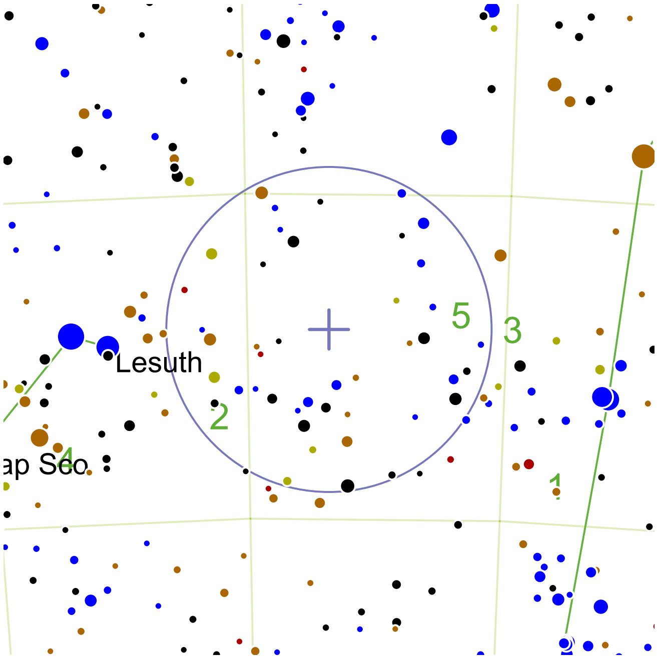
(1) M6 *(4.2$_m$ open cluster)*

(2) NGC 6416 *(5.7$_m$ open cluster)*

(3) NGC 6441 *(7.15$_m$ globular cluster)*

(4) NGC 6569 *(8.55$_m$ globular cluster)*

(5) SX Sco *(8.5$_m$ carbon star)*



C69

RA: 258.43° | 17h 13.7' — DEC: -37.1° | -37° 5'

C69 (Bug Nebula, NGC 6302) is a magnitude 12.8 planetary nebula. Angular size is 0.8'.

3.4° W from mag.2.8 Lesuth.

This complex planetary nebula was formed in several outbursts from the central star over the past 5000 years. The central star is extremely faint and was first observed with the Hubble Space Telescope in 2009.

Also visible:

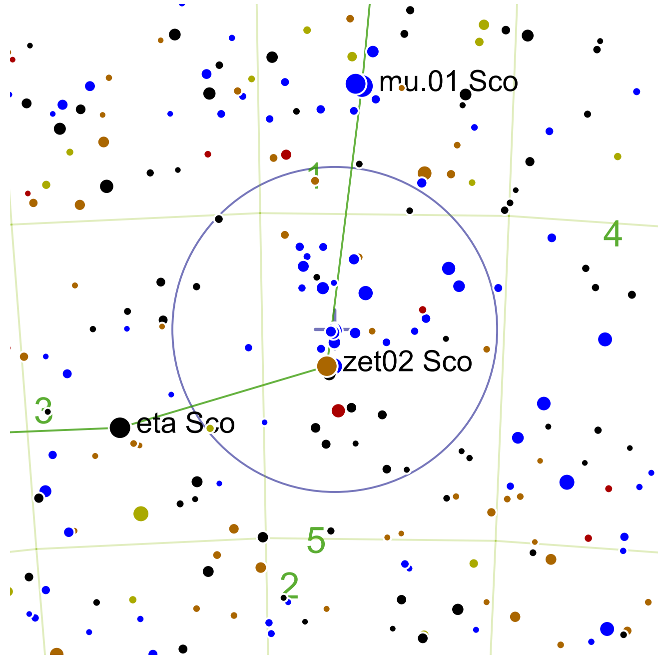
(1) NGC 6242 *(6.4$_m$ open cluster)*

(2) NGC 6337 *(12.0$_m$ planetary nebula)*

(3) NGC 6256 *(11.29$_m$ globular cluster)*

(4) NGC 6380 *(11.31$_m$ globular cluster)*

(5) RT Sco *(7.0$_m$ variable star)*



C76

RA: 253.5° | 16h 54.0' — DEC: -41.8° | -41° 47'

C76 (Northern Jewel Box, NGC 6231) is a magnitude 2.6 open cluster. Angular size is 15'.

0.5° NNW from mag.3.75 zet02 Sco.

This brilliant naked-eye cluster can be easily admired under any conditions with any telescope. Under dark skies, this cluster appears to form the head of a "False Comet", with the tail formed by the clusters Collinder 316 and Trumpler 24.

Also visible:

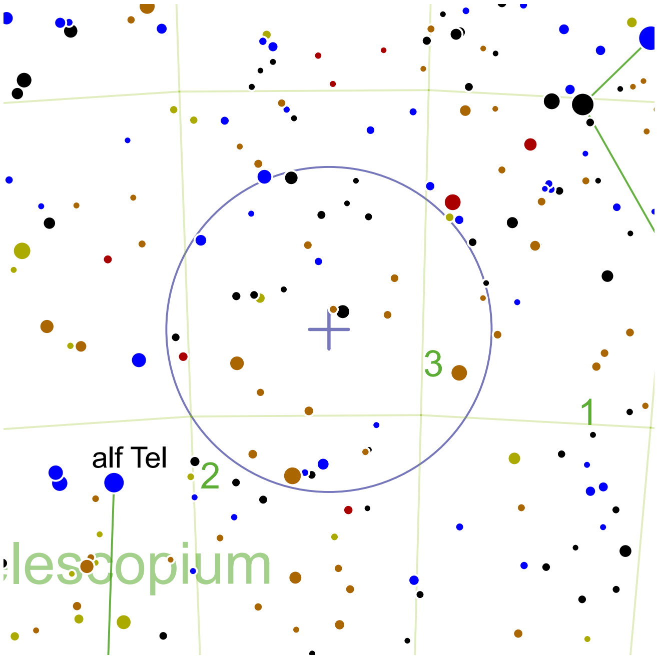
(1) NGC 6242 *(6.4$_m$ open cluster)*

(2) NGC 6250 *(5.9$_m$ open cluster)*

(3) NGC 6322 *(6.0$_m$ open cluster)*

(4) NGC 6153 *(11.0$_m$ planetary nebula)*

(5) RS Sco *(6.2$_m$ variable star)*



C78

RA: 272.0° | 18h 8.0' — DEC: -43.7° | -43° 41'

C78 (Cacciatore Cluster, NGC 6541) is a magnitude 6.6 globular cluster. Angular size is 13'.

4.0° NWW from mag.3.76 alf Tel.

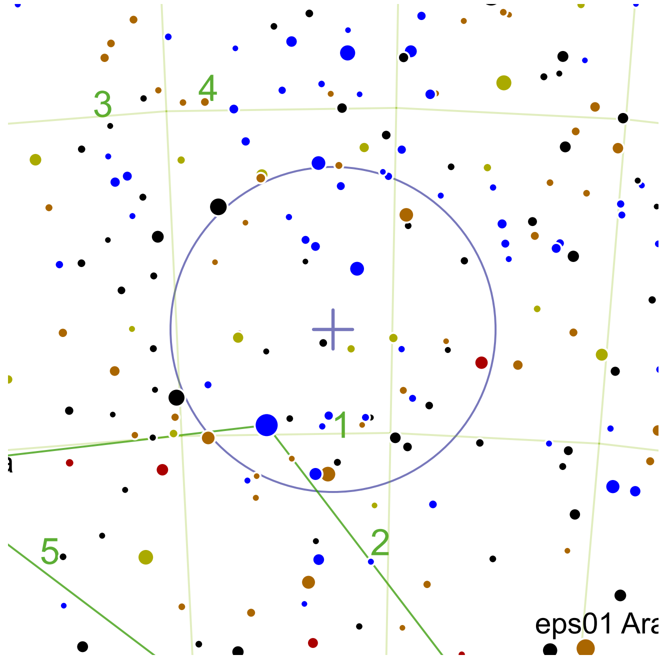
A bright globular cluster with the mass of half a million Suns, it is possible to resolve the stars in this cluster with a moderately-sized telescope.

Also visible:

(1) IC 4663 *(12.5$_m$ planetary nebula)*

(2) IC 4699 *(12.5$_m$ planetary nebula)*

(3) NGC 6496 *(8.54$_m$ globular cluster)*



C81

RA: 261.38° | 17h 25.5' — DEC: -48.42° | -48° 24'

C81 (NGC 6352) is a magnitude 8.1 globular cluster. Angular size is 7'.

1.7° NW from mag.2.97 alf Ara.

A loose globular cluster. The member stars can be resolved with moderately sized telescopes.

Also visible:

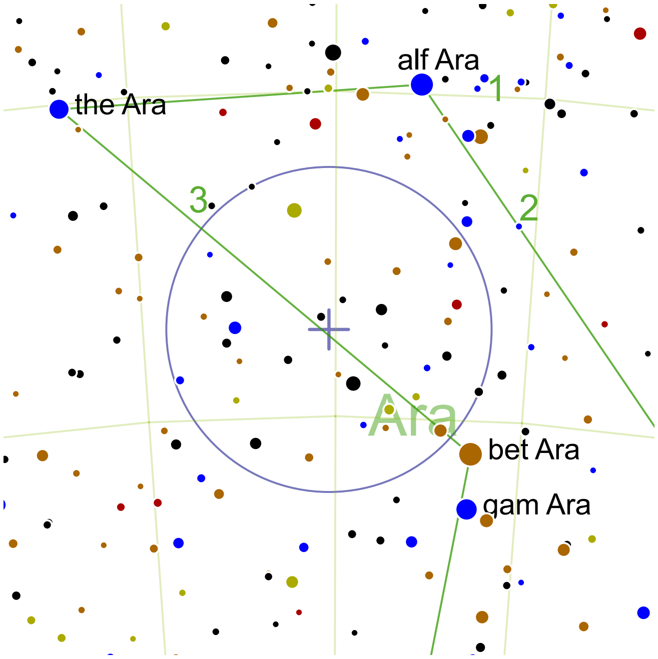
(1) IC 4651 *(6.9$_m$ open cluster)*

(2) NGC 6326 *(11.5$_m$ planetary nebula)*

(3) IC 4663 *(12.5$_m$ planetary nebula)*

(4) NGC 6388 *(6.72$_m$ globular cluster)*

(5) U Ara *(7.7$_m$ variable star)*



C86

RA: 265.18° | 17h 40.7' — DEC: -53.67° | -53° 39'

C86 (NGC 6397) is a magnitude 5.6 globular cluster. Angular size is 26'.

2.9° NE from mag.2.8 bet Ara.

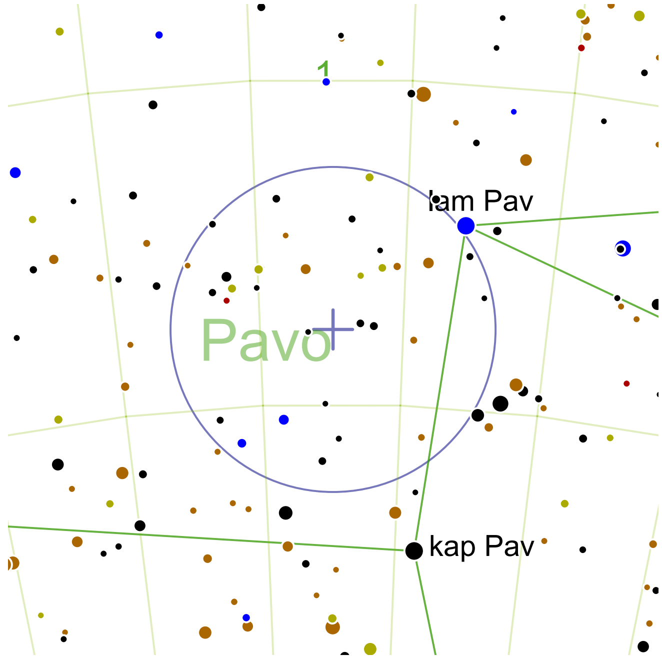
Relatively close at only 7,800 light-years, Caldwell 86 was close enough to have it's distance accurately measured by parallax by the Hubble Space Telescope. This in turn allowed an accurate estimate of age at 13.4 billion years, very nearly as old at the universe. Being relatively close, amateur instruments can more easily resolve its member stars.

Also visible:

(1) IC 4651 *(6.9$_m$ open cluster)*

(2) NGC 6326 *(11.5$_m$ planetary nebula)*

(3) U Ara *(7.7$_m$ variable star)*



C101

RA: 287.45° | 19h 9.79' — DEC: -63.85° | -63° 50'

C101 (NGC 6744) is a magnitude 9.0 barred spiral galaxy. Angular size is 16x10'.

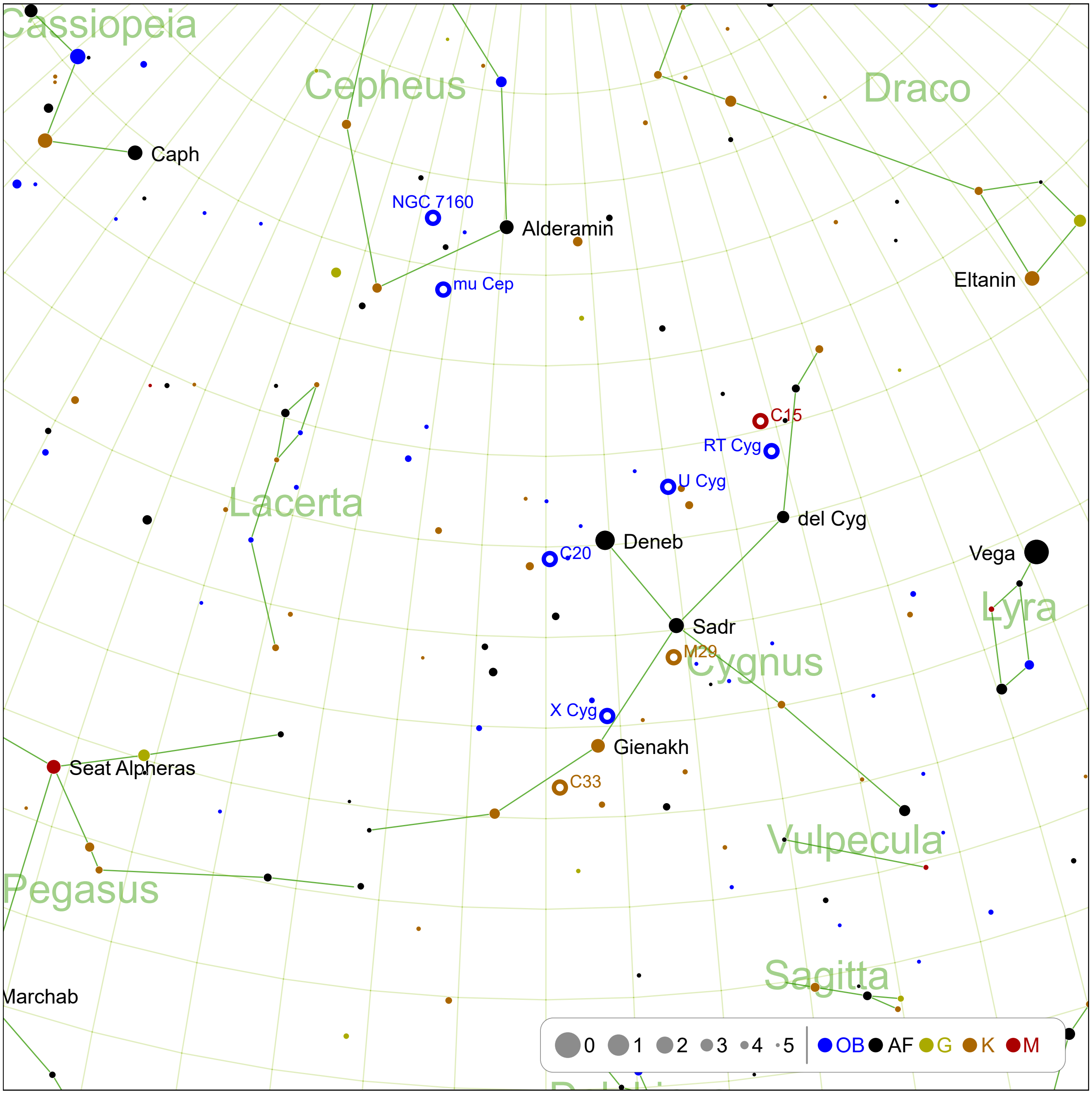
6.5° NWW from mag.3.64 del Pav.

Discovered in 1826 by James Dunlop, this galaxy is relatively close (at 30 million light-years distance) and the bright core is easily seen in smaller telescopes. Dark skies and larger telescopes can reveal the dim extended disk.

Also visible:

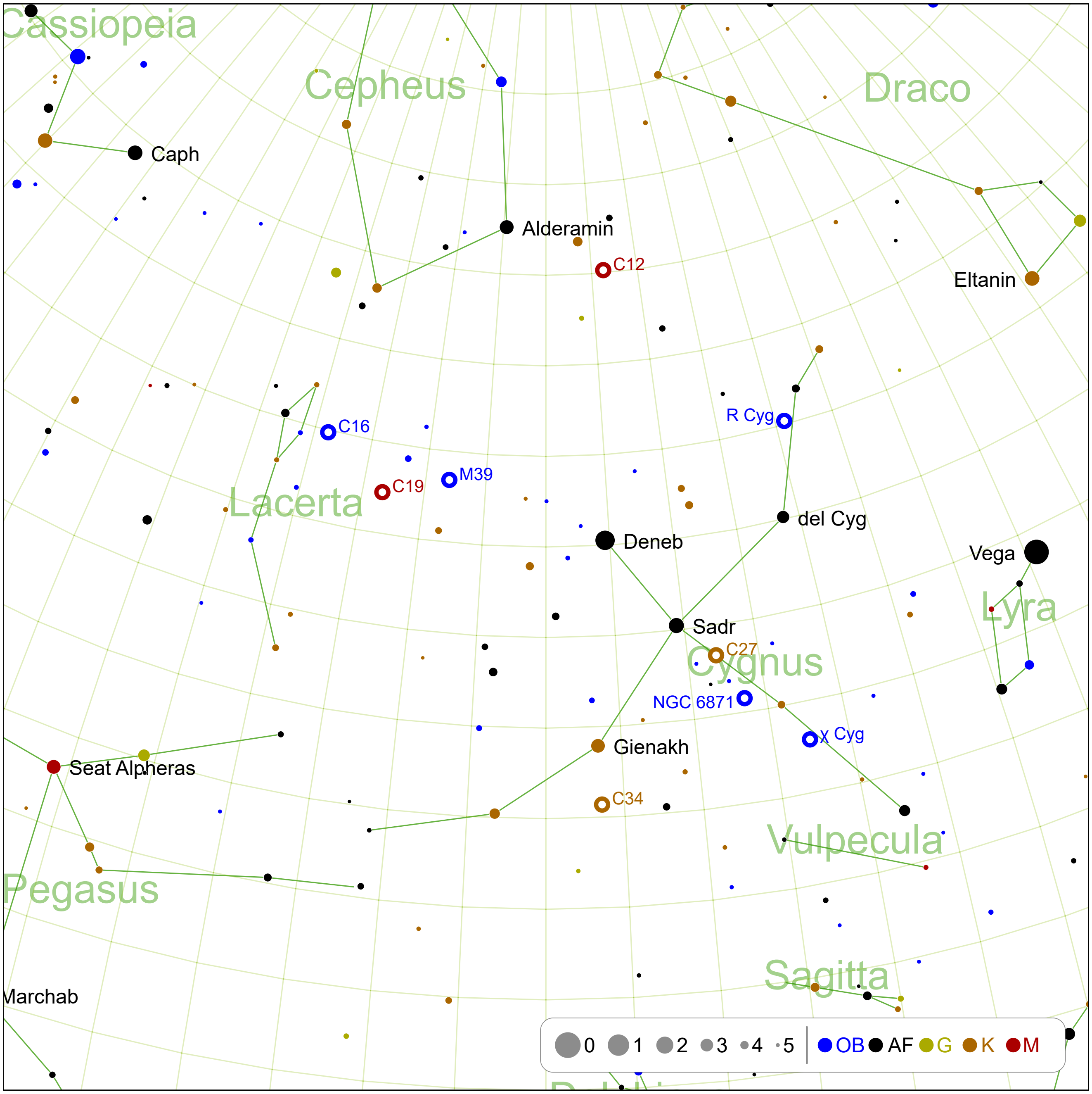
(1) C93 *(5.4$_m$ globular cluster)*

August: 45° North (1)

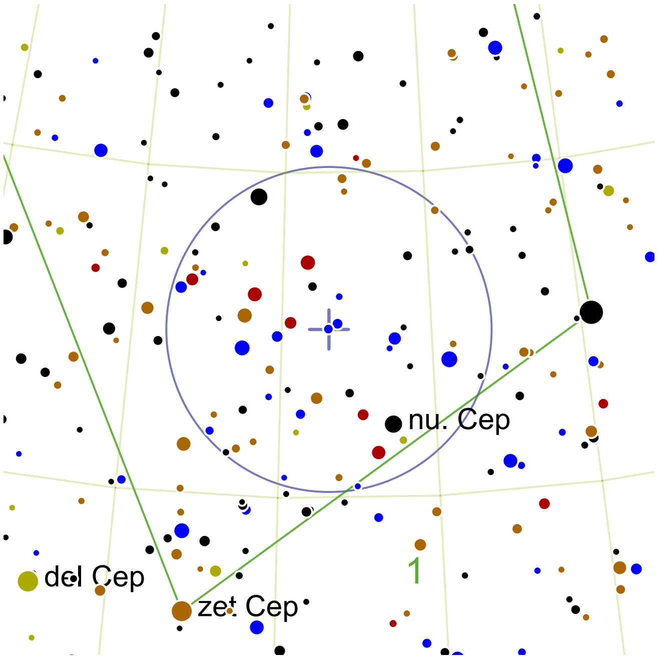


NGC 7160: page 273	mu Cep: page 273	C15: page 274	RT Cyg: page 274
U Cyg: page 275	C20: page 275	M29: page 276	X Cyg: page 276
C33: page 277			

August: 45° North (2)



C12: page 277	R Cyg: page 278	C16: page 278	M39: page 279
C19: page 279	C27: page 280	NGC 6871: page 280	χ Cyg: page 281
C34: page 281			



NGC 7160

RA: 328.43° | 21h 53.7' — DEC: 62.6° | 62° 36'

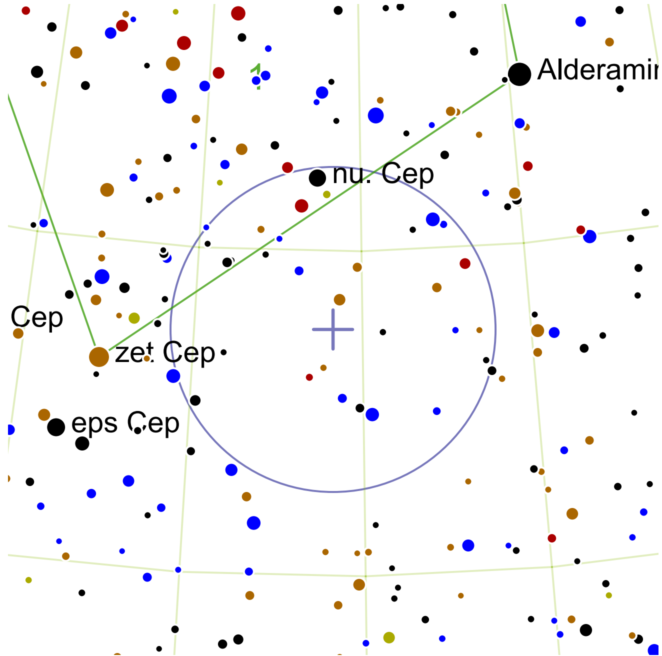
NGC 7160 is a magnitude 6.1 open cluster. Angular size is 7'.

4.0° E from mag.2.6 Alderamin.

This young cluster is aged less than 19 million years old and is about 2,570 light-years from Earth. The cluster is within the Cepheus bubble, a 10 degree wide shell of dust.

Also visible:

(1) mu Cep *(3.7$_m$ carbon star)*



mu Cep

RA: 325.88° | 21h 43.5' — DEC: 58.8° | 58° 48'

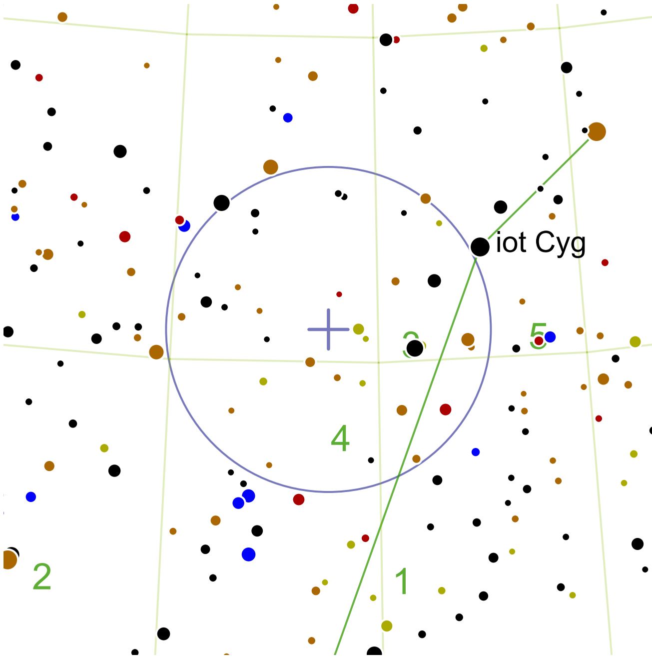
mu Cep (Garnet Star, NGC 206936) is a magnitude 3.7 carbon star. Magnitude ranges from 5.0 to 3.7 (Δ mag. 1.3).

3.6° NWW from mag.3.62 zet Cep.

The famed Garnet Star was one of the first carbon stars to be observed, and was named by William Herschel. This red hypergiant (B-V color index: 2.24) is so vast that it would encompass Jupiter's orbit if it were our sun. The absolute magnitude of this star is -7.6. Recent Gaia data places this star 3,060 light years from Earth.

Also visible:

(1) NGC 7160 *(6.1$_m$ open cluster)*



C15

RA: 296.2° | 19h 44.79' — DEC: 50.52° | 50° 31'

C15 (Blinking Planetary, NGC 6826) is a magnitude 9.8 planetary nebula. Angular size is 0.5'.

2.6° SEE from mag.3.94 iot Cyg.

This bright planetary nebula is most easily seen using averted vision, leading to the illusion that the object blinks into view.

Also visible:

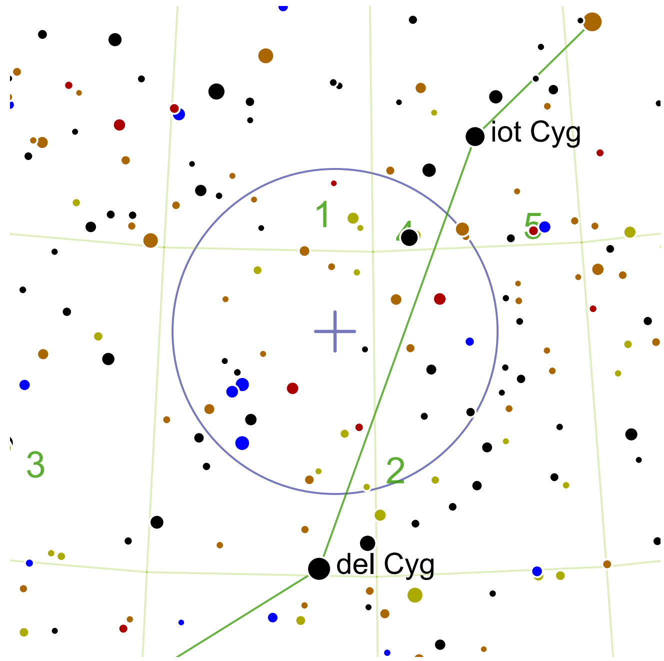
(1) NGC 6811 *(6.8_m open cluster)*

(2) NGC 6884 *(12.5_m planetary nebula)*

(3) R Cyg *(6.1_m variable star)*

(4) RT Cyg *(6.0_m variable star)*

(5) CH Cyg *(5.6_m variable star)*



RT Cyg

RA: 295.91° | 19h 43.62' — DEC: 48.78° | 48° 47'

RT Cyg (HD 186686) is a magnitude 6.0 variable star. Magnitude ranges from 13.1 to 6.0 (Δ mag. 7.1) with a period of 190d.

3.6° N from mag.2.97 del Cyg.

This moderately red pulsating giant shares the finder circle with two planetary nebulae. NGC 6833 is one degree to the east, while Caldwell 15 is two degrees to the north.

Also visible:

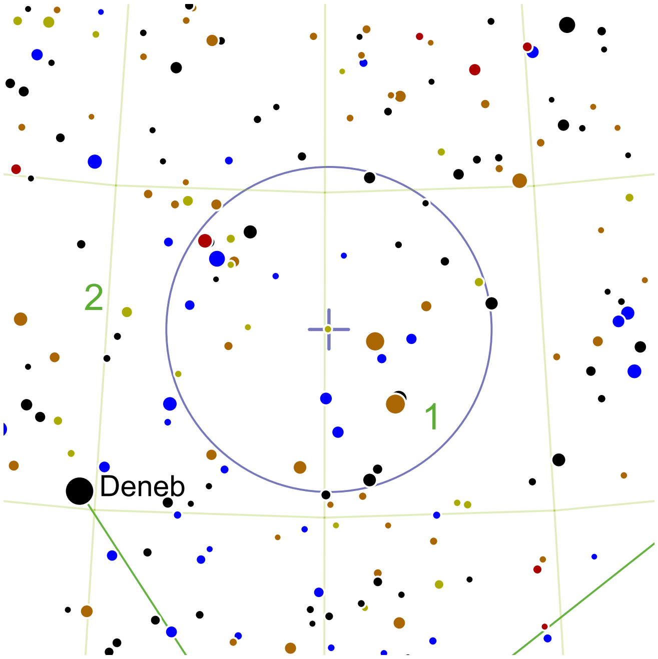
(1) C15 *(9.8_m planetary nebula)*

(2) NGC 6811 *(6.8_m open cluster)*

(3) NGC 6884 *(12.5_m planetary nebula)*

(4) R Cyg *(6.1_m variable star)*

(5) CH Cyg *(5.6_m variable star)*



U Cyg

RA: 304.9° | 20h 19.6' — DEC: 47.89° | 47° 54'

U Cyg (HD 193680) is a magnitude 5.9 variable star. Magnitude ranges from 12.1 to 5.9 (Δ mag. 6.2) with a period of 463d.

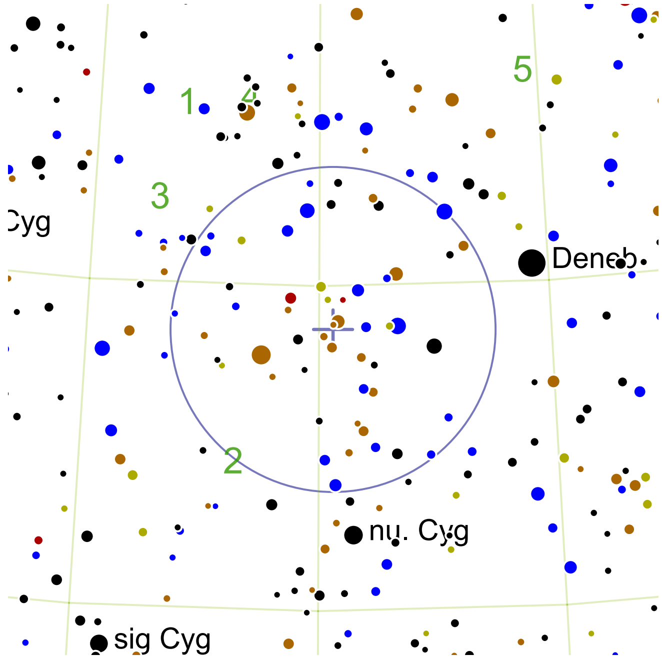
1.5° NE from mag.3.95 192578.

This extremely red carbon star has a B-V color index of 3.31 and a spectral type of C9,2e.

Also visible:

(1) NGC 6884 *(12.5_m planetary nebula)*

(2) V Cyg *(7.8_m carbon star)*



C20

RA: 314.7° | 20h 58.79' — DEC: 44.33° | 44° 20'

C20 (North America Nebula, NGC 7000) is a magnitude 6.0 bright nebula. Angular size is 120x100'.

1.1° NWW from mag.3.92 ksi Cyg.

A very difficult, if not entirely impossible, target for visual observers in light-polluted surroundings. Described by both William Herschel and his son John as "faint", the resemblance to the North American continent was a photographic discovery.

Also visible:

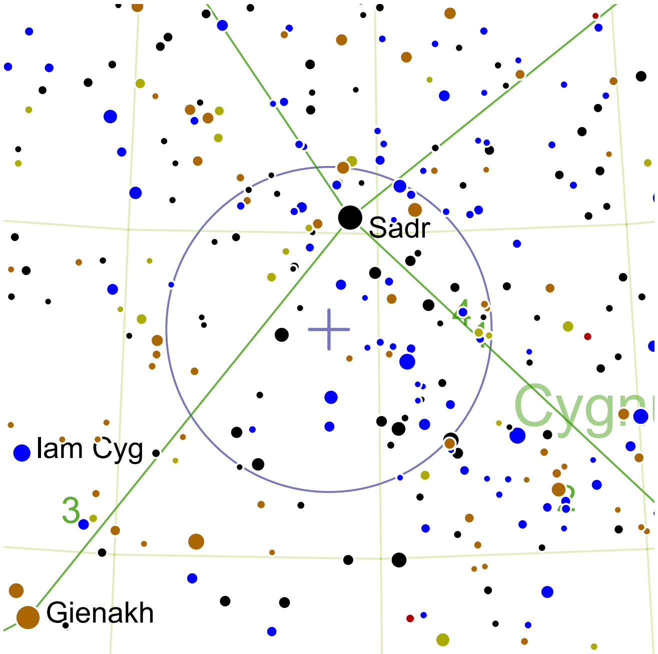
(1) IC 1369 *(6.8_m open cluster)*

(2) NGC 7027 *(9.0_m planetary nebula)*

(3) NGC 7048 *(11.5_m planetary nebula)*

(4) NGC 7026 *(12.0_m planetary nebula)*

(5) V Cyg *(7.8_m carbon star)*



M29

RA: 305.98° | 20h 23.9' — DEC: 38.53° | 38° 32'

M29 (NGC 6913) is a magnitude 7.1 open cluster. Angular size is 7'.

1.7° S from mag.2.32 Sadr.

A fairly bright open cluster with perhaps 20 bright member stars, this cluster is around 13 million years old.

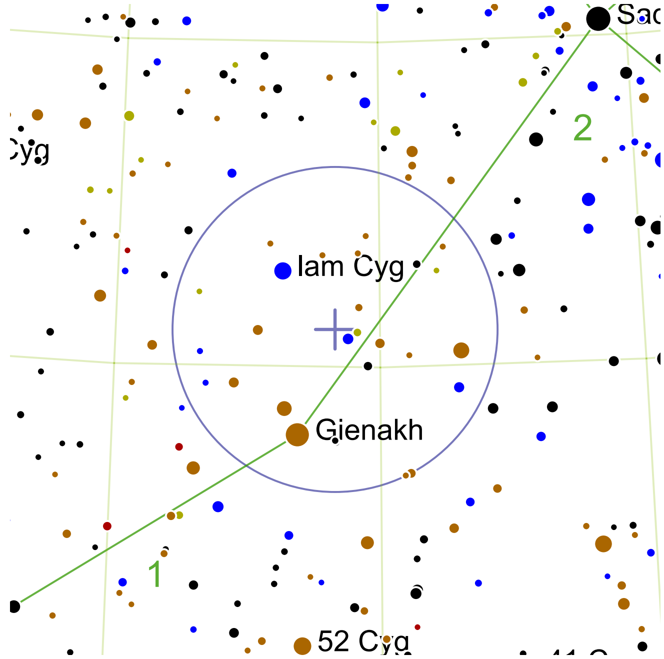
Also visible:

(1) C27 *(7.5_m bright nebula)*

(2) NGC 6871 *(5.2_m open cluster)*

(3) X Cyg *(5.85_m variable star)*

(4) RS Cyg *(6.6_m carbon star)*



X Cyg

RA: 310.85° | 20h 43.4' — DEC: 35.59° | 35° 35'

X Cyg (HD 197572) is a magnitude 5.85 variable star. Magnitude ranges from 6.91 to 5.85 (Δ mag. 1.1) with a period of 16.38633d.

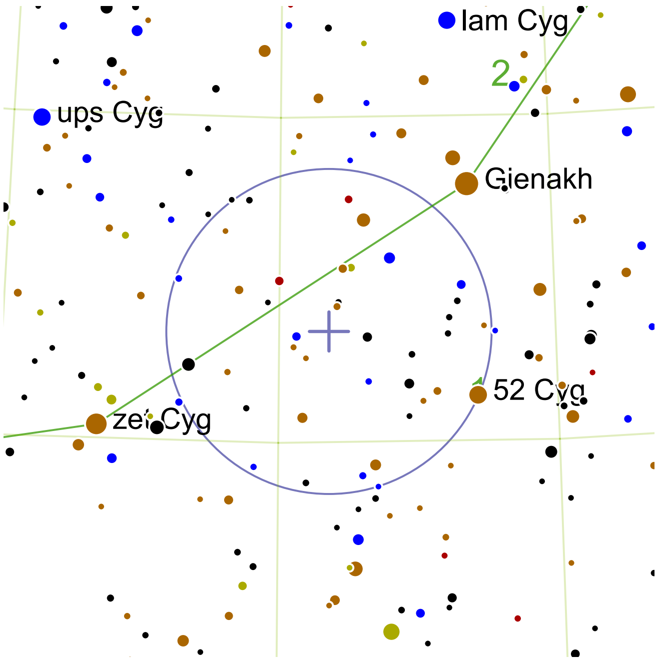
1.7° NNW from mag.2.64 Gienakh.

This bright Cepheid variable has a moderate range with a bright minimum over a relatively short period. The extremely regular change in brightness can be followed with a pair of binoculars. Its distance is estimated 3,623 light-years.

Also visible:

(1) C33 *(8.0_m supernova remnant)*

(2) M29 *(7.1_m open cluster)*



C33

RA: 314.1° | 20h 56.4' — DEC: 31.72° | 31° 43'

C33 (East Veil Nebula, NGC 6992/5) is a magnitude 8.0 supernova remnant. Angular size is 60x8'.

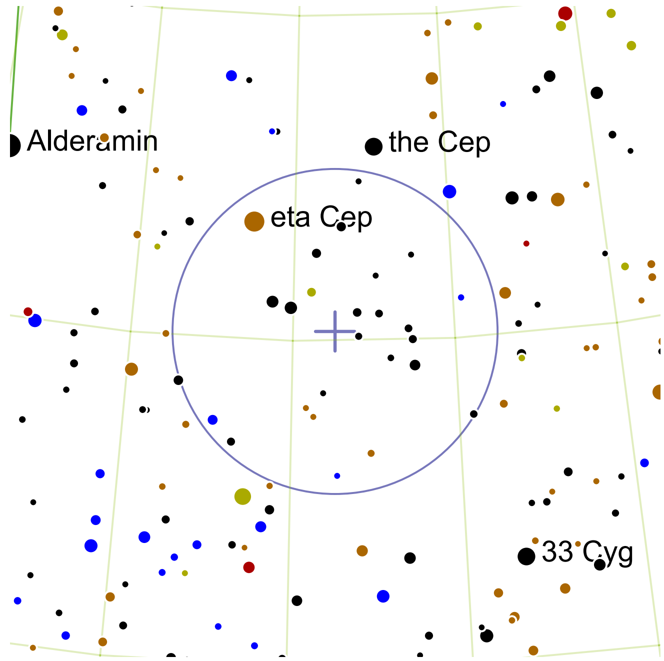
3.1° SE from mag.2.64 Gienakh.

The Eastern Veil nebula is an extensive fragment of a supernova remnant. Although fairly bright, it is a widely extended object so the best chance of viewing it is with a nebula filter such as an OIII filter, which will block all light except the wavelengths emitted by the glowing nebula. Because of its size, the nebula is best viewed in very small, widefield telescopes.

Also visible:

(1) C34 *(8.0$_m$ supernova remnant)*

(2) X Cyg *(5.85$_m$ variable star)*



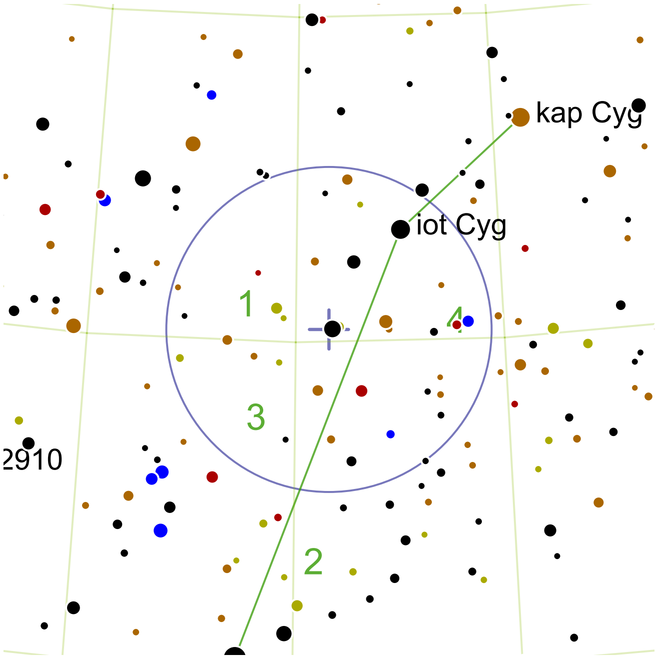
C12

RA: 308.7° | 20h 34.79' — DEC: 60.15° | 60° 9'

C12 (NGC 6946) is a magnitude 9.7 spiral galaxy. Angular size is 12x10'.

2.0° SW from mag.3.59 eta Cep.

A bright face-on spiral galaxy. Because the galaxy is seen face on, the spiral arms are dimmer, but the core remains bright. The galaxy is known as the Fireworks Galaxy as it frequently hosts supernovae (1917, 1939, 1948, 1968, 1969, 1980, 2002, 2004, 2008, and 2017).



R Cyg

RA: 294.21° | 19h 36.82' — DEC: 50.2° | 50° 12'

R Cyg (HD 185456) is a magnitude 6.1 variable star. Magnitude ranges from 14.4 to 6.1 (Δ mag. 8.3) with a period of 426d.

1.8° SE from mag.3.94 iot Cyg.

This star shows a strong phenomenon of period doubling, where the maxima alternate between roughly magnitude 7 and 8, so the period of the star can be considered twice the stated period.

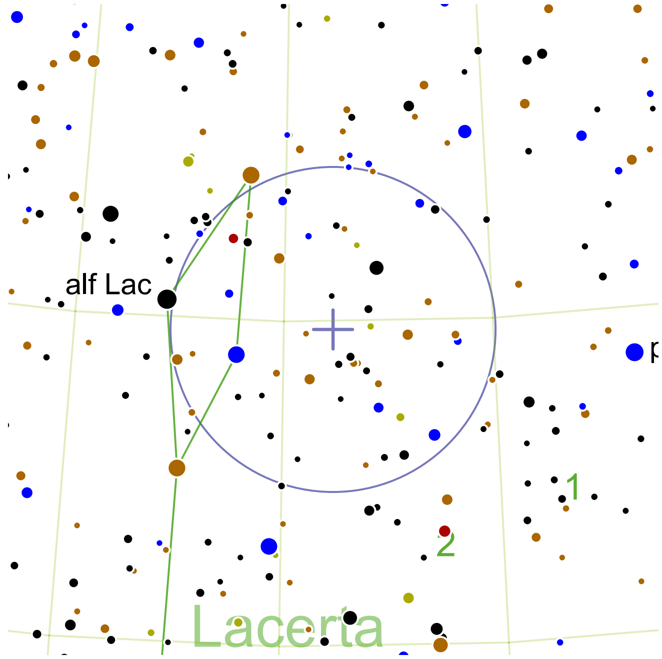
Also visible:

(1) C15 *(9.8$_m$ planetary nebula)*

(2) NGC 6811 *(6.8$_m$ open cluster)*

(3) RT Cyg *(6.0$_m$ variable star)*

(4) CH Cyg *(5.6$_m$ variable star)*



C16

RA: 333.83° | 22h 15.29' — DEC: 49.88° | 49° 53'

C16 (NGC 7243) is a magnitude 6.4 open cluster. Angular size is 21'.

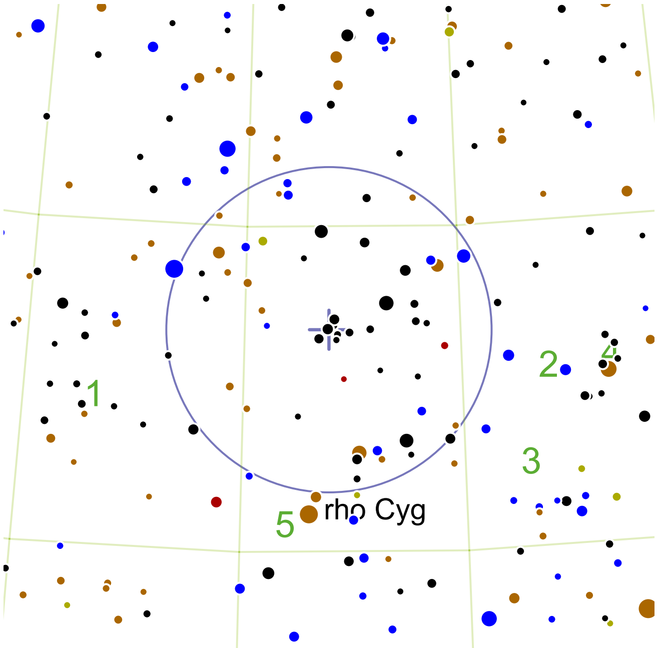
Roughly halfway between Caph and Deneb, the cluster is pointed to by the line from Navi through Caph.

A dispersed cluster composed of many relatively faint blue and white stars. It is approximately 100 million years old.

Also visible:

(1) C19 *(10.0$_m$ bright nebula)*

(2) NGC 7209 *(6.7$_m$ open cluster)*



M39

RA: 323.05° | 21h 32.2' — DEC: 48.43° | 48° 26'

M39 (NGC 7092) is a magnitude 4.6 open cluster. Angular size is 32'.

6.5° NE from mag.3.92 ksi Cyg.

This bright cluster is a naked-eye target in dark conditions. It is a small cluster with an estimated mass of only around 230 Suns.

Also visible:

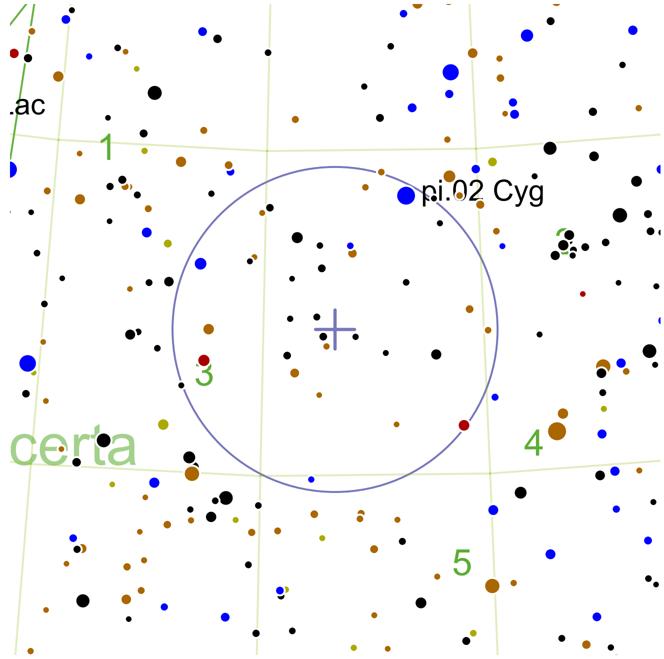
(1) C19 *(10.0$_m$ bright nebula)*

(2) IC 1369 *(6.8$_m$ open cluster)*

(3) NGC 7048 *(11.5$_m$ planetary nebula)*

(4) NGC 7026 *(12.0$_m$ planetary nebula)*

(5) W Cyg *(6.8$_m$ variable star)*



C19

RA: 328.38° | 21h 53.5' — DEC: 47.27° | 47° 16'

C19 (Cocoon Nebula, IC 5146) is a magnitude 10.0 bright nebula. Angular size is 12'.

Pointed at by lines from Navi through Caph in Cassiopeia, and from Vega through Deneb.

A relatively compact nebula, connected with a spectacular region of dark nebulae 1.5° to the northwest.

Also visible:

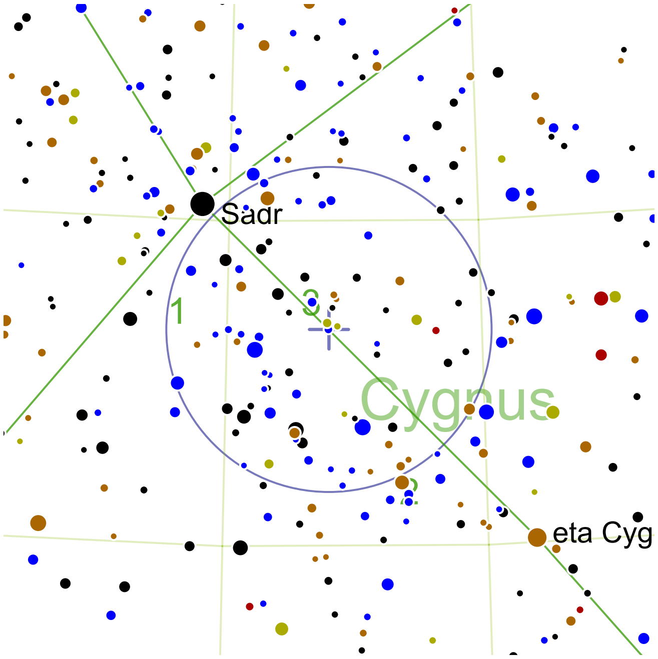
(1) C16 *(6.4$_m$ open cluster)*

(2) M39 *(4.6$_m$ open cluster)*

(3) NGC 7209 *(6.7$_m$ open cluster)*

(4) W Cyg *(6.8$_m$ variable star)*

(5) SS Cyg *(7.7$_m$ variable star)*



C27

RA: 303.0° | 20h 12.0' — DEC: 38.35° | 38° 21'

C27 (Crescent Nebula, NGC 6888) is a magnitude 7.5 bright nebula. Angular size is 20x10'.

2.7° SW from mag.2.32 Sadr.

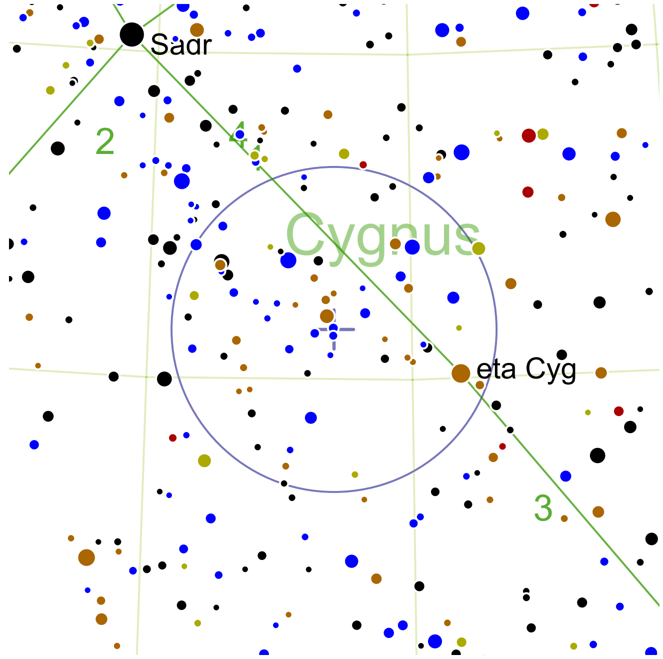
The Crescent Nebula is formed by the ejected matter of WR 136, a massive and unstable Wolf-Rayet star. A quarter of million years ago, the star expelled a large quantity of gas when it was a red supergiant, forming a shell. Having now evolved into a Wolf-Rayet, matter is ejected at a higher velocity from the star, which is colliding with the earlier shell and leading to the intricate structures revealed in photographs.

Also visible:

(1) M29 *(7.1$_m$ open cluster)*

(2) NGC 6871 *(5.2$_m$ open cluster)*

(3) RS Cyg *(6.6$_m$ carbon star)*



NGC 6871

RA: 301.48° | 20h 5.9' — DEC: 35.78° | 35° 47'

NGC 6871 is a magnitude 5.2 open cluster. Angular size is 20'.

5.5° SW from mag.2.32 Sadr.

This very bright cluster is estimated at less than 10 million years age and the blue and white stars that are visible are all hot type O and B stars. The cluster is quite distant at 5,133 light-years.

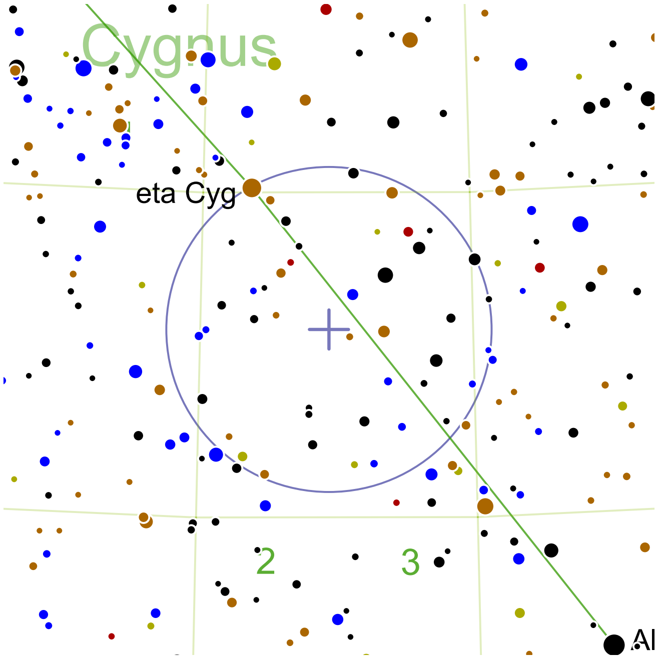
Also visible:

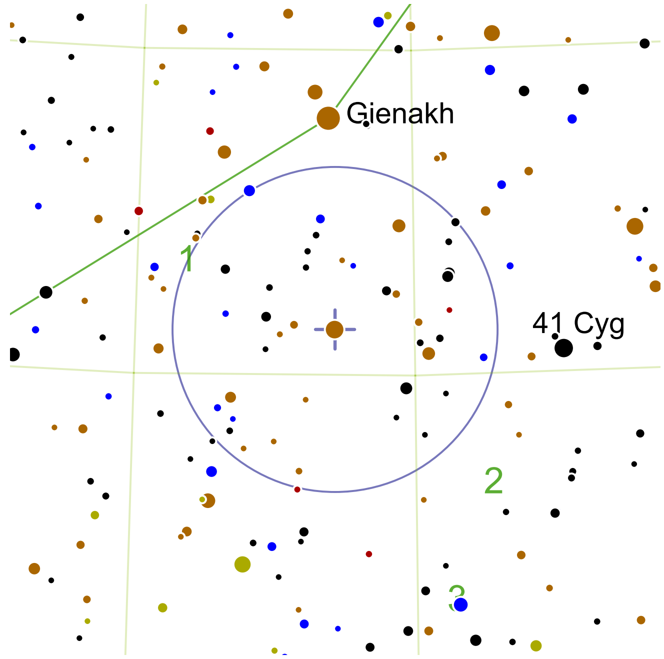
(1) C27 *(7.5$_m$ bright nebula)*

(2) M29 *(7.1$_m$ open cluster)*

(3) χ Cyg *(3.3$_m$ variable star)*

(4) RS Cyg *(6.6$_m$ carbon star)*





χ Cyg

RA: 297.64° | 19h 50.56' — DEC: 32.91° | 32° 55'

χ Cyg (HD 187796) is a magnitude 3.3 variable star. Magnitude ranges from 14.2 to 3.3 (Δ mag. 10.9) with a period of 408d.

6.5° NE from mag.3.24 183913.

This Mira variable shows one of the largest variations in visual brightness of stars of its type, varying by a factor of 10,000. Distance is calculated at 553 light years. The star's radius appears to range between 348 and 480 solar radii.

Also visible:

(1) NGC 6871 *(5.2$_m$ open cluster)*

(2) NGC 6842 *(13.0$_m$ planetary nebula)*

(3) SU Cyg *(6.44$_m$ variable star)*

C34

RA: 311.43° | 20h 45.7' — DEC: 30.72° | 30° 43'

C34 (West Veil Nebula, NGC 6960) is a magnitude 8.0 supernova remnant. Angular size is 70x6'.

3.2° S from mag.2.64 Gienakh.

The Western Veil nebula resembles a witch's broom. Like the Eastern Veil (Caldwell 33), it is best viewed with a nebula filter at very low magnification. The Veil complex was formed by a supernova explosion between 10 and 20 thousand years ago.

Also visible:

(1) C33 *(8.0$_m$ supernova remnant)*

(2) NGC 6940 *(6.3$_m$ open cluster)*

(3) BD Vul *(9.3$_m$ carbon star)*

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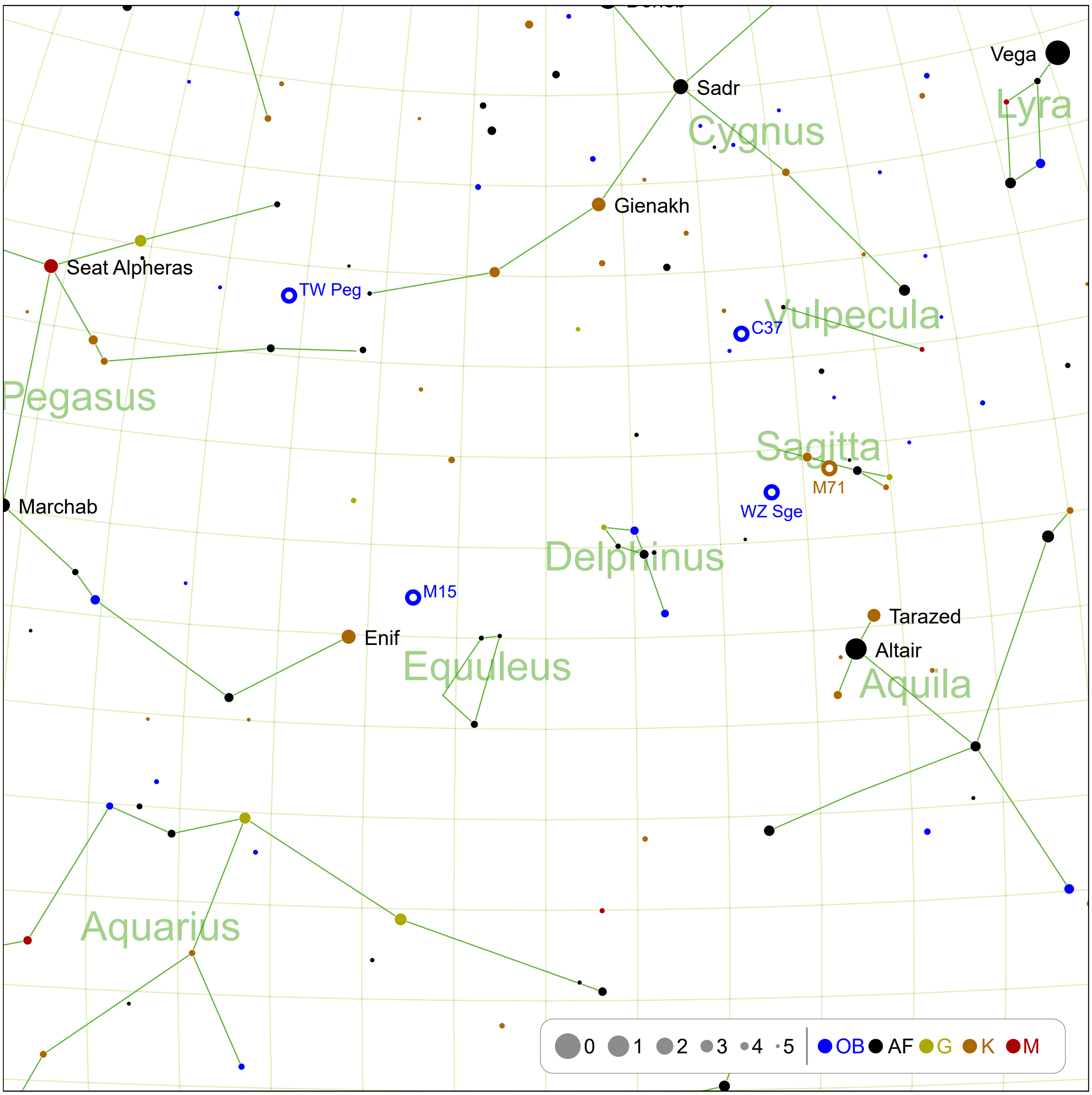
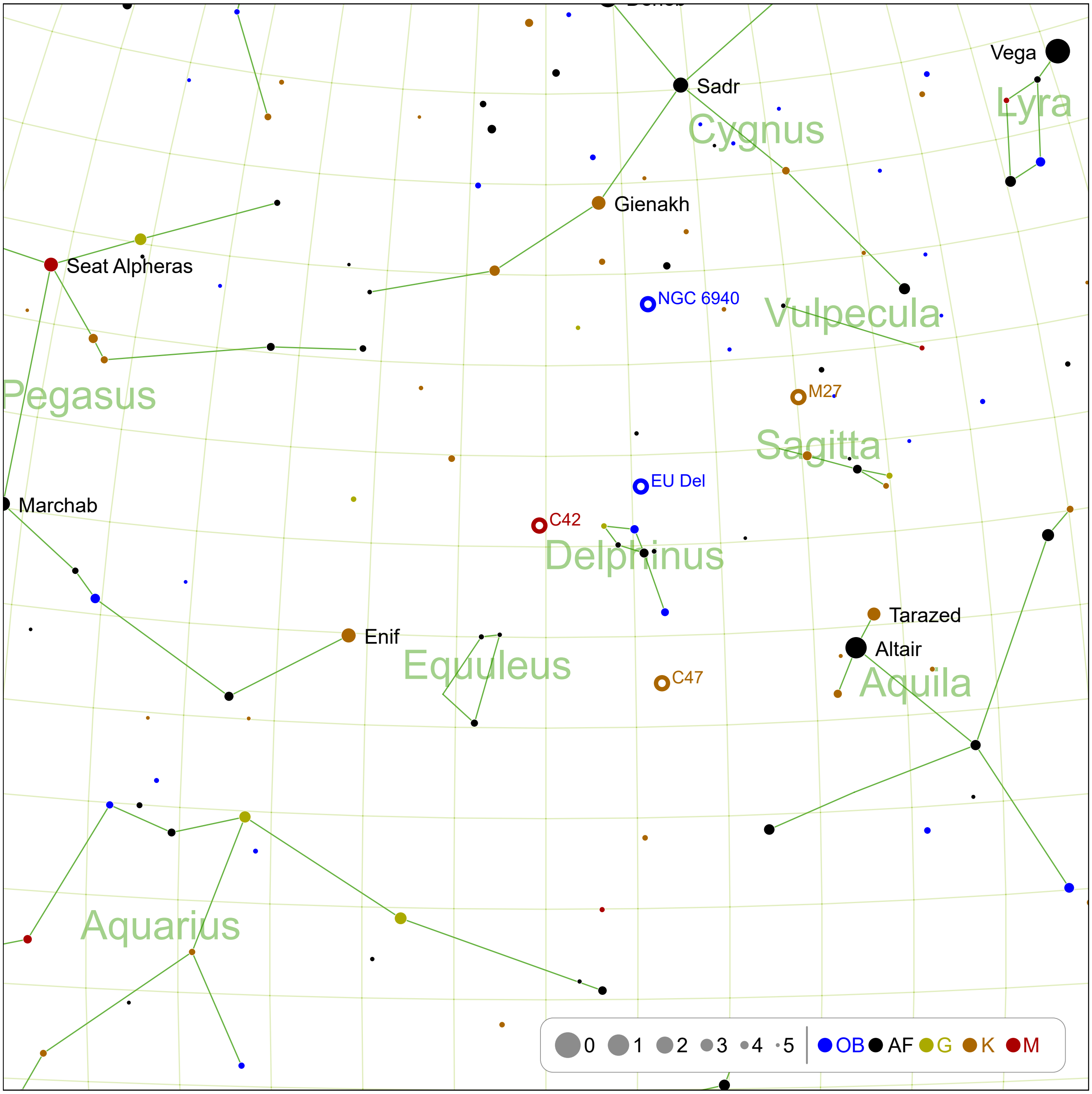
August: 15° North (1)

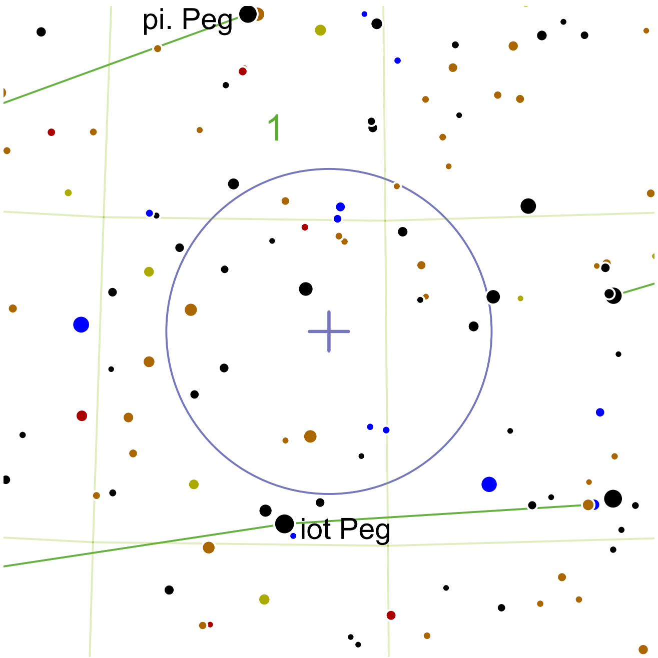


TW Peg: page 285 C37: page 285 M71: page 286 WZ Sge: page 286
M15: page 287

August: 15° North (2)



NGC 6940: page 287
M27: page 288
EU Del: page 288
C42: page 289
C47: page 289



TW Peg

RA: 331.0° | 22h 4.0' — DEC: 28.3° | 28° 18'

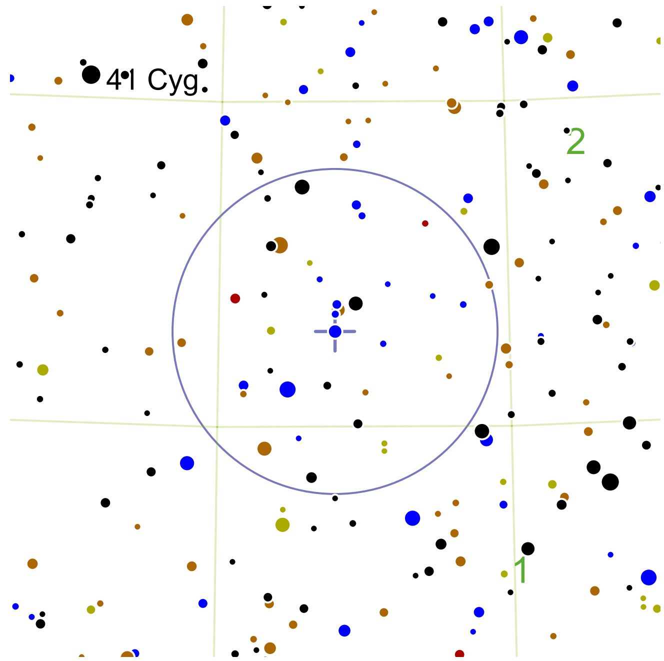
TW Peg (HD 209598) is a magnitude 7.0 carbon star. Magnitude ranges from 9.2 to 7.0 (Δ mag. 2.2) with a period of 956d.

3.0° NNW from mag.3.96 iot Peg.

A pulsating variable star with a small range in brightness but with a glacially long period of 929 days, TW Peg is located only 796 light-years from Earth.

Also visible:

(1) NGC 7217 *(11.02$_m$ barred spiral galaxy)*



C37

RA: 303.0° | 20h 12.0' — DEC: 26.48° | 26° 29'

C37 (20 Vulpeculae Cluster, NGC 6885) is a magnitude 5.7 open cluster. Angular size is 7'.

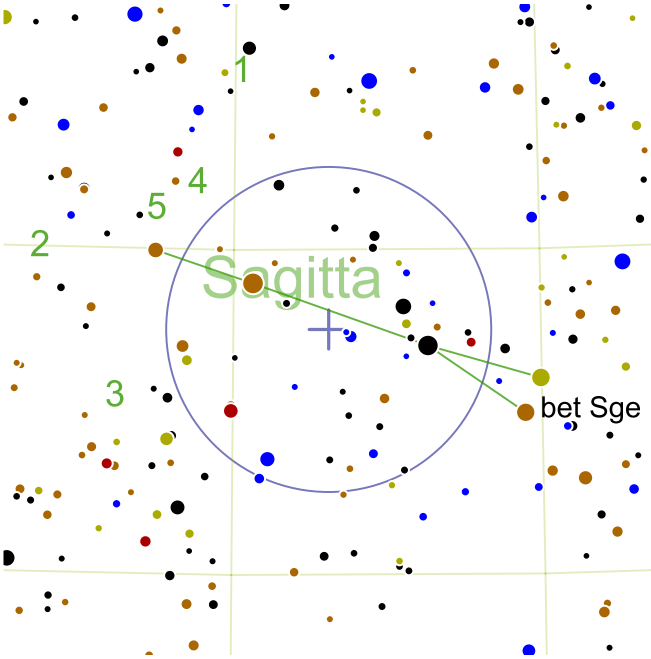
Roughly halfway between Deneb and Altair, slightly closer to Deneb.

Open cluster NGC 6940 (mag. 6.3) is located just over a finder circle to the north east. A finder circle to the south west lies the famous Dumbbell Nebula (Messier 27, mag. 7.4).

Also visible:

(1) M27 *(7.4$_m$ planetary nebula)*

(2) NGC 6842 *(13.0$_m$ planetary nebula)*



M71

RA: 298.45° | 19h 53.79' — DEC: 18.78° | 18° 47'

M71 (NGC 6838) is a magnitude 8.2 globular cluster. Angular size is 7'.

1.3° SWW from mag.3.71 gam Sge.

For a long time this globular cluster was misclassified as an open cluster, but now proven to be a globular cluster without significant central compression. M71 is relatively young (9-10 billion years) and 13,000 light-years distant.

Also visible:

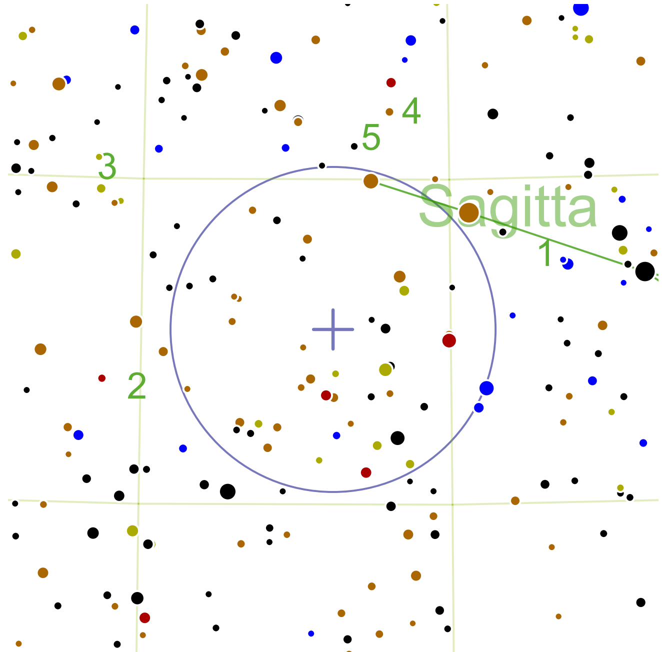
(1) M27 *(7.4$_m$ planetary nebula)*

(2) NGC 6886 *(12.0$_m$ planetary nebula)*

(3) WZ Sge *(7.0$_m$ variable star)*

(4) BF Sge *(8.5$_m$ carbon star)*

(5) X Sge *(8.7$_m$ carbon star)*



WZ Sge

RA: 301.9° | 20h 7.6' — DEC: 17.7° | 17° 42'

WZ Sge (HV 03518) is a magnitude 7.0 variable star. Magnitude ranges from 15.53 to 7.0 (Δ mag. 8.5) with a period of 33y.

2.7° SE from mag.3.71 gam Sge.

A cataclysmic dwarf nova, with eruptions in 1913, 1946, 1978 and 2001, this binary system consists of a white dwarf and a low mass red or brown dwarf. The red dwarf edges across the Roche limit of the white dwarf in its rapid 1.361 hour orbit, and material is torn from it into an accretion disk. An outburst occurs when this disk collapses onto the white dwarf, releasing gravitational potential energy. 147 light-years distant.

Also visible:

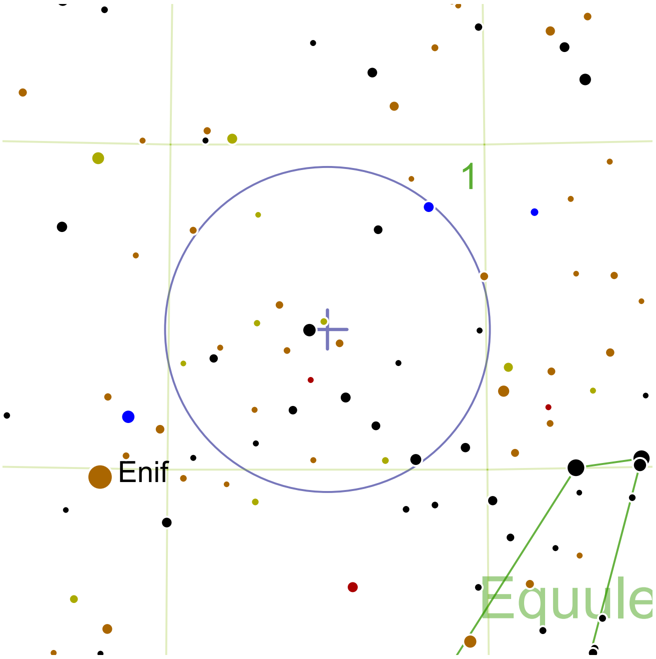
(1) M71 *(8.2$_m$ globular cluster)*

(2) IC 4997 *(11.5$_m$ planetary nebula)*

(3) NGC 6905 *(11.5$_m$ planetary nebula)*

(4) BF Sge *(8.5$_m$ carbon star)*

(5) X Sge *(8.7$_m$ carbon star)*



M15

RA: 322.5° | 21h 30.0' — DEC: 12.17° | 12° 10'

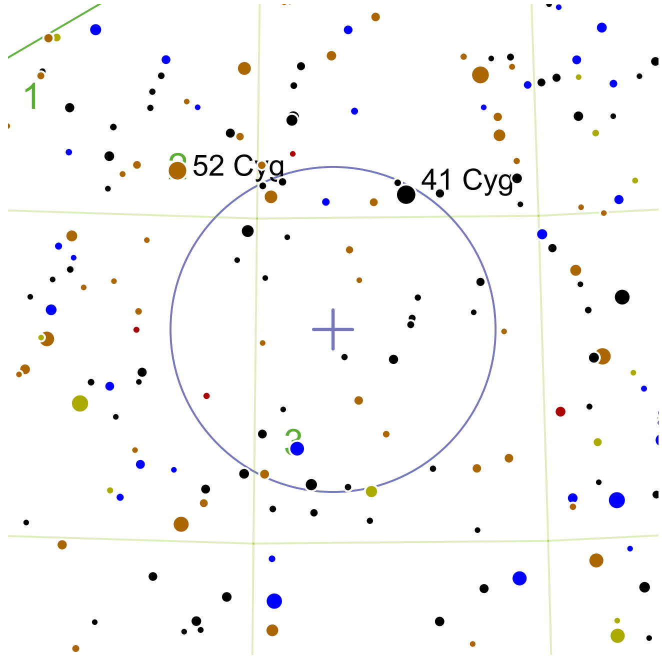
M15 (Great Pegasus Globular, NGC 7078) is a magnitude 6.2 globular cluster. Angular size is 12'.

Midway between Altair and Markab (the corner of the square of Pegasus closest to Altair).

This globular is old even by the standards of these typically ancient objects, with an estimated age of 12.5 billion years. It is slightly too faint to be seen by the naked eye even from a dark site. It contains many interesting objects, including 8 pulsars and a planetary nebula (Pease 1 which, with magnitude 15.4 and angular size of 3", is best seen with a camera from a mountain-top!).

Also visible:

(1) X Peg *(8.8$_m$ variable star)*



NGC 6940

RA: 308.65° | 20h 34.59' — DEC: 28.3° | 28° 18'

NGC 6940 is a magnitude 6.3 open cluster. Angular size is 31'.

6.1° SSW from mag.2.64 Gienakh.

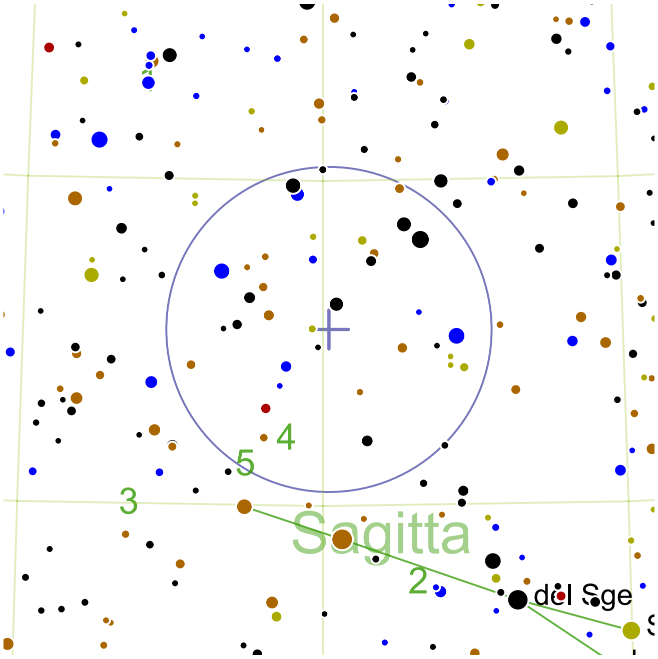
Relatively ancient for an open cluster, NGC 6940 is estimated to be 720 million years old. The scattered cluster is dominated by 20 red giants. The distance to NGC 6940 is roughly 2,510 light-years.

Also visible:

(1) C33 *(8.0$_m$ supernova remnant)*

(2) C34 *(8.0$_m$ supernova remnant)*

(3) BD Vul *(9.3$_m$ carbon star)*



M27

RA: 299.9° | 19h 59.59' — DEC: 22.72° | 22° 43'

M27 (Dumbbell Nebula, NGC 6853) is a magnitude 7.4 planetary nebula. Angular size is 8x6'.

One third of the distance from Altair to Deneb.

The Dumbbell Nebula is one of the most famous of all the Messiers and rightly so. Bright enough to be appreciated in urban skies, especially with a nebula filter, it is also generously proportioned with an intricate shape. The nebula is roughly 10,000 years old and at its center lies a white dwarf with the mass of half the Sun.

Also visible:

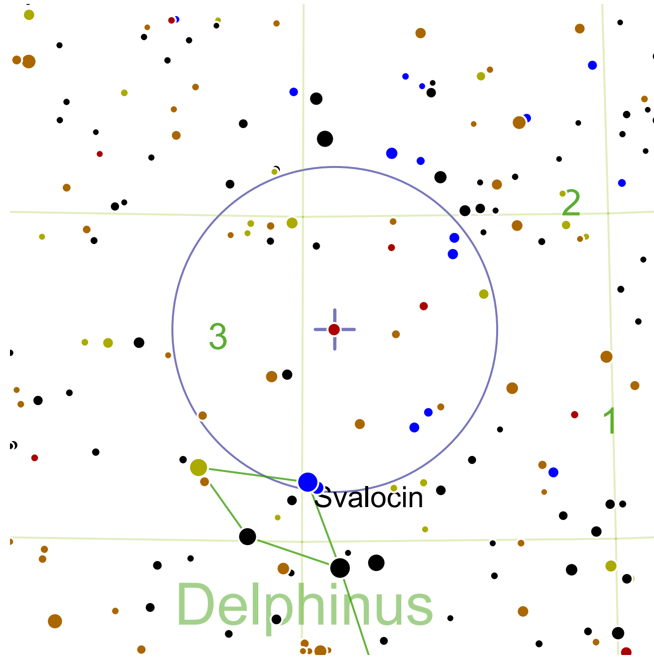
(1) C37 *(5.7_m open cluster)*

(2) M71 *(8.2_m globular cluster)*

(3) NGC 6886 *(12.0_m planetary nebula)*

(4) BF Sge *(8.5_m carbon star)*

(5) X Sge *(8.7_m carbon star)*



EU Del

RA: 309.48° | 20h 37.91' — DEC: 18.27° | 18° 16'

EU Del (HD 196610) is a magnitude 5.79 variable star. Magnitude ranges from 6.9 to 5.79 (Δ mag. 1.1) with a period of 59.7d.

2.3° N from mag.3.86 Svalocin.

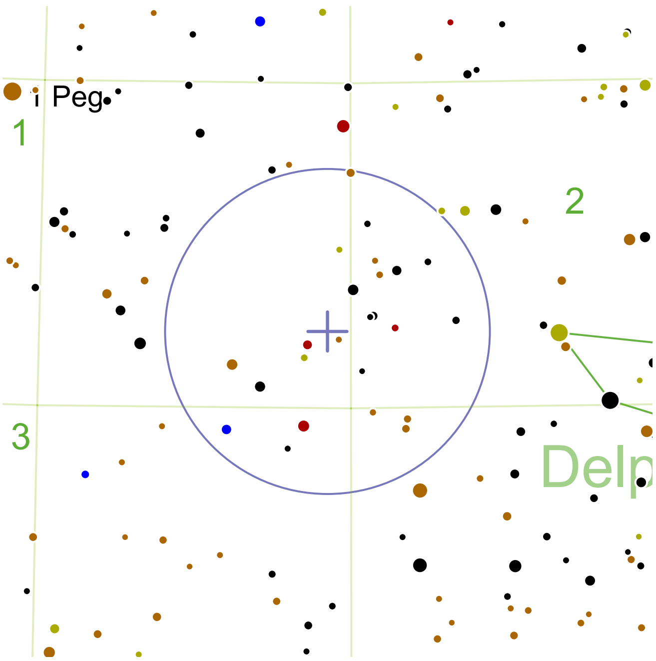
This pulsating red giant is very close at only 359 light-years.

Also visible:

(1) IC 4997 *(11.5_m planetary nebula)*

(2) NGC 6905 *(11.5_m planetary nebula)*

(3) U Del *(7.6_m variable star)*



C42

RA: 315.38° | 21h 1.5' — DEC: 16.18° | 16° 11'

C42 (NGC 7006) is a magnitude 10.6 globular cluster. Angular size is 2.8'.

5.2° E from mag.3.86 Svalocin.

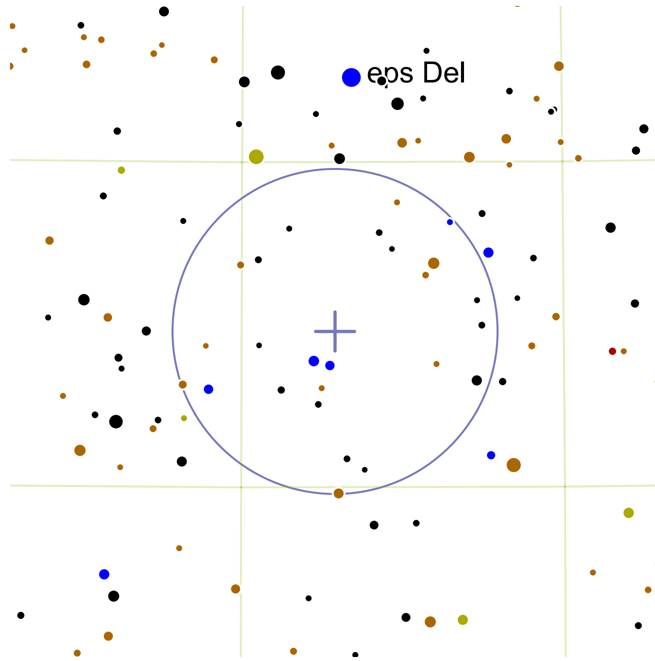
This globular cluster is somewhat attenuated by galactic dust. As this scatters away shorter wavelengths, the cluster is significantly brighter in infrared wavelengths. The cluster has a mass equivalent to 3.03 million Suns, or three quarters of the mass of the supermassive black hole at the center of the Milky Way.

Also visible:

(1) Segue 3 *(14.9$_m$ globular cluster)*

(2) U Del *(7.6$_m$ variable star)*

(3) X Peg *(8.8$_m$ variable star)*



C47

RA: 308.55° | 20h 34.2' — DEC: 7.4° | 7° 24'

C47 (NGC 6934) is a magnitude 8.9 globular cluster. Angular size is 5.9'.

Two and a half finder circles east of Altair.

Roughly 50,000 light-years from Earth, the stars of this globular cluster can only be resolved with larger telescopes.

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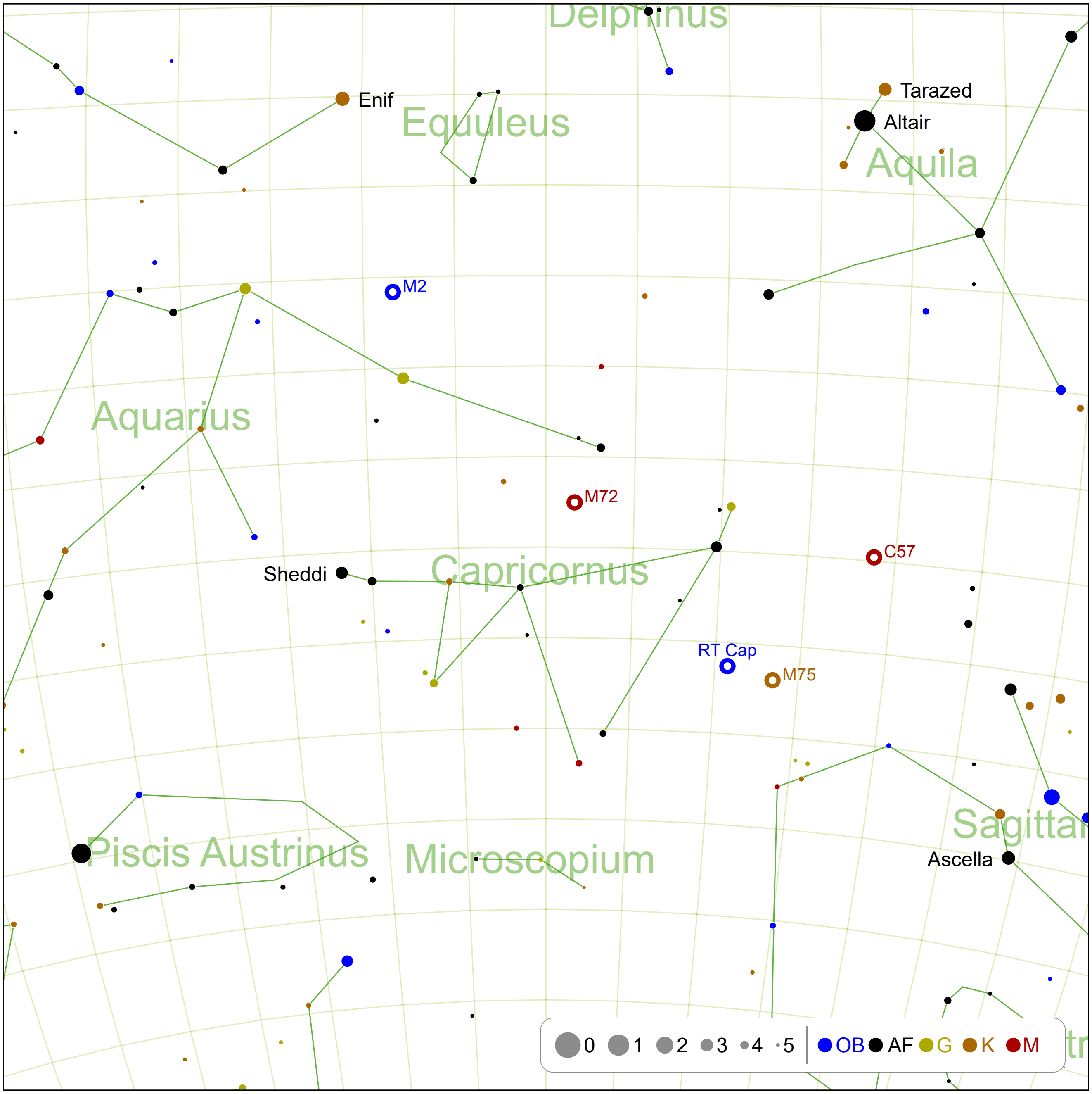
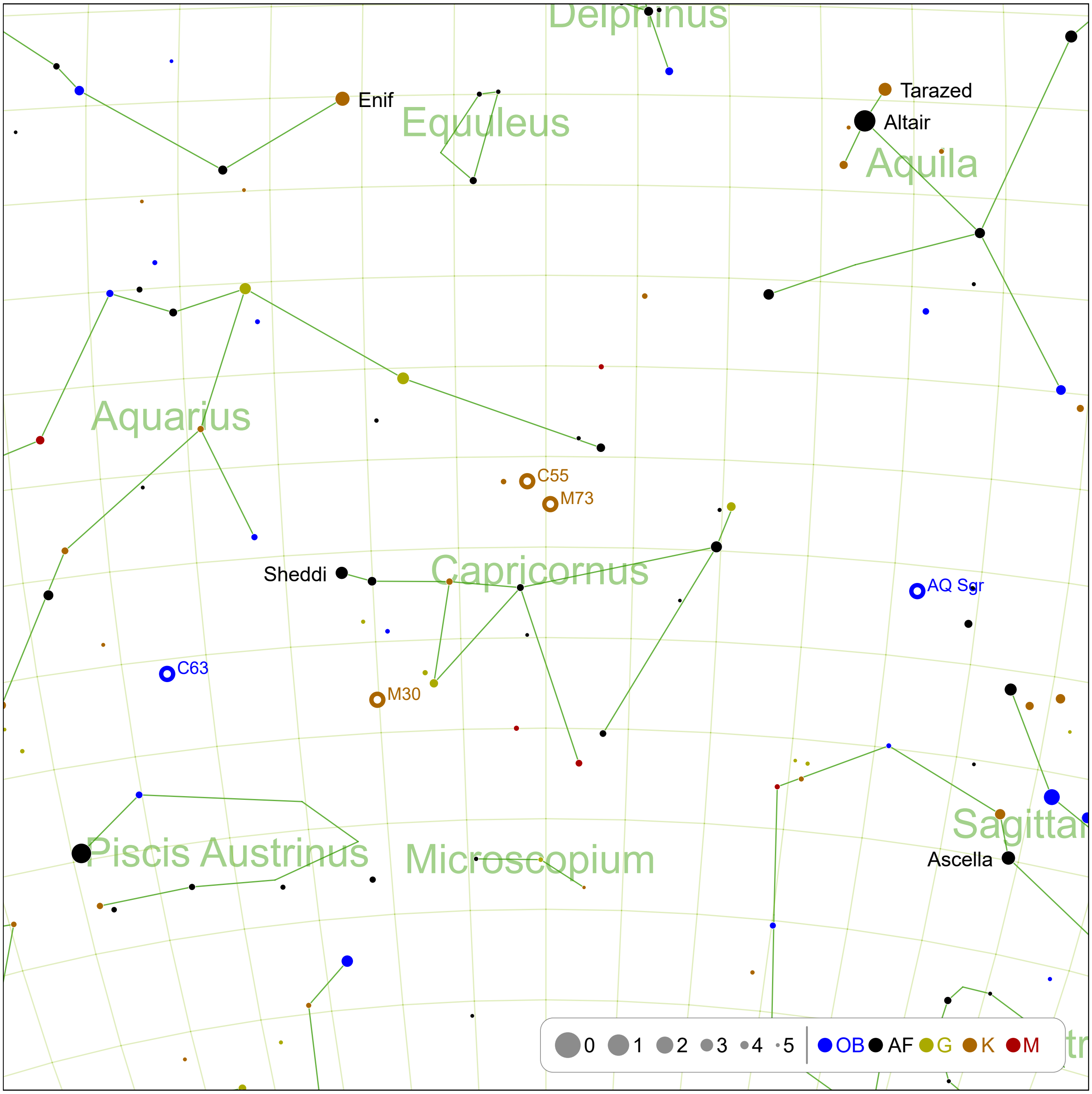
August: -15° South (1)

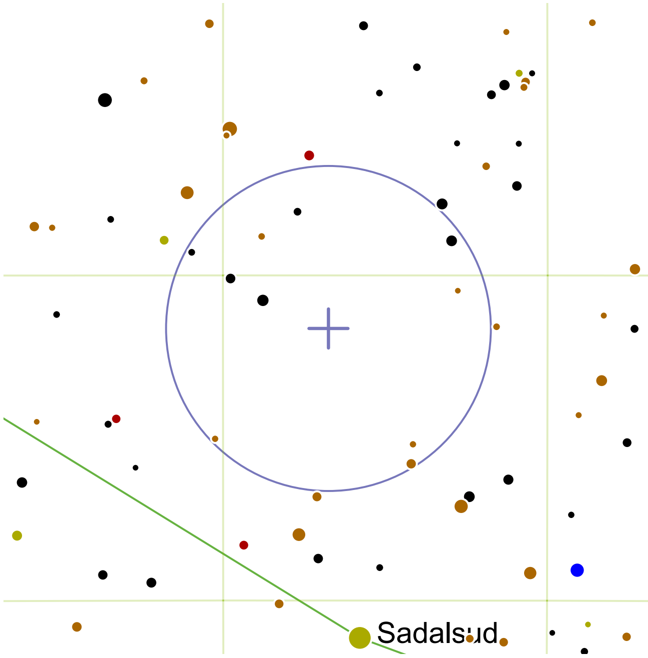


M2: page 293 M72: page 293 C57: page 294 RT Cap: page 294
M75: page 295

August: -15° South (2)



C55: page 295
M73: page 296
AQ Sgr: page 296
C63: page 297
M30: page 297



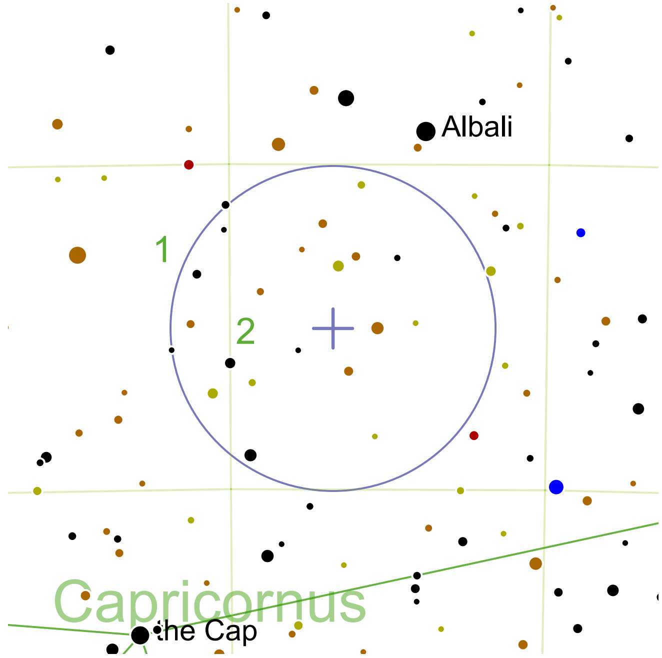
M2

RA: 323.38° | 21h 33.5' — DEC: -0.82° | 0° 48'

M2 (NGC 7089) is a magnitude 6.5 globular cluster. Angular size is 12.9'.

4.7° N from mag.3.07 Sadalsud.

One of the largest globular clusters, M2 is quite distant (55,000 light-years). As such its stars are dimmed by the distance and the brightest only shine at magnitude 13.1.



M72

RA: 313.38° | 20h 53.5' — DEC: -12.53° | -12° 31'

M72 (NGC 6981) is a magnitude 9.3 globular cluster. Angular size is 6'.

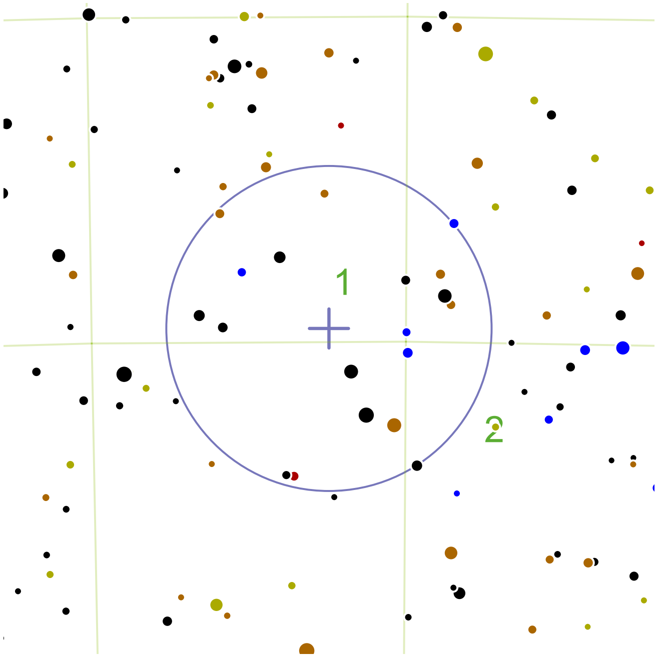
3.3° SSE from mag.3.83 Albali.

This globular cluster is quite distant at over 54,000 light-years. A telescope of at least 150 mm aperture is needed to resolve some of its stars.

Also visible:

(1) C55 *(8.3$_m$ planetary nebula)*

(2) M73 *(9.0$_m$ asterism)*



C57

RA: 296.23° | 19h 44.9' — DEC: -14.8° | -14° 47'

C57 (Barnard's Galaxy, NGC 6822) is a magnitude 9.3 irregular galaxy. Angular size is 10x9'.

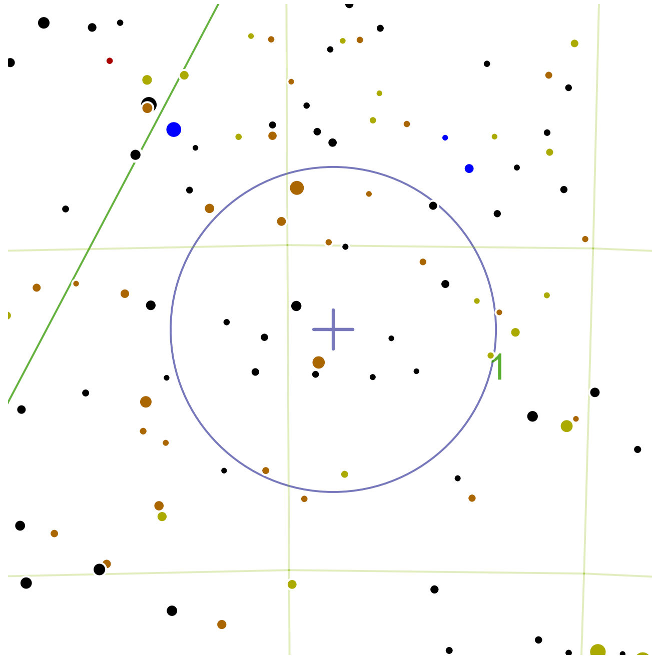
Due south of Altair, at the same declination as Dabikh (2 finder circles to the east).

This member of the Local Group of galaxies is a barred irregular galaxy discovered by E E Barnard in 1884 using a 6 inch refractor. This was the first galaxy beyond the Magellanic Clouds to have its distance measured, and was the first strong indication that the universe was substantially larger than the Milky Way. This object is difficult to spot in its busy star field, even with larger telescopes.

Also visible:

(1) NGC 6818 *(9.3$_m$ planetary nebula)*

(2) AQ Sgr *(6.6$_m$ carbon star)*



RT Cap

RA: 304.25° | 20h 17.0' — DEC: -21.3° | -21° 17'

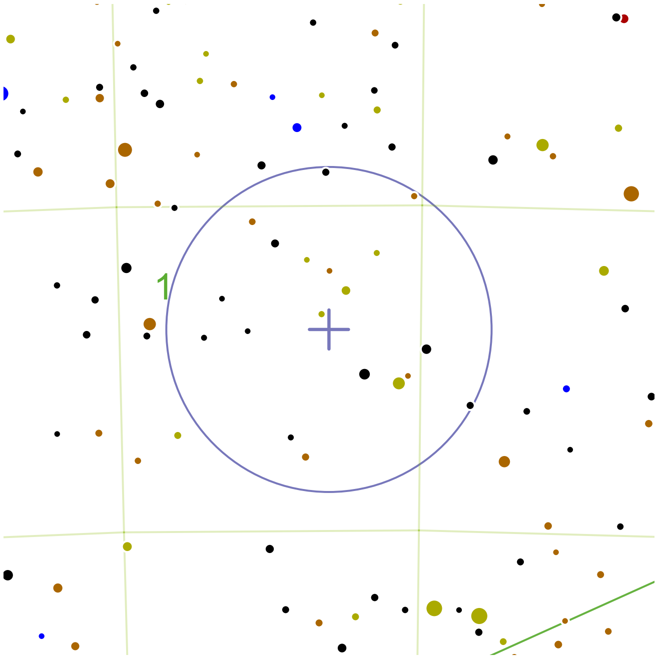
RT Cap (HD 192737) is a magnitude 6.5 carbon star. Magnitude ranges from 8.1 to 6.5 (Δ mag. 1.6) with a period of 395d.

6.5° S from mag.3.25 193496.

A carbon star with B-V color index 2.46 and spectral type C6,4, RT Cap also has a faint magnitude 13 companion separated by 25.7" at position angle 230°.

Also visible:

(1) M75 *(8.5$_m$ globular cluster)*



M75

RA: 301.52° | 20h 6.09' — DEC: -21.92° | -21° 54'

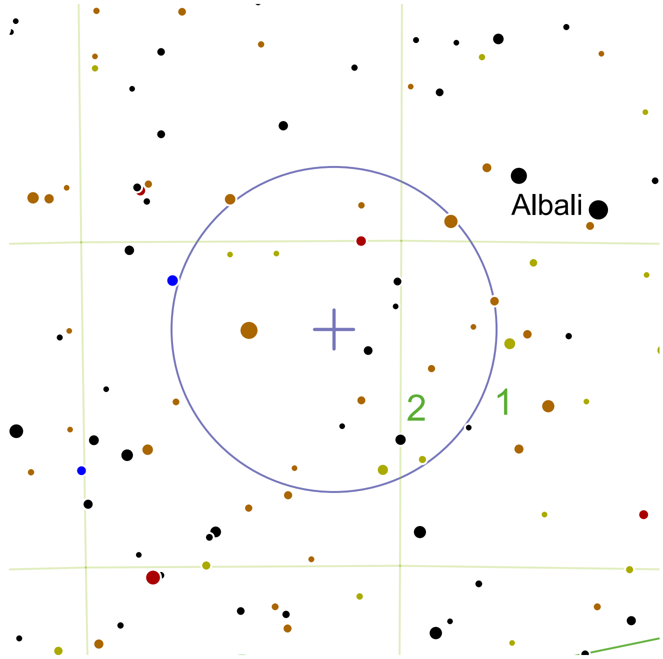
M75 (NGC 6864) is a magnitude 8.5 globular cluster. Angular size is 6'.

7.9° SSW from mag.3.25 193496.

This giant globular cluster appears to be gently rotating. It is over 67,000 light years from Earth, and so telescopes of at least 250 mm aperture are required to resolve the stars in this cluster. As the cluster's concentrated center is quite bright, it is relatively easy to spot with binoculars. M75 is part of the Gaia Sausage, a grouping of objects that may be the remnants of a galaxy absorbed by the Milky Way.

Also visible:

(1) RT Cap *(6.5$_m$ carbon star)*



C55

RA: 316.05° | 21h 4.2' — DEC: -11.37° | -11° 21'

C55 (Saturn Nebula, NGC 7009) is a magnitude 8.3 planetary nebula. Angular size is 0.7'.

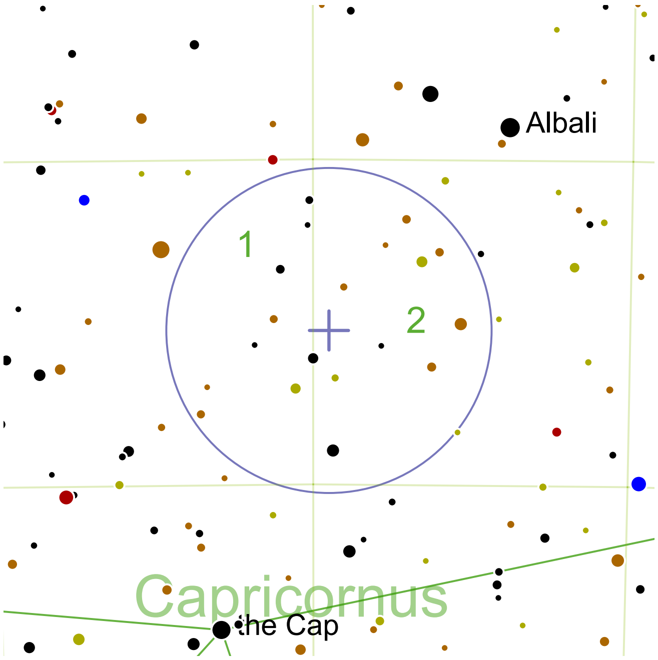
Midway between Fomalhaut and Altair - slightly closer to Altair.

Somewhat resembling Saturn's rings, this superb bright planetary nebula was first observed by William Herschel in 1782. It was only in the 1840s that it acquired the Saturn Nebula moniker.

Also visible:

(1) M72 *(9.3$_m$ globular cluster)*

(2) M73 *(9.0$_m$ asterism)*



M73

RA: 314.75° | 20h 59.0' — DEC: -12.63° | -12° 37'

M73 (NGC 6994) is a magnitude 9.0 asterism. Angular size is 3'.

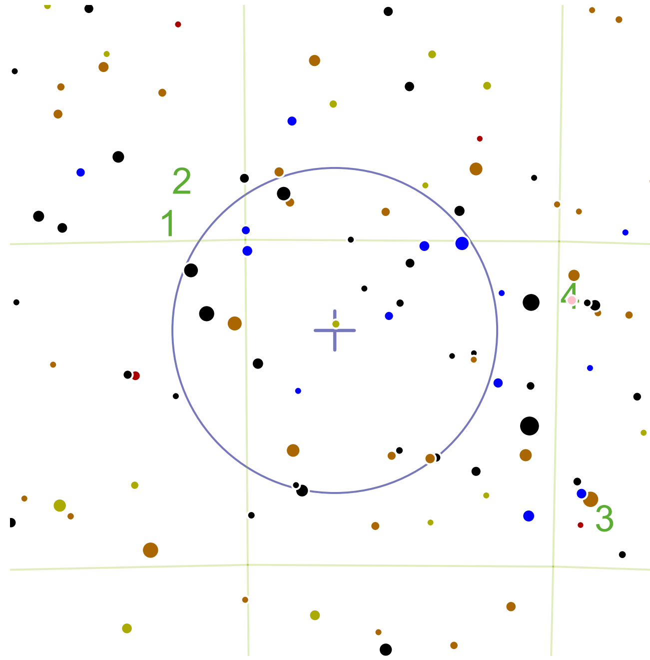
4.1° SE from mag.3.83 Albali.

Messier 73 is an asterism, a chance alignment of otherwise unrelated stars. Although classified as a cluster by Charles Messier, this classification was first questioned by John Herschel.

Also visible:

(1) C55 *(8.3$_m$ planetary nebula)*

(2) M72 *(9.3$_m$ globular cluster)*



AQ Sgr

RA: 293.58° | 19h 34.29' — DEC: -16.4° | -16° 23'

AQ Sgr (HD 184283) is a magnitude 6.6 carbon star. Magnitude ranges from 7.7 to 6.6 (Δ mag. 1.1) with a period of 200d.

3.3° NEE from mag.3.95 rho01 Sgr.

A carbon star with B-V color index 3.0 and spectral type C-N5, AQ Sgr forms a wide optical double and nice color contrast with magnitude 7.55 SAO 162744, a white main sequence star about 4' to the north.

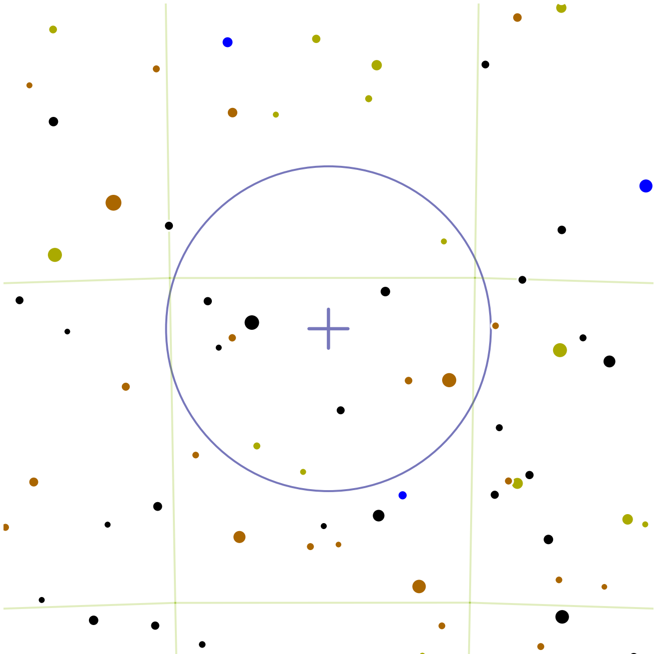
Also visible:

(1) C57 *(9.3$_m$ irregular galaxy)*

(2) NGC 6818 *(9.3$_m$ planetary nebula)*

(3) R Sgr *(6.7$_m$ variable star)*

(4) V1942 Sgr *(6.7$_m$ carbon star)*



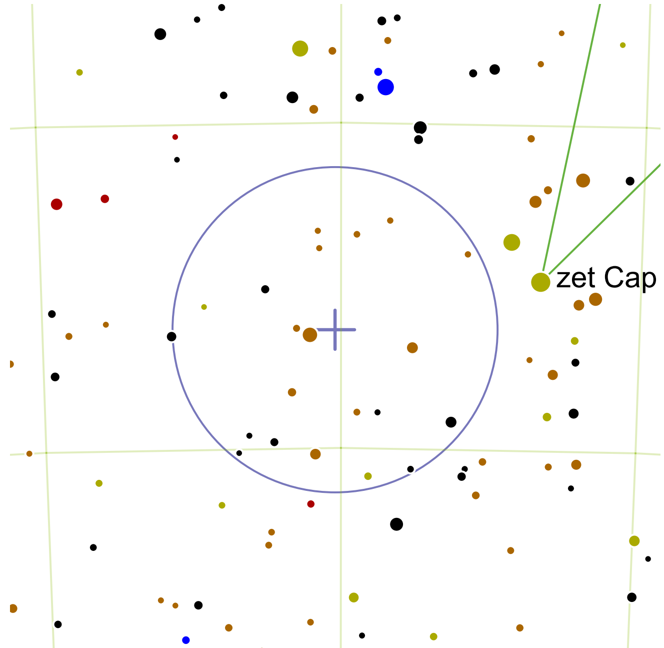
C63

RA: 337.4° | 22h 29.59' — DEC: -20.8° | -20° 47'

C63 (Helix Nebula, NGC 7293) is a magnitude 6.5 planetary nebula. Angular size is 13'.

7.7° SW from mag.3.51 Scheat.

This fabulous planetary nebula spans over three light-years and is only 650 light-years from Earth.



M30

RA: 325.1° | 21h 40.4' — DEC: -23.18° | -23° 10'

M30 (NGC 7099) is a magnitude 7.2 globular cluster. Angular size is 11'.

3.2° SEE from mag.3.86 zet Cap.

This globular cluster was described by William Herschel as a "remarkable globular, bright, large, slightly oval". M30 has a retrograde orbit, indicating it was in all likelihood captured from a smaller galaxy devoured by the Milky Way in the distant past.

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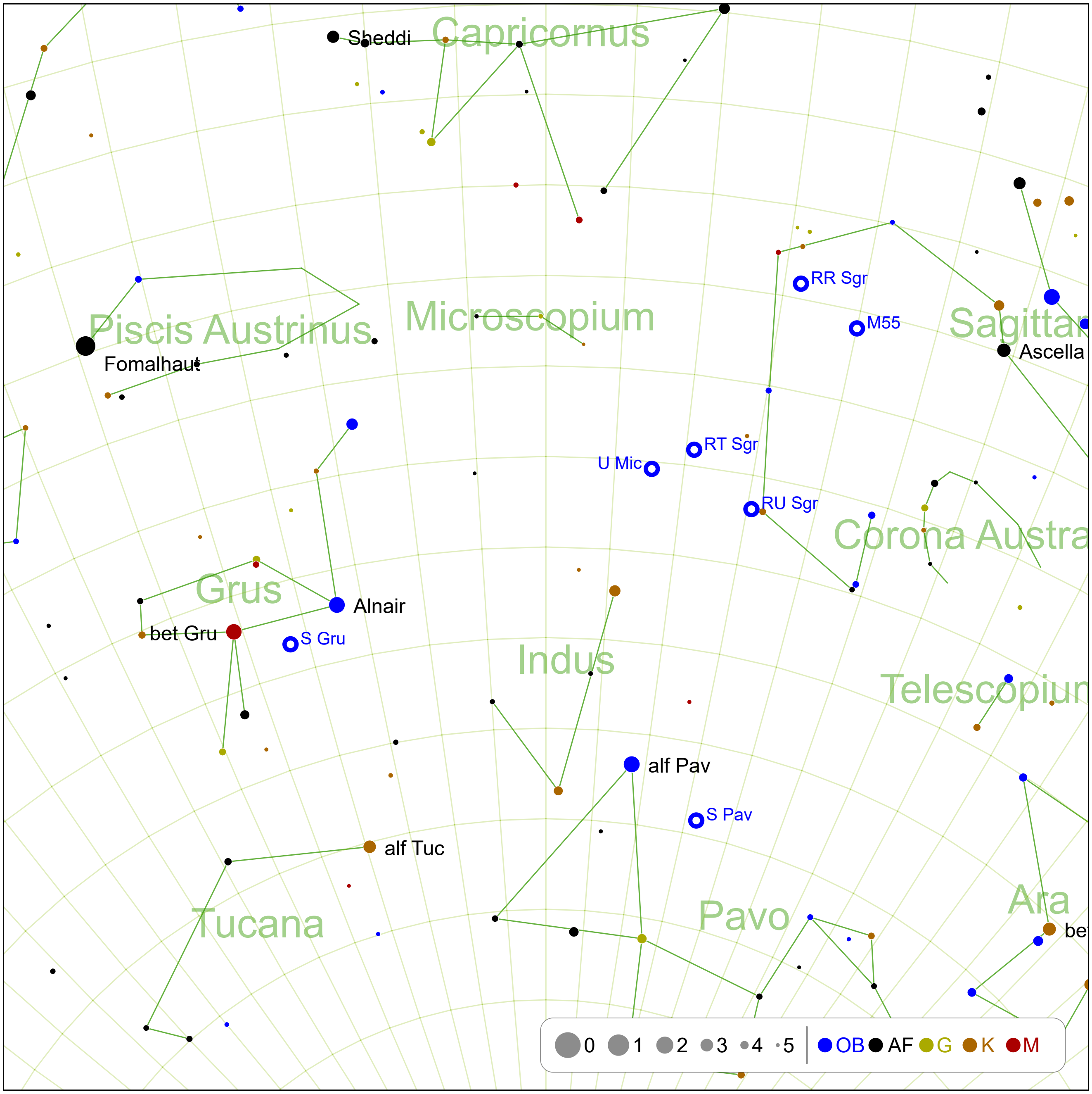
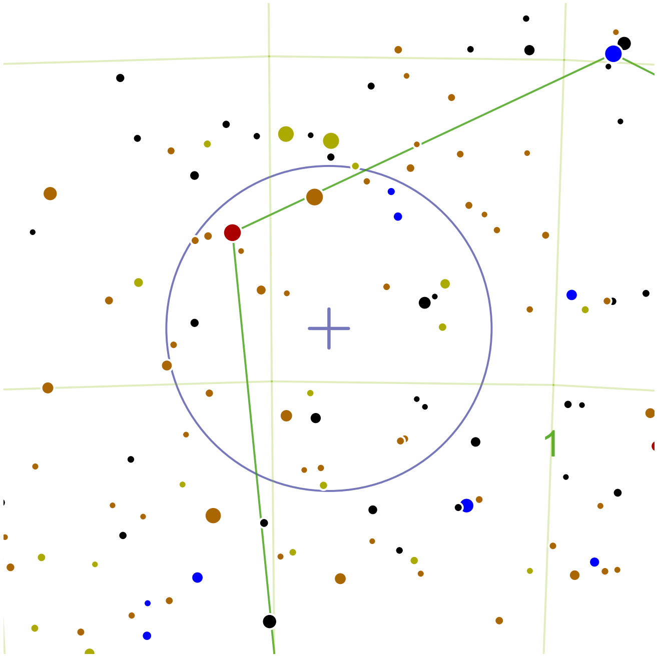
August: -45° South



RR Sgr: page 300	M55: page 300	RT Sgr: page 301	U Mic: page 301
RU Sgr: page 302	S Gru: page 302	S Pav: page 303	



RR Sgr

RA: 298.99° | 19h 55.94' — DEC: -29.19° | -29° 10'

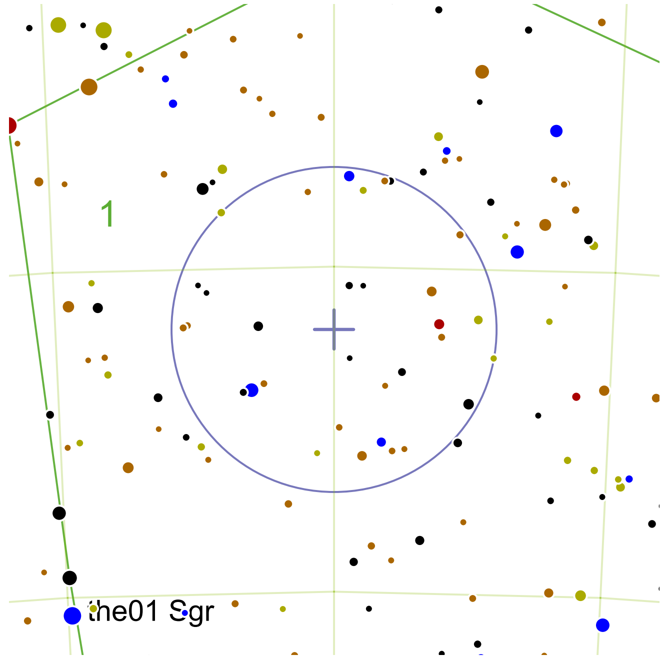
RR Sgr (HD 188378) is a magnitude 5.4 variable star. Magnitude ranges from 14.0 to 5.4 (Δ mag. 8.6) with a period of 336d.

10.8° E from mag.3.42 tau Sgr.

A moderately red pulsating variable star, RR Sgr is a respectable 1,260 light-years from Earth.

Also visible:

(1) M55 *(6.3_m globular cluster)*



M55

RA: 295.0° | 19h 40.0' — DEC: -30.97° | -30° 57'

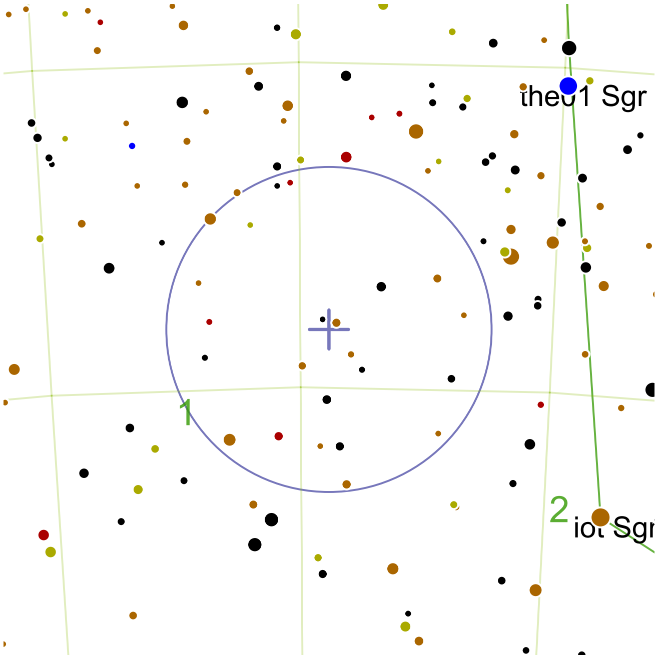
M55 (NGC 6809) is a magnitude 6.3 globular cluster. Angular size is 19'.

7.9° SEE from mag.3.42 tau Sgr.

This globular cluster is relatively closer to us at 17,600 light-years, so its individual stars burn a little brighter in our telescopes. The cluster has been aged at 12.3 billion years.

Also visible:

(1) RR Sgr *(5.4_m variable star)*



RT Sgr

RA: 304.43° | 20h 17.72' — DEC: -39.11° | -39° 6'

RT Sgr (HD 192702) is a magnitude 6.0 variable star. Magnitude ranges from 14.1 to 6.0 (Δ mag. 8.1) with a period of 306d.

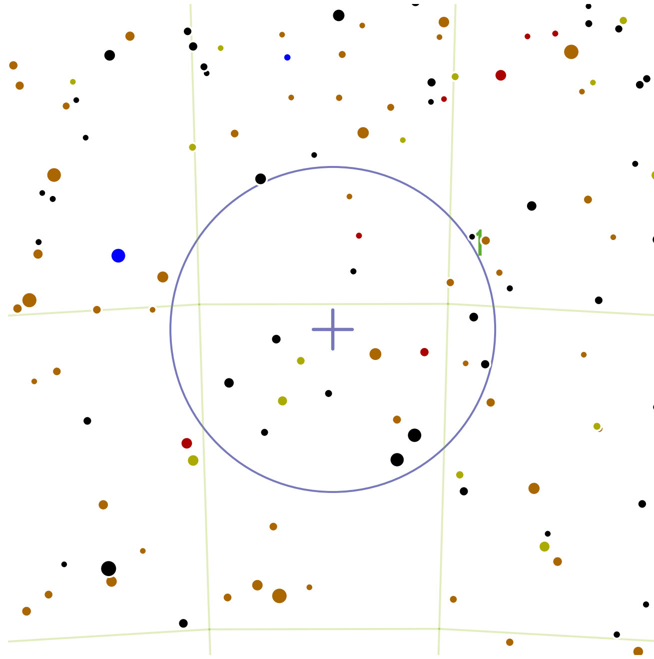
8.9° NNW from mag.3.21 alf Ind.

This pulsating variable star is moderately red and is about 1,870 light-years from Earth.

Also visible:

(1) U Mic *(7.0$_m$ variable star)*

(2) RU Sgr *(6.0$_m$ variable star)*



U Mic

RA: 307.32° | 20h 29.26' — DEC: -40.42° | -40° 24'

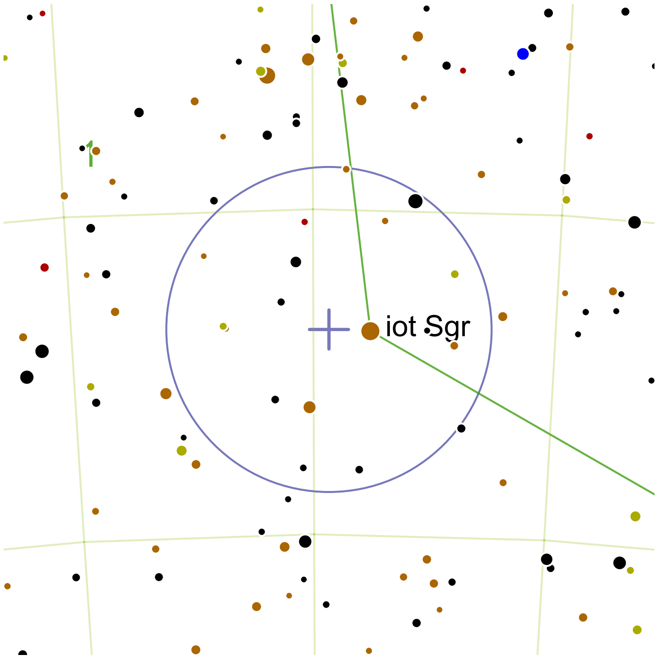
U Mic (HD 194814) is a magnitude 7.0 variable star. Magnitude ranges from 14.4 to 7.0 (Δ mag. 7.4) with a period of 334d.

7.0° NNW from mag.3.21 alf Ind.

This pulsating variable star is moderately red and is about 2,100 light-years from Earth.

Also visible:

(1) RT Sgr *(6.0$_m$ variable star)*



RU Sgr

RA: 299.68° | 19h 58.71' — DEC: -41.85° | -41° 50'

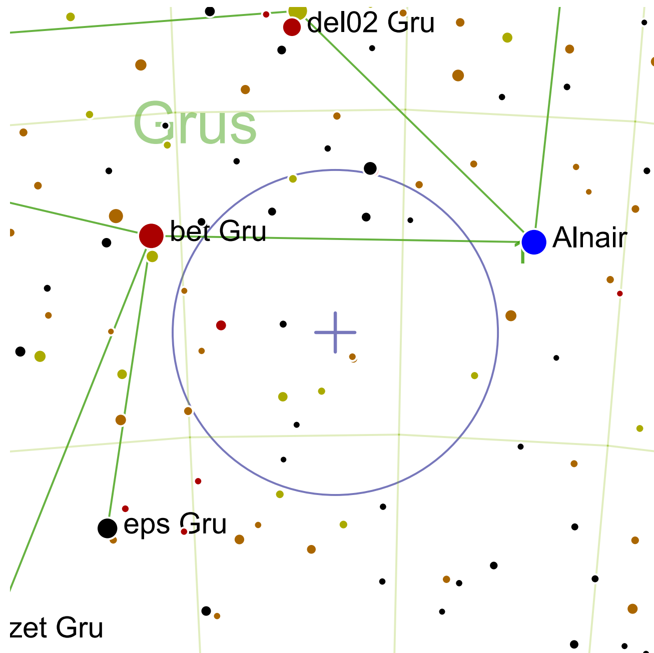
RU Sgr (HD 188813) is a magnitude 6.0 variable star. Magnitude ranges from 13.8 to 6.0 (Δ mag. 7.8) with a period of 240d.

8.7° NW from mag.3.21 alf Ind.

This orange-red pulsating variable star is about 5,200 light-years from Earth. The absolute magnitude of this star is around -3.4.

Also visible:

(1) RT Sgr *(6.0$_m$ variable star)*



S Gru

RA: 336.52° | 22h 26.09' — DEC: -48.44° | -48° 25'

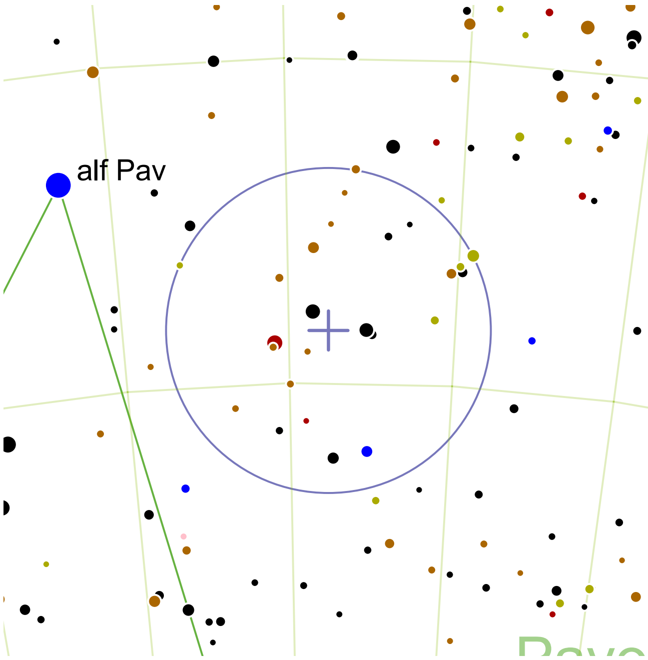
S Gru (HD 212539) is a magnitude 6.0 variable star. Magnitude ranges from 15.0 to 6.0 (Δ mag. 9.0) with a period of 402d.

3.1° SWW from mag.2.24 bet Gru.

This moderately red pulsating variable star is about 2,190 light-years from Earth.

Also visible:

(1) NGC 7213 *(11.01$_m$ barred spiral galaxy)*



S Pav

RA: 298.81° | 19h 55.23' — DEC: -59.2° | -59° 11'

S Pav (HD 187835) is a magnitude 6.6 variable star. Magnitude ranges from 10.4 to 6.6 (Δ mag. 3.8) with a period of 381d.

4.7° SW from mag.2.12 alf Pav.

Only 620 light-years from Earth, this red giant (spectral type M8III) is small in comparison to many red giants, being only 14 times the the radius of the Sun.

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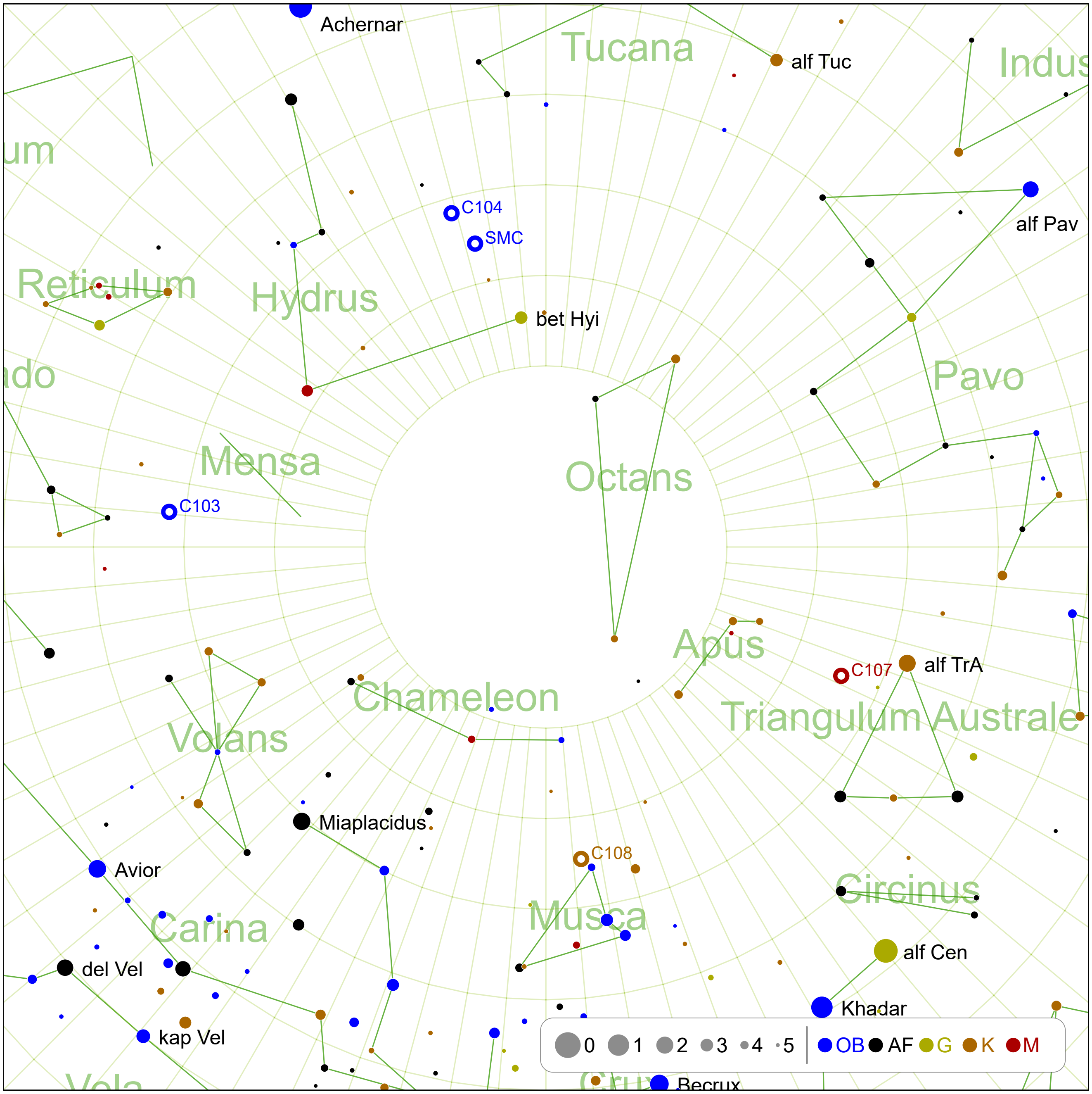
Southern Circumpolar Sky (1)



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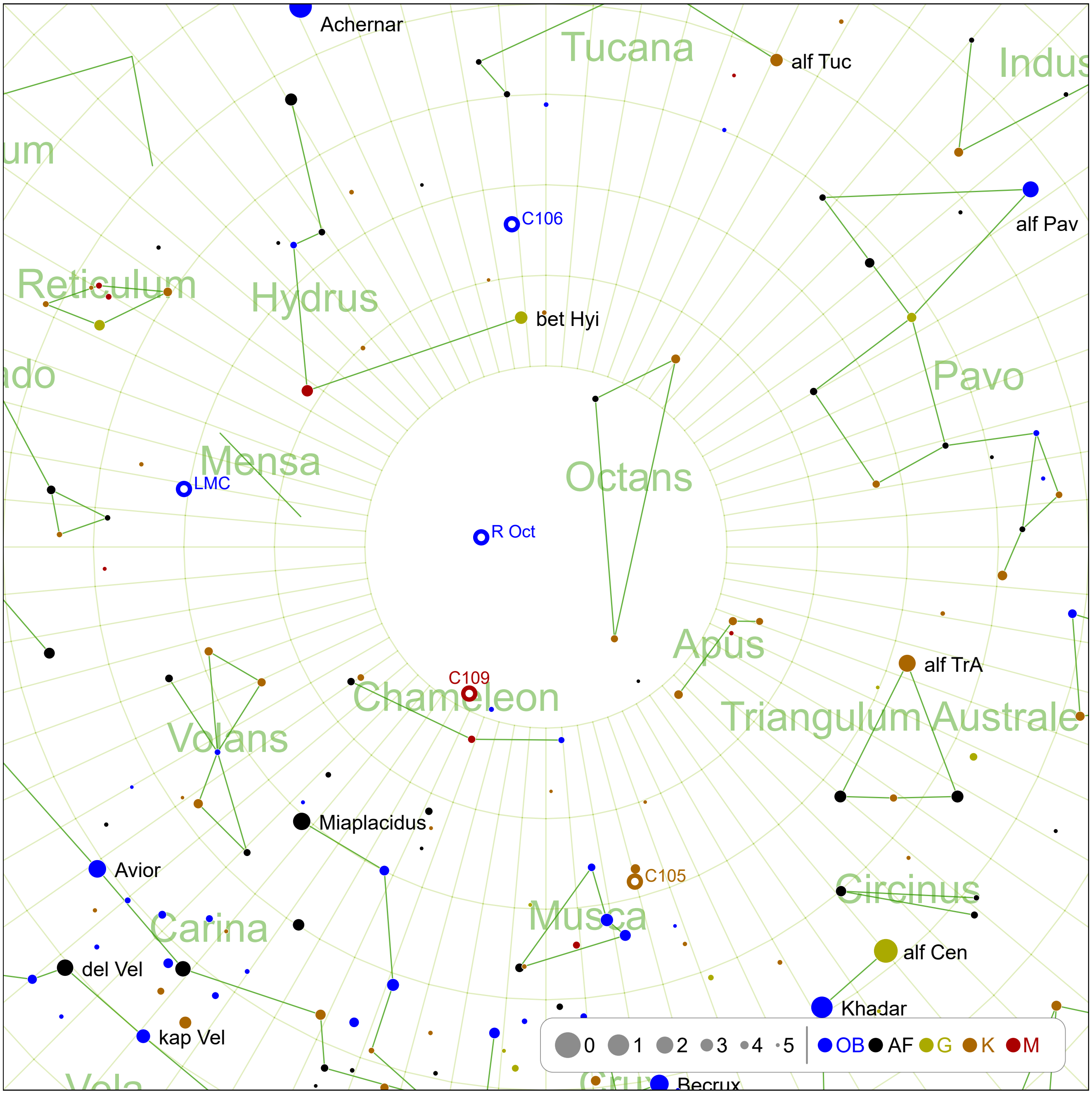
Southern Circumpolar Sky (2)



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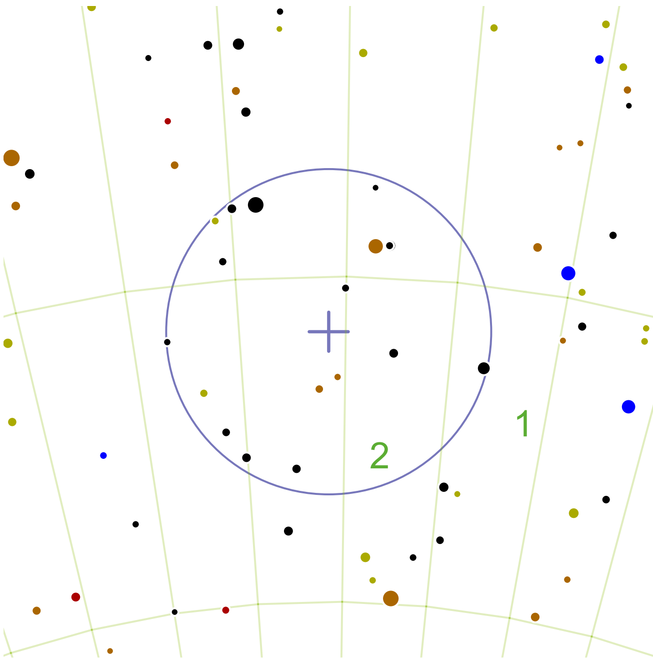
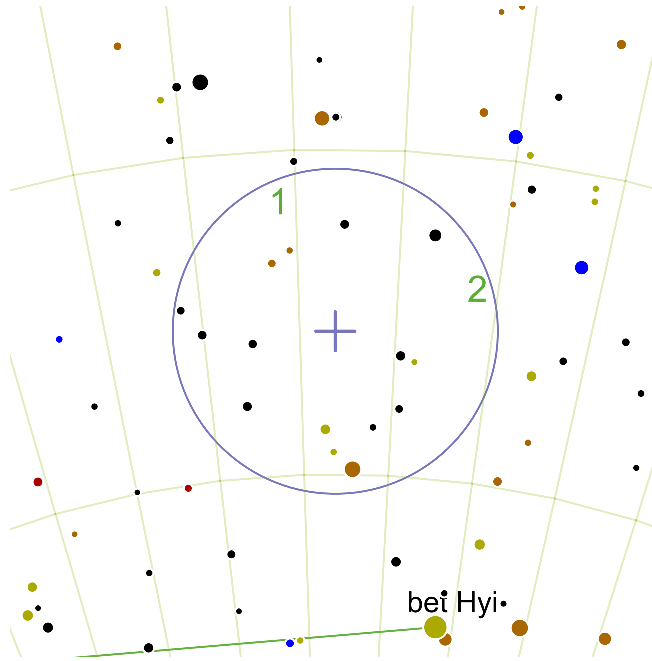




C104

RA: 15.8° | 1h 3.2' — DEC: -70.85° | -70° 50'

C104 (NGC 362) is a magnitude 6.6 globular cluster. Angular size is 13'.

6.9° NNE from mag.2.9 bet Hyi.

This moderately bright object is two or three billion years younger than the the majority of other globular clusters.

Also visible:

(1) C106 *(4.0_m globular cluster)*

(2) SMC *(2.7_m Magellanic barred spiral galaxy)*

SMC

RA: 13.15° | 0h 52.6' — DEC: -72.8° | -72° 47'

SMC is a magnitude 2.7 Magellanic barred spiral galaxy. Angular size is 315'.

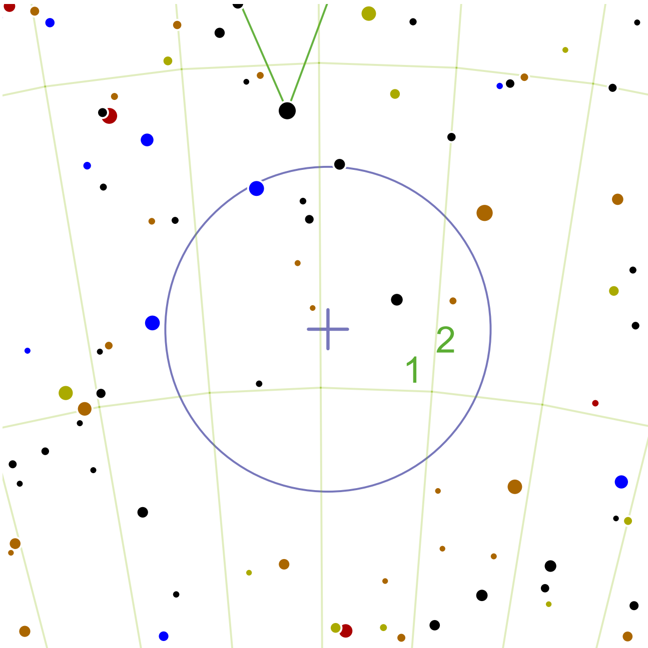
4.8° NNE from mag.2.9 bet Hyi.

The Small Magellanic Cloud has the mass of 7 billion Suns and spans about 7,000 light years. It is currently a satellite galaxy of the Milky Way but may formerly have been a satellite of the Large Magellanic Cloud. It is about 200,000 light years from Earth and spans over 4 degrees in our sky.

Also visible:

(1) C104 *(6.6_m globular cluster)*

(2) C106 *(4.0_m globular cluster)*



C103

RA: 84.68° | 5h 38.69' — DEC: -69.1° | -69° 5'

C103 (Tarantula Nebula, NGC 2070) is a magnitude 4.0 bright nebula. Angular size is 40x25'.

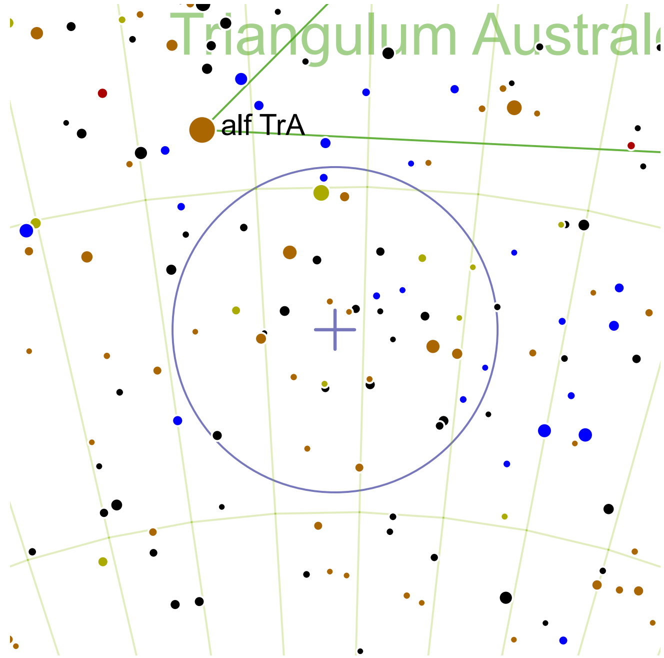
6.6° S from mag.3.81 bet Dor.

This colossal nebula shines at fourth magnitude despite being at a distance of 170,000 light-years. This is not an ordinary star-forming region like the little Orion Nebula, this complex is the bow shock of Large Magellanic Cloud as is crashes through the outer fringes of the Milky Way. The clusters forming in the Tarantula Nebula are also massive, like R136, which has the mass of half a million Suns and is quite possibly a newly formed globular cluster.

Also visible:

(1) LMC *(0.91_m Magellanic barred spiral galaxy)*

(2) S Dor *(8.6_m variable star)*



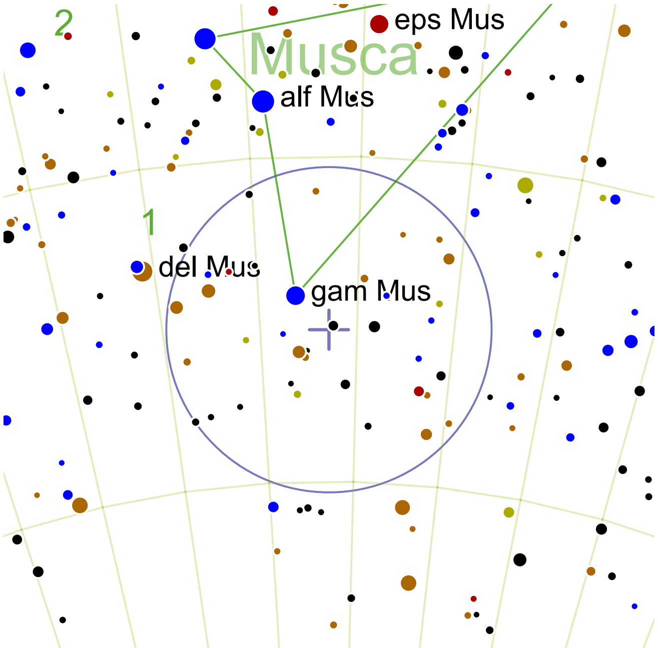
C107

RA: 246.45° | 16h 25.79' — DEC: -72.2° | -72° 11'

C107 (NGC 6101) is a magnitude 9.3 globular cluster. Angular size is 11'.

3.6° SSW from mag.1.88 alf TrA.

This distant globular cluster (50,000 light-years from Earth) is quite dim, requiring dark skies to appreciate it.



C108

RA: 186.45° | 12h 25.79' — DEC: -72.67° | -72° 39'

C108 (NGC 4372) is a magnitude 7.8 globular cluster. Angular size is 19'.

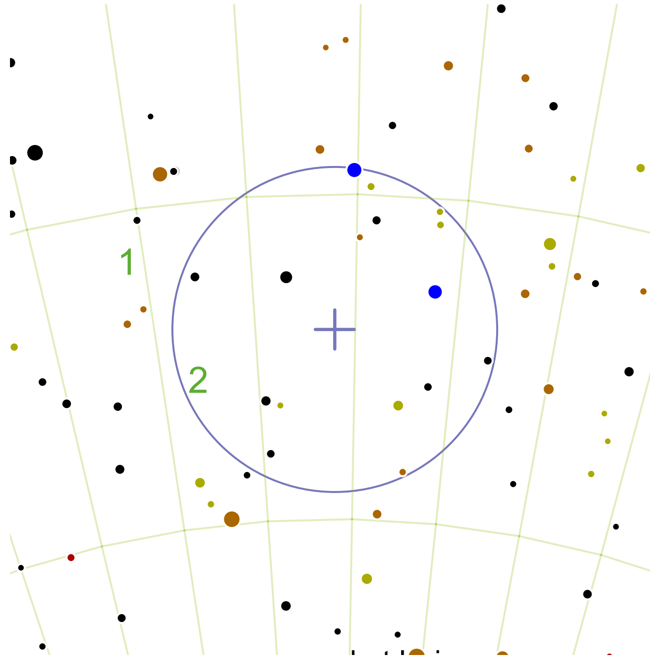
3.0° SWW from mag.3.63 del Mus.

A relatively dim globular cluster, it is 19,000 light-years away, so it can be possible to resolve some stars in the cluster with a moderately sized telescope.

Also visible:

(1) C105 *(7.3$_m$ globular cluster)*

(2) IC 4191 *(11.5$_m$ planetary nebula)*



C106

RA: 6.03° | 0h 24.1' — DEC: -72.08° | -72° 4'

C106 (47 Tucanae, NGC 104) is a magnitude 4.0 globular cluster. Angular size is 31'.

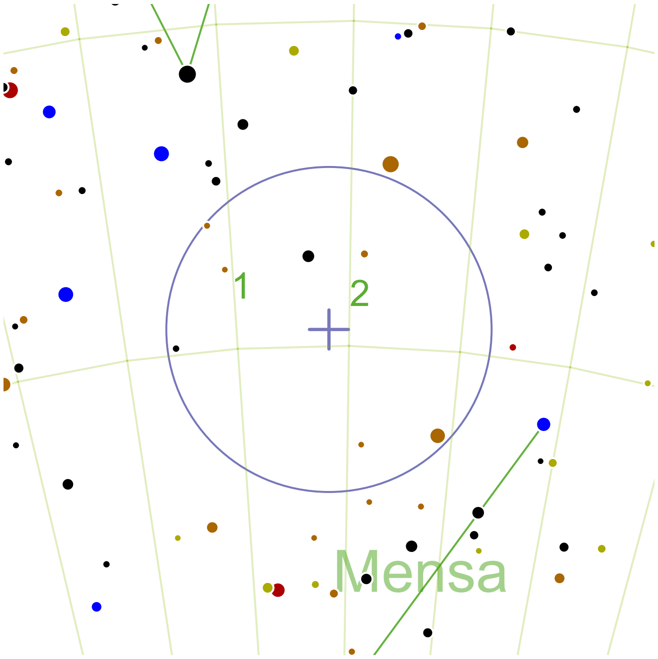
5.1° N from mag.2.9 bet Hyi.

The second-brightest globular cluster in our sky (after Omega Centauri), Caldwell 106 (better known as 47 Tucanae) has a very dense, bright core. The Hubble Space Telescope scanned this cluster for exoplanets. Based on the density of exoplanets near Earth around a dozen exoplanets should have been discovered, but none were - indicating planets might be rare in globulars. So there might be no-one living in these clusters, looking up at the brightest skies imaginable.

Also visible:

(1) C104 *(6.6$_m$ globular cluster)*

(2) SMC *(2.7$_m$ Magellanic barred spiral galaxy)*



LMC

RA: 80.9° | 5h 23.6' — DEC: -69.75° | -69° 44'

LMC is a magnitude 0.91 Magellanic barred spiral galaxy. Angular size is 645'.

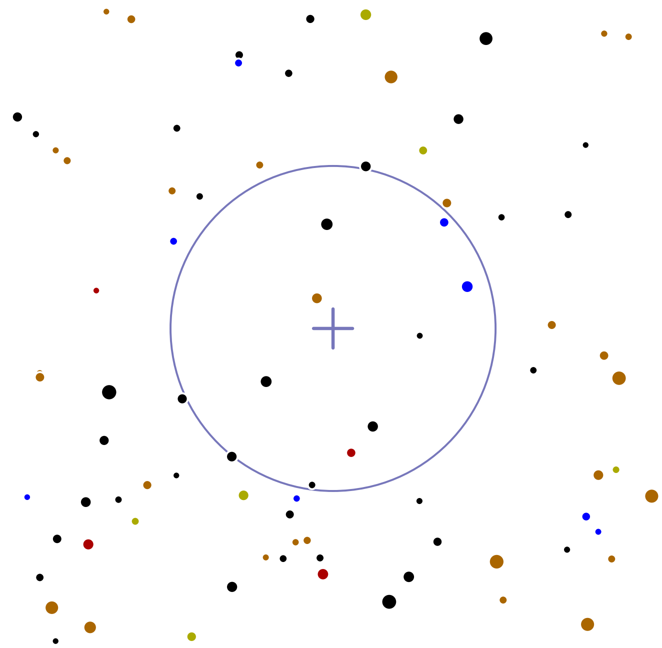
7.3° S from mag.3.81 bet Dor.

With a mass of 10 billion Suns, the Large Magellanic Cloud is 1% of the mass of the Milky Way. It is the fourth-largest galaxy in the Local Group, after M31, the Milky Way and M33. It is classified as Magellanic Spiral (a galaxy with a core and one spiral arm). It lies 163,000 light-years from Earth, and spans 10 degrees in our sky.

Also visible:

(1) C103 *(4.0$_m$ bright nebula)*

(2) S Dor *(8.6$_m$ variable star)*



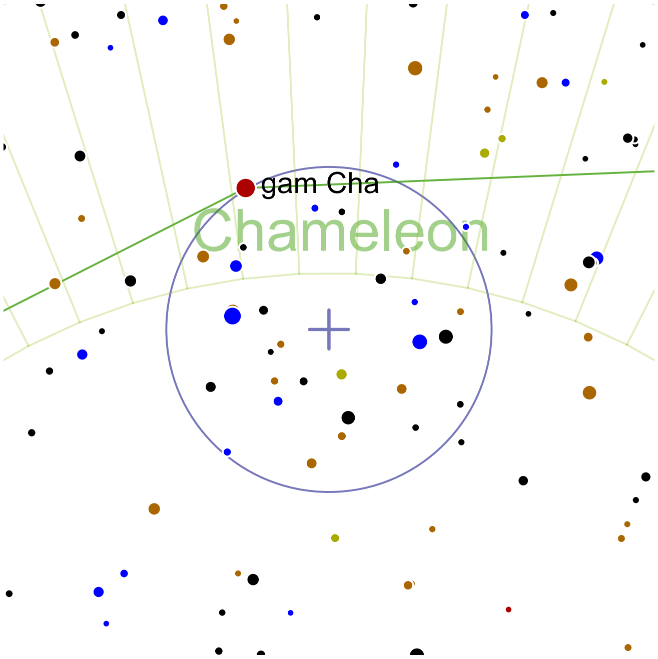
R Oct

RA: 81.53° | 5h 26.1' — DEC: -86.39° | -86° 22'

R Oct (HD 040857) is a magnitude 6.4 variable star. Magnitude ranges from 13.2 to 6.4 (Δ mag. 6.8) with a period of 405d.

12.3° SSE from mag.2.9 bet Hyi.

This moderately red pulsating giant star is approximately 1,650 light-years from Earth.



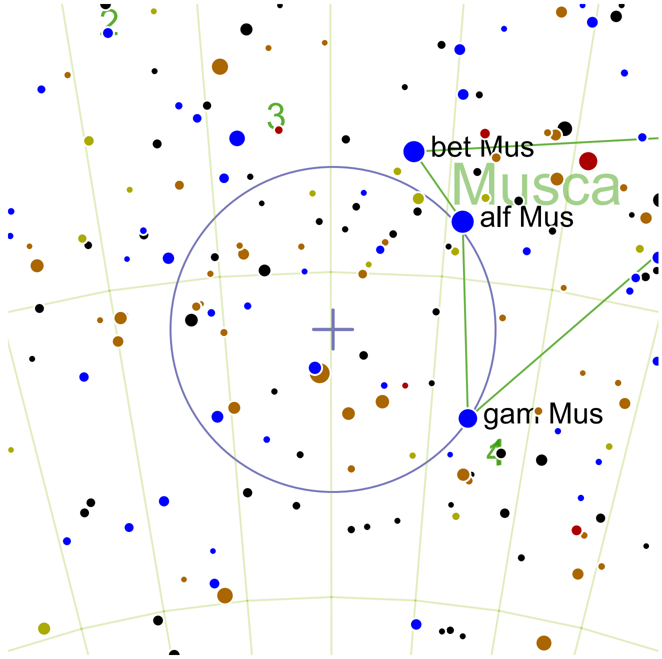
C109

RA: 152.38° | 10h 9.5' — DEC: -80.87° | -80° 51'

C109 (NGC 3195) is a magnitude 11.6 planetary nebula. Angular size is 1.3'.

10.8° S from mag.3.56 ome Car.

A small and dim planetary nebula, discovered by John Herschel in 1835.



C105

RA: 194.9° | 12h 59.6' — DEC: -70.88° | -70° 52'

C105 (The Southern Butterfly, NGC 4833) is a magnitude 7.3 globular cluster. Angular size is 14'.

0.7° NNW from mag.3.63 del Mus.

Somewhat fainter and sparser than Caldwell 104, this globular cluster to 22,000 light-years from Earth.

Also visible:

(1) C108 *(7.8$_m$ globular cluster)*

(2) NGC 5189 *(10.0$_m$ planetary nebula)*

(3) IC 4191 *(11.5$_m$ planetary nebula)*

(4) NGC 4372 *(7.24$_m$ globular cluster)*

Acknowledgements

This book would not be possible without the prior work of many others, so I would like to offer my thanks here to a number of my main resources. Sadly there are other resources that I have used over the years to which I also owe thanks but which have become part of the furniture of my mind and have thus been overlooked on the following list.

The Messier Catalog was one of the first and certainly the most famous of catalogs of deep sky objects. Intended as list of extended objects that were not comets as an aid to comet hunters, I must say that even in a small telescope very few Messiers look at all like a comet.

https://en.wikipedia.org/wiki/Messier_object

Being the first, Messier managed to collect many of the very best objects but by no means all. Patrick Moore's Caldwell catalog addresses this by collecting many more notable objects. A drawback of the Caldwell catalog is that a number of the objects are very difficult.

https://en.wikipedia.org/wiki/Caldwell_catalogue

In addition to these catalogs there are still a further number of galaxies, nebulae and clusters that were worth including in this book. These were mostly cataloged by the Herschels in the titanic NGC catalog.

https://en.wikipedia.org/wiki/New_General_Catalogue

The planetarium software Stellarium has been helpful, particularly in selecting double stars that are bright and easily locatable:

http://stellarium.org/

Wikipedia is a phenomenal resource and more trustworthy than many think - but double checking is always advisable, both for Wikipedia and any other online resource!

https://en.wikipedia.org/wiki/Main_Page

The Henry Draper catalog compiled by Annie Jump Cannon is the main resource for star positions in the charts. Some variables and high proper motion star have been manually corrected by me.

https://ui.adsabs.harvard.edu/abs/1993yCat.3135....0C/abstract

The charts would be labelled with incomprehensible Henry Draper numbers without the help of this catalog that cross references Flamsteed and Bayer designations with HD numbers.

https://cdsarc.unistra.fr/viz-bin/cat/IV/27A

In addition to the Bayer and Flamsteed designations, the IAU provides official and usually widely accepted names for a few stars:

https://www.iau.org/public/themes/naming_stars/

The Apache Software Foundation and the Apache FOP contributors provided the PDF and SVG rendering software required for this book. They said FOP 0.96 was dead, but 20 years later it is still going strong. Version 2.6 and counting!

https://xmlgraphics.apache.org/fop/

The World Wide Web Consortium developed the XSL FO and SVG standards used by Apache FOP. The work that went into creating these standards opened up technical publishing technology to the world.

https://www.w3.org/TR/xsl/

https://www.w3.org/TR/SVG2/

The cover image was taken by me and shows Messiers 42 and 43, as well as the Running Man nebula, which is three NGC objects for the price of one: NGC 1973, NGC 1975 and NGC 1977.

This book received constructive input from the members of the Stargazer's Lounge and Cloudy Nights forums, which brought about many improvements, from diagram colors to indexing of information.

Linda Clarke contributed many hours of patient editing, diagram adjustment, and data normalization that made this book possible.

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143	IC 4651	17h 24.7'	-49° 0-56.9'	6.9	open cluster	269, 270
144	IC 4663	17h 45.5'	-44° 0-53.9'	12.5	planetary nebula	269, 269
145	IC 4665	17h 46.3'	+5° 43.0'	4.2	open cluster	243
146	IC 4699	18h 18.5'	-45° 0-58.9'	12.5	planetary nebula	269
147	IC 4756	18h 39.0'	+5° 27.0'	5.0	open cluster	241, 242, 243
148	IC 4997	20h 20.2'	+16° 45.0'	11.5	planetary nebula	286, 288
149	KS Mon	06h 19.8'	-5° 0-17.9'	8.5	carbon star	127, 127
150	l Car	09h 45.2'	-62° 0-30.4'	3.28	variable star	158, 159, 161, 162, 162, 163
151	LMC	05h 23.6'	-69° 0-44.9'	0.91	Magellanic barred spiral galaxy	310, 308
152	M1	05h 34.5'	+22° 01.0'	8.4	supernova remnant	114
153	M10	16h 57.1'	-4° 0-5.9'	6.6	globular cluster	247, 247
154	M100	12h 23.0'	+15° 50.0'	9.3	spiral galaxy	180, 181, 185, 188, 188, 185
155	M101	14h 03.2'	+54° 21.0'	7.9	spiral galaxy	208
156	M102	15h 06.5'	+55° 46.0'	9.9	lenticular galaxy	208
157	M103	01h 33.2'	+60° 42.0'	7.4	open cluster	59, 64, 81, 85, 85

	Name	RA	DEC	Mag.	Type	Page
158	M104	12h 40.0'	-11° 0-36.9'	8.0	spiral galaxy	192
159	M105	10h 47.8'	+12° 35.0'	9.3	elliptical galaxy	182, 189, 180
160	M106	12h 18.9'	+47° 19.0'	8.4	spiral galaxy	173, 172, 169
161	M107	16h 32.5'	-13° 0-2.9'	7.9	globular cluster	220, 249
162	M108	11h 11.5'	+55° 40.0'	10.0	spiral galaxy	171, 168
163	M109	11h 57.6'	+53° 23.0'	9.8	barred spiral galaxy	171, 172, 167
164	M11	18h 51.1'	-6° 0-15.9'	6.3	open cluster	248, 253, 248
165	M110	00h 40.4'	+41° 41.0'	8.5	elliptical galaxy	65, 62, 62, 66
166	M12	16h 47.2'	-1° 0-56.9'	6.7	globular cluster	247, 247
167	M13	16h 41.7'	+36° 28.0'	5.8	globular cluster	236
168	M14	17h 37.6'	-3° 0-14.9'	7.6	globular cluster	253, 252
169	M15	21h 30.0'	+12° 10.0'	6.2	globular cluster	287
170	M16	18h 18.8'	-13° 0-46.9'	6.4	open cluster	249, 250, 254, 255, 254
171	M17	18h 20.8'	-16° 0-10.9'	7.0	diffuse nebula	254, 254, 256, 249
172	M18	18h 19.9'	-17° 0-7.9'	7.5	open cluster	254, 255
173	M19	17h 02.6'	-26° 0-15.9'	6.8	globular cluster	261, 261, 257
174	M2	21h 33.5'	+0° 0-48.9'	6.5	globular cluster	293
175	M20	18h 02.6'	-23° 0-1.9'	9.0	diffuse nebula	250, 256
176	M21	18h 04.6'	-22° 0-29.9'	6.5	open cluster	250, 250, 252, 256, 257, 251
177	M22	18h 36.4'	-23° 0-53.9'	5.1	globular cluster	252, 256, 251
178	M23	17h 56.8'	-19° 0-0.9'	6.9	open cluster	251, 256, 250
179	M24	18h 16.9'	-18° 0-29.9'	4.6	star cloud	249, 251, 254, 254, 255, 256, 256, 250

	Name	RA	DEC	Mag.	Type	Page
180	M25	18h 31.6'	-19° 0-14.9'	6.5	open cluster	249, 250, 251, 254, 255, 256
181	M26	18h 45.2'	-9° 0-23.9'	8.0	open cluster	248, 253, 248
182	M27	19h 59.6'	+22° 43.0'	7.4	planetary nebula	285, 286, 288
183	M28	18h 24.5'	-24° 0-51.9'	6.8	globular cluster	251, 251, 257, 252
184	M29	20h 23.9'	+38° 32.0'	7.1	open cluster	276, 276, 280, 280
185	M3	13h 42.2'	+28° 23.0'	6.2	globular cluster	214
186	M30	21h 40.4'	-23° 0-10.9'	7.2	globular cluster	297
187	M31	00h 41.8'	+41° 16.0'	3.4	spiral galaxy	62, 65, 66, 62
188	M32	00h 42.8'	+40° 52.0'	8.1	elliptical galaxy	66, 62, 62, 65
189	M33	01h 33.9'	+30° 39.0'	5.7	spiral galaxy	88
190	M34	02h 42.0'	+42° 47.0'	5.5	open cluster	83, 87
191	M35	06h 08.9'	+24° 20.0'	5.3	open cluster	113, 118
192	M36	05h 36.1'	+34° 08.0'	6.3	open cluster	109, 108, 108, 109, 110
193	M37	05h 52.4'	+32° 33.0'	6.2	open cluster	110, 109
194	M38	05h 28.7'	+35° 50.0'	7.4	open cluster	108, 108, 109, 109
195	M39	21h 32.2'	+48° 26.0'	4.6	open cluster	279, 279
196	M4	16h 23.6'	-26° 0-31.9'	5.6	globular cluster	221, 222, 222
197	M40	12h 22.4'	+58° 05.0'	8.4	double star	171, 167
198	M41	06h 47.0'	-20° 0-43.9'	4.6	open cluster	129
199	M42	05h 35.4'	-5° 0-26.9'	4.0	diffuse nebula	128, 123, 123, 124
200	M43	05h 35.6'	-5° 0-15.9'	9.0	diffuse nebula	124, 123, 123, 128
201	M44	08h 40.1'	+19° 59.0'	3.7	open cluster	140, 140
202	M45	03h 47.0'	+24° 07.0'	1.6	open cluster	90
203	M46	07h 41.8'	-14° 0-48.9'	6.0	open cluster	151, 148, 150, 151
204	M47	07h 36.6'	-14° 0-29.9'	5.2	open cluster	148, 125, 129, 147, 151, 151
205	M48	08h 13.8'	-5° 0-47.9'	5.5	open cluster	147
206	M49	12h 29.8'	+8° 00.0'	8.4	elliptical galaxy	181, 182, 183, 183, 188, 189, 190

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207	M5	15h 18.6'	+2° 05.0'	5.6	globular cluster	218
208	M50	07h 03.2'	-8° 0-19.9'	6.3	open cluster	124
209	M51	13h 30.0'	+47° 11.0'	8.4	spiral galaxy	168
210	M52	23h 24.2'	+61° 35.0'	7.3	open cluster	63, 63, 59
211	M53	13h 12.9'	+18° 10.0'	7.6	globular cluster	184, 178
212	M54	18h 55.1'	-30° 0-28.9'	7.6	globular cluster	262, 263, 266
213	M55	19h 40.0'	-30° 0-57.9'	6.3	globular cluster	300, 300
214	M56	19h 16.6'	+30° 11.0'	8.3	globular cluster	237
215	M57	18h 53.6'	+33° 02.0'	8.8	planetary nebula	236
216	M58	12h 37.7'	+11° 49.0'	9.7	barred spiral galaxy	182
217	M59	12h 42.0'	+11° 39.0'	9.6	elliptical galaxy	190, 189
218	M6	17h 40.1'	-32° 0-12.9'	4.2	open cluster	262, 267, 266
219	M60	12h 43.7'	+11° 33.0'	8.8	elliptical galaxy	179, 180, 181, 181, 182, 186, 188, 188, 189, 190, 183
220	M61	12h 21.9'	+4° 28.0'	9.7	spiral galaxy	190, 190, 183
221	M62	17h 01.2'	-30° 0-6.9'	6.5	globular cluster	257, 261, 261
222	M63	13h 15.8'	+42° 02.0'	8.6	spiral galaxy	173, 169
223	M64	12h 56.7'	+21° 41.0'	8.5	spiral galaxy	177, 178, 184
224	M65	11h 18.9'	+13° 05.0'	9.3	spiral galaxy	187, 187
225	M66	11h 20.2'	+12° 59.0'	8.9	spiral galaxy	187, 187
226	M67	08h 50.4'	+11° 49.0'	6.1	open cluster	141
227	M68	12h 39.5'	-26° 0-44.9'	7.8	globular cluster	196
228	M69	18h 31.4'	-32° 0-20.9'	7.6	globular cluster	262, 267

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229	M7	17h 53.9'	-34° 0-48.9'	3.3	open cluster	262, 266, 267
230	M70	18h 43.2'	-32° 0-17.9'	7.9	globular cluster	263, 266, 267, 262
231	M71	19h 53.8'	+18° 47.0'	8.2	globular cluster	286, 288, 286
232	M72	20h 53.5'	-12° 0-31.9'	9.3	globular cluster	293, 295, 296
233	M73	20h 59.0'	-12° 0-37.9'	9.0	asterism	296, 293, 295
234	M74	01h 36.7'	+15° 47.0'	9.4	spiral galaxy	91
235	M75	20h 06.1'	-21° 0-54.9'	8.5	globular cluster	294, 295
236	M76	01h 42.4'	+51° 34.0'	10.1	planetary nebula	86
237	M77	02h 42.7'	+0° 02.0'	8.9	spiral galaxy	94
238	M78	05h 46.7'	+0° 03.0'	8.3	diffuse nebula	120, 123, 123
239	M79	05h 24.5'	-24° 0-32.9'	7.7	globular cluster	126
240	M8	18h 03.8'	-24° 0-22.9'	6.0	diffuse nebula	251, 252, 256, 257
241	M80	16h 17.0'	-22° 0-58.9'	7.3	globular cluster	222, 222, 221
242	M81	09h 55.6'	+69° 04.0'	6.9	spiral galaxy	53, 49, 49, 50
243	M82	09h 55.8'	+69° 41.0'	8.4	irregular galaxy	50, 49, 49, 53
244	M83	13h 37.0'	-29° 0-51.9'	7.6	spiral galaxy	229, 225
245	M84	12h 25.1'	+12° 53.0'	9.1	lenticular galaxy	179, 179, 180, 181, 181, 182, 183, 185, 186, 186, 188, 188
246	M85	12h 25.5'	+18° 12.0'	9.1	lenticular galaxy	179, 179, 185, 186, 186, 185
247	M86	12h 26.2'	+12° 57.0'	8.9	lenticular galaxy	179, 179, 180, 181, 182, 183, 185, 186, 186, 188, 188, 189, 181
248	M87	12h 30.8'	+12° 24.0'	8.6	elliptical galaxy	179, 179, 180, 181, 181, 182, 183, 185, 186, 186, 188, 189, 190, 188
249	M88	12h 32.1'	+14° 26.0'	9.6	spiral galaxy	185, 179

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250	M89	12h 35.7'	+12° 33.0'	9.8	elliptical galaxy	181
251	M9	17h 19.2'	-18° 0-30.9'	7.7	globular cluster	255
252	M90	12h 36.8'	+13° 10.0'	9.5	spiral galaxy	181, 188, 180
253	M91	12h 35.5'	+14° 30.0'	10.2	barred spiral galaxy	185, 186
254	M92	17h 17.1'	+43° 08.0'	6.4	globular cluster	235
255	M93	07h 44.6'	-23° 0-51.9'	6.0	open cluster	152, 149
256	M94	12h 50.9'	+41° 08.0'	8.2	spiral galaxy	173, 173, 169, 169, 170
257	M95	10h 44.0'	+11° 42.0'	9.7	barred spiral galaxy	180, 182, 189
258	M96	10h 46.8'	+11° 49.0'	9.2	spiral galaxy	180, 189, 182
259	M97	11h 14.8'	+55° 01.0'	9.9	planetary nebula	171, 168
260	M98	12h 13.9'	+14° 55.0'	10.1	spiral galaxy	185, 179
261	M99	12h 18.9'	+14° 26.0'	9.9	spiral galaxy	185, 186
262	mu Cep	21h 43.5'	+58° 48.0'	3.7	carbon star	273, 273
263	NGC 134	00h 30.4'	-33° 0-14.9'	11.23	barred spiral galaxy	76
264	NGC 157	00h 34.8'	-8° 0-23.9'	11.0	barred spiral galaxy	72
265	NGC 488	01h 21.8'	+5° 15.0'	11.15	barred spiral galaxy	70, 93
266	NGC 613	01h 34.3'	-29° 0-24.9'	10.73	barred spiral galaxy	76
267	NGC 925	02h 27.3'	+33° 35.0'	10.69	barred spiral galaxy	84
268	NGC 936	02h 27.6'	-1° 0-8.9'	11.12	lenticular galaxy	94, 96
269	NGC 1023	02h 40.4'	+39° 04.0'	10.35	lenticular galaxy	83, 87

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270	NGC 1027	02h 42.7'	+61° 33.0'	6.7	open cluster	82
271	NGC 129	00h 29.9'	+60° 14.0'	6.5	open cluster	60
272	NGC 1291	03h 17.3'	-41° 0-5.9'	9.39	barred spiral galaxy	101, 101
273	NGC 1313	03h 18.3'	-66° 0-29.9'	9.2	barred spiral galaxy	103, 103
274	NGC 1316	03h 22.7'	-37° 0-11.9'	9.42	lenticular galaxy	101, 101, 101
275	NGC 1342	03h 31.6'	+37° 20.0'	6.7	open cluster	83
276	NGC 1350	03h 31.1'	-33° 0-37.9'	11.16	barred spiral galaxy	101
277	NGC 1360	03h 33.3'	-25° 0-50.9'	9.5	planetary nebula	98
278	NGC 1365	03h 33.6'	-36° 0-7.9'	10.32	barred spiral galaxy	101
279	NGC 1380	03h 36.4'	-34° 0-58.9'	10.87	lenticular galaxy	101
280	NGC 1395	03h 38.5'	-23° 0-1.9'	10.55	elliptical galaxy	97, 98
281	NGC 1398	03h 38.9'	-26° 0-19.9'	10.57	barred spiral galaxy	97, 98
282	NGC 1399	03h 38.5'	-35° 0-26.9'	10.55	elliptical galaxy	101
283	NGC 1433	03h 42.0'	-47° 0-12.9'	10.7	barred spiral galaxy	102, 102
284	NGC 1444	03h 49.4'	+52° 40.0'	6.6	open cluster	82
285	NGC 1501	04h 07.0'	+60° 55.0'	12.5	planetary nebula	81
286	NGC 1502	04h 07.7'	+62° 20.0'	5.7	open cluster	81
287	NGC 1512	04h 03.9'	-43° 0-20.9'	11.13	barred spiral galaxy	102
288	NGC 1514	04h 09.2'	+30° 47.0'	9.5	planetary nebula	84

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289	NGC 1528	04h 15.4'	+51° 14.0'	6.4	open cluster	82, 86, 86
290	NGC 1535	04h 14.2'	-12° 0-43.9'	9.5	planetary nebula	97
291	NGC 1545	04h 20.9'	+50° 15.0'	6.2	open cluster	86, 82
292	NGC 1647	04h 46.0'	+19° 04.0'	6.4	open cluster	114, 91, 117
293	NGC 1662	04h 48.5'	+10° 56.0'	6.4	open cluster	115
294	NGC 1746	05h 03.6'	+23° 49.0'	6.0	open cluster	117
295	NGC 1792	05h 05.3'	-37° 0-58.9'	10.87	barred spiral galaxy	132, 133
296	NGC 1808	05h 07.7'	-37° 0-30.9'	10.74	barred spiral galaxy	132, 133
297	NGC 1981	05h 35.2'	-4° 0-25.9'	4.6	open cluster	123, 120, 123, 124, 128
298	NGC 2022	05h 42.1'	+9° 05.0'	11.5	planetary nebula	115
299	NGC 2129	06h 01.0'	+23° 18.0'	6.7	open cluster	113, 118
300	NGC 2169	06h 08.4'	+13° 57.0'	5.9	open cluster	118
301	NGC 2175	06h 09.8'	+20° 19.0'	6.8	open cluster	113, 118
302	NGC 2232	06h 26.6'	-4° 0-44.9'	3.9	open cluster	127, 127
303	NGC 2281	06h 49.3'	+41° 04.0'	5.4	open cluster	107, 107
304	NGC 2298	06h 49.0'	-36° 0-0.2'	9.29	globular cluster	132, 126
305	NGC 2301	06h 51.8'	+0° 28.0'	6.0	open cluster	116
306	NGC 2343	07h 08.3'	-10° 0-38.9'	6.7	open cluster	124
307	NGC 2346	07h 09.4'	+0° 0-47.9'	10.5	planetary nebula	116
308	NGC 2354	07h 14.3'	-25° 0-43.9'	6.5	open cluster	126, 130, 130
309	NGC 2423	07h 37.1'	-13° 0-51.9'	6.7	open cluster	151, 125, 129, 147, 148, 151
310	NGC 2440	07h 41.9'	-18° 0-12.9'	10.5	planetary nebula	151
311	NGC 2451	07h 45.4'	-37° 0-57.9'	2.8	open cluster	159, 155
312	NGC 2452	07h 47.4'	-27° 0-19.9'	12.5	planetary nebula	149, 152
313	NGC 2527	08h 05.3'	-28° 0-9.9'	6.5	open cluster	149, 152

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314	NGC 2539	08h 10.7'	-12° 0-49.9'	6.5	open cluster	148, 150
315	NGC 2546	08h 12.4'	-37° 0-37.9'	6.3	open cluster	155, 155
316	NGC 2547	08h 10.7'	-49° 0-15.9'	4.7	open cluster	156
317	NGC 2669	08h 44.9'	-52° 0-57.9'	6.1	open cluster	161
318	NGC 2681	08h 53.6'	+51° 19.0'	11.09	barred spiral galaxy	137
319	NGC 2768	09h 11.6'	+60° 02.0'	10.84	elliptical galaxy	136
320	NGC 2808	09h 12.0'	-64° 0-51.7'	6.2	globular cluster	159, 126, 158, 159, 163
321	NGC 2841	09h 22.0'	+50° 59.0'	10.09	barred spiral galaxy	137
322	NGC 288	00h 52.8'	-26° 0-34.9'	8.09	globular cluster	74
323	NGC 2899	09h 27.0'	-56° 0-5.9'	12.0	planetary nebula	161
324	NGC 3077	10h 03.4'	+68° 44.0'	10.61	irregular galaxy	49, 49, 50, 53
325	NGC 3114	10h 02.7'	-60° 0-6.9'	4.2	open cluster	162, 157, 158, 162, 163
326	NGC 3211	10h 17.8'	-62° 0-39.9'	11.5	planetary nebula	200, 202
327	NGC 3228	10h 21.8'	-51° 0-42.9'	6.0	open cluster	157
328	NGC 3384	10h 48.3'	+12° 38.0'	10.85	elliptical galaxy	180, 182, 189
329	NGC 3489	11h 00.3'	+13° 54.0'	11.12	lenticular galaxy	180, 182, 187, 189
330	NGC 3587	11h 14.8'	+55° 01.0'	11.0	planetary nebula	171
331	NGC 3607	11h 16.9'	+18° 03.0'	10.82	lenticular galaxy	178
332	NGC 3628	11h 20.3'	+13° 35.0'	10.28	barred spiral galaxy	178, 187, 187
333	NGC 3631	11h 21.0'	+53° 10.0'	11.01	spiral galaxy	171, 168

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334	NGC 3699	11h 28.0'	-59° 0-56.9'	11.0	planetary nebula	200, 204, 204
335	NGC 3893	11h 48.7'	+48° 43.0'	11.16	spiral galaxy	172
336	NGC 3918	11h 50.3'	-57° 0-10.9'	8.0	Type	201, 204
337	NGC 3938	11h 52.8'	+44° 07.0'	10.9	spiral galaxy	172
338	NGC 3953	11h 53.8'	+52° 20.0'	10.84	barred spiral galaxy	172
339	NGC 4051	12h 03.2'	+44° 32.0'	10.83	barred spiral galaxy	172, 173
340	NGC 4088	12h 05.6'	+50° 33.0'	11.15	barred spiral galaxy	172, 172
341	NGC 4125	12h 08.1'	+65° 10.0'	10.65	elliptical galaxy	52
342	NGC 4214	12h 15.7'	+36° 20.0'	10.24	irregular galaxy	174
343	NGC 4278	12h 20.1'	+29° 17.0'	11.09	elliptical galaxy	177
344	NGC 4361	12h 24.5'	-18° 0-47.9'	10.5	planetary nebula	194
345	NGC 4365	12h 24.5'	+7° 19.0'	10.52	elliptical galaxy	183
346	NGC 4372	12h 25.8'	-72° 0-39.4'	7.24	globular cluster	311
347	NGC 4395	12h 25.8'	+33° 33.0'	10.64	Magellanic barred spiral galaxy	174, 170
348	NGC 4414	12h 26.5'	+31° 13.0'	10.96	spiral galaxy	170
349	NGC 4490	12h 30.6'	+41° 38.0'	10.22	barred spiral galaxy	173, 173, 174, 169
350	NGC 4494	12h 31.4'	+25° 46.0'	10.71	elliptical galaxy	177, 184
351	NGC 4517	12h 32.8'	+0° 07.0'	11.1	spiral galaxy	190
352	NGC 4535	12h 34.3'	+8° 12.0'	10.59	spiral galaxy	183
353	NGC 4536	12h 34.4'	+2° 11.0'	11.16	barred spiral galaxy	190

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354	NGC 4605	12h 40.0'	+61° 37.0'	10.89	barred spiral galaxy	171, 167
355	NGC 4618	12h 41.6'	+41° 09.0'	11.22	SBd	174, 169
356	NGC 4636	12h 42.8'	+2° 41.0'	10.43	elliptical galaxy	190
357	NGC 4656	12h 44.0'	+32° 10.0'	10.96	Magellanic barred spiral galaxy	177, 184, 170
358	NGC 4699	12h 49.0'	-8° 0-39.9'	10.41	barred spiral galaxy	192, 192
359	NGC 4725	12h 50.4'	+25° 30.0'	10.11	barred spiral galaxy	177, 177, 184, 184
360	NGC 4753	12h 52.4'	-1° 0-11.9'	10.85	irregular galaxy	192
361	NGC 4776	12h 54.1'	-9° 0-12.9'	11.5	planetary nebula	192, 192
362	NGC 4976	13h 08.6'	-49° 0-29.9'	11.04	elliptical galaxy	199, 203
363	NGC 5033	13h 13.5'	+36° 36.0'	10.75	spiral galaxy	170
364	NGC 5053	13h 16.5'	+17° 42.0'	9.47	globular cluster	178, 178, 184
365	NGC 5068	13h 18.9'	-21° 0-1.9'	10.7	barred spiral galaxy	195
366	NGC 5102	13h 22.0'	-36° 0-37.9'	10.35	lenticular galaxy	229
367	NGC 5189	13h 33.5'	-65° 0-58.9'	10.0	planetary nebula	205, 228, 232, 311
368	NGC 5253	13h 39.9'	-31° 0-38.9'	10.87	irregular galaxy	225, 229
369	NGC 5281	13h 46.6'	-62° 0-53.9'	5.9	open cluster	228, 228, 231, 232
370	NGC 5286	13h 46.4'	-51° 0-22.3'	7.34	globular cluster	199, 229
371	NGC 5307	13h 51.1'	-51° 0-11.9'	11.5	planetary nebula	229, 230

	Name	RA	DEC	Mag.	Type	Page
372	NGC 5315	13h 53.9'	-66° 0-30.9'	11.5	planetary nebula	232
373	NGC 5316	13h 53.9'	-61° 0-51.9'	6.0	open cluster	228, 231, 232, 228
374	NGC 5363	13h 56.1'	+5° 15.0'	11.05	irregular galaxy	217
375	NGC 5364	13h 56.2'	+5° 01.0'	11.17	barred spiral galaxy	217
376	NGC 5460	14h 07.6'	-48° 0-18.9'	5.6	open cluster	230, 229
377	NGC 5585	14h 19.8'	+56° 44.0'	11.2	spiral galaxy	208
378	NGC 5617	14h 29.8'	-60° 0-42.9'	6.3	open cluster	228, 231, 231, 228
379	NGC 5643	14h 32.7'	-44° 0-9.9'	10.74	spiral galaxy	229
380	NGC 5662	14h 35.2'	-56° 0-32.9'	5.5	open cluster	227, 228, 231, 231
381	NGC 5846	15h 06.5'	+1° 36.0'	11.05	elliptical galaxy	218
382	NGC 5882	15h 16.8'	-45° 0-38.9'	10.0	planetary nebula	226
383	NGC 5907	15h 15.9'	+56° 20.0'	11.12	spiral galaxy	208
384	NGC 5927	15h 28.0'	-50° 0-40.3'	8.01	globular cluster	226, 226
385	NGC 5946	15h 35.5'	-50° 0-39.5'	9.61	globular cluster	226, 226, 227
386	NGC 5979	15h 47.7'	-61° 0-12.9'	12.0	planetary nebula	227, 232
387	NGC 6058	16h 04.4'	+40° 41.0'	13.0	planetary nebula	209, 210, 210
388	NGC 6067	16h 13.2'	-54° 0-12.9'	5.6	open cluster	226, 227, 230
389	NGC 6139	16h 27.7'	-38° 0-50.8'	8.99	globular cluster	225
390	NGC 6144	16h 27.2'	-26° 0-1.3'	9.01	globular cluster	221, 222, 222
391	NGC 6153	16h 31.5'	-40° 0-14.9'	11.0	planetary nebula	225, 268
392	NGC 6167	16h 34.4'	-49° 0-35.9'	6.7	open cluster	230, 264, 265

	Name	RA	DEC	Mag.	Type	Page
393	NGC 6221	16h 52.8'	-59° 0-12.9'	10.66	barred spiral galaxy	227
394	NGC 6242	16h 55.6'	-39° 0-29.9'	6.4	open cluster	264, 268, 268
395	NGC 6250	16h 58.0'	-45° 0-47.9'	5.9	open cluster	264, 265, 268, 264
396	NGC 6256	16h 59.5'	-37° 0-7.2'	11.29	globular cluster	268
397	NGC 6287	17h 05.2'	-22° 0-42.4'	9.35	globular cluster	255
398	NGC 6293	17h 10.2'	-26° 0-34.8'	8.22	globular cluster	257
399	NGC 6304	17h 14.5'	-29° 0-27.6'	8.22	globular cluster	257, 261, 261
400	NGC 6322	17h 18.5'	-42° 0-56.9'	6.0	open cluster	264, 268, 264
401	NGC 6326	17h 20.8'	-51° 0-44.9'	11.5	planetary nebula	269, 270
402	NGC 6337	17h 22.3'	-38° 0-28.9'	12.0	planetary nebula	268
403	NGC 6342	17h 21.2'	-19° 0-35.1'	9.66	globular cluster	255, 255
404	NGC 6356	17h 23.6'	-17° 0-48.7'	8.25	globular cluster	255, 255
405	NGC 6366	17h 27.7'	-5° 0-4.7'	9.2	globular cluster	252, 252
406	NGC 6380	17h 34.5'	-39° 0-4.1'	11.31	globular cluster	268
407	NGC 6384	17h 32.4'	+7° 04.0'	11.14	barred spiral galaxy	243
408	NGC 6388	17h 36.3'	-44° 0-44.0'	6.72	globular cluster	264, 269
409	NGC 6416	17h 44.4'	-32° 0-20.9'	5.7	open cluster	262, 266, 267, 262
410	NGC 6426	17h 44.9'	+3° 10.2'	11.01	globular cluster	243
411	NGC 6440	17h 48.9'	-20° 0-21.5'	9.2	globular cluster	250

	Name	RA	DEC	Mag.	Type	Page
412	NGC 6441	17h 50.2'	-37° 0-3.0'	7.15	globular cluster	262, 267
413	NGC 6453	17h 50.8'	-34° 0-35.9'	10.08	globular cluster	266
414	NGC 6496	17h 59.0'	-44° 0-15.9'	8.54	globular cluster	269
415	NGC 6503	17h 49.5'	+70° 09.0'	10.91	spiral galaxy	234
416	NGC 6517	18h 01.8'	-8° 0-57.4'	10.23	globular cluster	253
417	NGC 6522	18h 03.6'	-30° 0-1.9'	8.27	globular cluster	262
418	NGC 6539	18h 04.8'	-7° 0-35.1'	9.33	globular cluster	253
419	NGC 654	01h 44.1'	+61° 53.0'	6.5	open cluster	59, 64, 81, 85, 85
420	NGC 6544	18h 07.3'	-24° 0-59.7'	7.77	globular cluster	252, 257
421	NGC 6553	18h 09.3'	-25° 0-54.4'	8.06	globular cluster	257
422	NGC 6558	18h 10.3'	-31° 0-45.7'	9.26	globular cluster	267
423	NGC 6567	18h 13.7'	-19° 0-4.9'	11.5	planetary nebula	250
424	NGC 6569	18h 13.6'	-31° 0-49.5'	8.55	globular cluster	267, 267
425	NGC 6572	18h 12.1'	+6° 51.0'	8.5	planetary nebula	242
426	NGC 6605	18h 17.1'	-14° 0-57.9'	6.0	open cluster	249, 250, 254, 255, 256, 254
427	NGC 6624	18h 23.7'	-30° 0-21.6'	7.87	globular cluster	262, 267
428	NGC 6633	18h 27.7'	+6° 34.0'	4.6	open cluster	241, 243, 242
429	NGC 6638	18h 30.9'	-25° 0-29.7'	9.02	globular cluster	251
430	NGC 6642	18h 31.9'	-23° 0-28.4'	9.13	globular cluster	251

	Name	RA	DEC	Mag.	Type	Page
431	NGC 6652	18h 35.8'	-32° 0-59.3'	8.62	globular cluster	262, 266, 267
432	NGC 6709	18h 51.5'	+10° 21.0'	6.7	open cluster	241, 242, 241
433	NGC 6712	18h 53.1'	-8° 0-42.3'	8.1	globular cluster	248, 253
434	NGC 6716	18h 54.6'	-19° 0-52.9'	6.9	open cluster	251
435	NGC 6723	18h 59.5'	-36° 0-37.8'	7.01	globular cluster	262, 263, 263
436	NGC 6781	19h 18.4'	+6° 33.0'	12.0	planetary nebula	242
437	NGC 6811	19h 38.2'	+46° 34.0'	6.8	open cluster	234, 274, 274, 278
438	NGC 6818	19h 44.0'	-14° 0-8.9'	9.3	planetary nebula	294, 296
439	NGC 6842	19h 55.0'	+29° 17.0'	13.0	planetary nebula	281, 285
440	NGC 6871	20h 05.9'	+35° 47.0'	5.2	open cluster	280, 276, 280, 281
441	NGC 6884	20h 10.4'	+46° 28.0'	12.5	planetary nebula	274, 274, 275
442	NGC 6886	20h 12.7'	+19° 59.0'	12.0	planetary nebula	286, 288
443	NGC 6905	20h 22.4'	+20° 07.0'	11.5	planetary nebula	286, 288
444	NGC 6940	20h 34.6'	+28° 18.0'	6.3	open cluster	281, 285, 287, 287
445	NGC 7026	21h 06.3'	+47° 51.0'	12.0	planetary nebula	275, 279
446	NGC 7027	21h 07.1'	+42° 14.0'	9.0	planetary nebula	275
447	NGC 7048	21h 14.2'	+46° 16.0'	11.5	planetary nebula	275, 279
448	NGC 7160	21h 53.7'	+62° 36.0'	6.1	open cluster	273, 273
449	NGC 7209	22h 05.2'	+46° 30.0'	6.7	open cluster	278, 279
450	NGC 7213	22h 09.3'	-47° 0-9.9'	11.01	barred spiral galaxy	302

	Name	RA	DEC	Mag.	Type	Page
451	NGC 7217	22h 07.9'	+31° 22.0'	11.02	barred spiral galaxy	285
452	NGC 7354	22h 40.4'	+61° 17.0'	12.5	planetary nebula	63
453	NGC 7686	23h 30.2'	+49° 08.0'	5.6	open cluster	64, 60
454	NGC 7789	23h 57.0'	+56° 44.0'	6.7	open cluster	59, 60
455	NGC 7793	23h 57.8'	-32° 0-34.9'	9.63	spiral galaxy	76
456	Palomar 10	19h 18.0'	+18° 34.3'	13.22	globular cluster	240
457	Palomar 13	23h 06.7'	+12° 46.3'	13.47	globular cluster	69, 69
458	Palomar 5	15h 16.1'	+0° 06.7'	11.75	globular cluster	218
459	R And	00h 24.0'	+38° 34.6'	5.8	variable star	62, 65, 66, 62
460	R Aql	19h 06.4'	+8° 13.8'	5.5	variable star	241, 242
461	R Aqr	23h 43.8'	-15° 0-17.0'	5.8	variable star	73, 72
462	R Ari	02h 16.1'	+25° 03.4'	7.4	variable star	90
463	R Aur	05h 17.3'	+53° 35.2'	6.7	variable star	106
464	R Boo	14h 37.2'	+26° 44.2'	6.2	variable star	215
465	R Car	09h 32.2'	-62° 0-47.2'	3.9	variable star	163, 158, 159, 161, 162, 162
466	R Cas	23h 58.4'	+51° 23.3'	4.7	variable star	64, 60
467	R Cen	14h 16.6'	-59° 0-54.7'	5.3	variable star	228, 228, 231, 232, 231
468	R CMa	07h 19.5'	-16° 0-23.6'	5.7	variable star	125, 129, 148, 151
469	R Cnc	08h 16.6'	+11° 43.6'	6.07	variable star	141
470	R Com	12h 04.3'	+18° 46.9'	7.1	variable star	179, 185, 186
471	R CrB	15h 48.6'	+28° 09.4'	5.71	variable star	214, 215
472	R Cru	12h 23.6'	-61° 0-37.6'	6.4	variable star	201, 203, 205, 201
473	R Crv	12h 19.6'	-19° 0-15.3'	6.7	variable star	193, 194, 194
474	R Cyg	19h 36.8'	+50° 12.0'	6.1	variable star	278, 274, 274
475	R For	02h 29.3'	-26° 0-5.8'	7.5	variable star	98, 100
476	R Gem	07h 07.4'	+22° 42.2'	6.0	variable star	113
477	R Hor	02h 53.9'	-49° 0-53.3'	4.7	variable star	102
478	R Hya	13h 29.7'	-23° 0-16.8'	3.5	variable star	195

	Name	RA	DEC	Mag.	Type	Page
479	R Leo	09h 47.6'	+11° 25.7'	4.4	variable star	142
480	R Lep	04h 59.6'	-14° 0-47.9'	5.9	carbon star	125, 128, 128
481	R LMi	09h 45.6'	+34° 30.7'	6.3	variable star	138
482	R Lyr	18h 55.3'	+43° 56.8'	3.88	variable star	235
483	R Nor	15h 36.0'	-49° 0-30.4'	6.5	variable star	226
484	R Oct	05h 26.1'	-86° 0-23.2'	6.4	variable star	310
485	R Ori	04h 59.0'	+8° 07.8'	9.05	variable star	115
486	R Peg	23h 06.7'	+10° 32.6'	6.9	variable star	69, 69
487	R Pic	04h 46.2'	-49° 0-14.7'	6.35	variable star	133
488	R Psc	01h 30.6'	+2° 52.9'	7.0	variable star	93
489	R Scl	01h 27.0'	-32° 0-29.9'	6.1	carbon star	76
490	R Sct	18h 47.5'	-5° 0-42.2'	4.2	variable star	248, 248, 253
491	R Ser	15h 50.7'	+15° 08.0'	5.16	variable star	216
492	R Sgr	19h 16.7'	-19° 0-18.4'	6.7	variable star	296
493	R Tau	04h 28.3'	+10° 09.7'	7.6	variable star	93
494	R Tri	02h 37.0'	+34° 15.9'	5.4	variable star	84
495	R UMa	10h 44.6'	+68° 46.5'	6.5	variable star	49, 49, 50, 53
496	R Vir	12h 38.5'	+6° 59.3'	6.1	variable star	183, 183, 189, 190
497	RR Sco	16h 56.6'	-30° 0-34.7'	5.0	variable star	257, 261, 261
498	RR Sgr	19h 55.9'	-29° 0-11.3'	5.4	variable star	300, 300
499	RS Cyg	20h 13.4'	+38° 42.0'	6.6	carbon star	276, 280, 280
500	RS Oph	17h 50.2'	-6° 0-42.4'	4.3	variable star	252, 253
501	RS Pup	08h 13.1'	-34° 0-34.6'	6.52	variable star	155, 155
502	RS Sco	16h 55.6'	-45° 0-6.1'	6.2	variable star	264, 264, 265, 268
503	RT Cap	20h 17.0'	-21° 0-17.9'	6.5	carbon star	295, 294
504	RT Cyg	19h 43.6'	+48° 46.7'	6.0	variable star	234, 274, 274, 278
505	RT Pup	08h 05.4'	-38° 0-41.9'	8.5	carbon star	155, 155, 159
506	RT Sco	17h 03.5'	-36° 0-55.1'	7.0	variable star	268
507	RT Sgr	20h 17.7'	-39° 0-6.7'	6.0	variable star	301, 302, 301
508	RT UMa	09h 18.4'	+51° 24.0'	8.6	carbon star	137, 136
509	RU Sgr	19h 58.7'	-41° 0-50.9'	6.0	variable star	301, 302
510	Ruprecht 106	12h 38.7'	-51° 0-8.9'	10.9	globular cluster	203

	Name	RA	DEC	Mag.	Type	Page
511	RX Lep	05h 11.4'	-11° 0-50.8'	5.0	variable star	128, 125
512	RY Dra	12h 56.4'	+66° 00.0'	6.0	carbon star	167, 52
513	RY Sgr	19h 16.5'	-33° 0-31.2'	5.8	variable star	263, 266, 263
514	S Car	10h 09.4'	-61° 0-32.8'	4.5	variable star	200, 202, 162, 157, 158, 162, 163
515	S CMi	07h 32.7'	+8° 19.1'	6.6	variable star	142
516	S Cnc	08h 43.9'	+19° 02.1'	8.29	variable star	140, 140
517	S CrB	15h 21.4'	+31° 22.0'	5.8	variable star	211, 211
518	S Dor	05h 18.2'	-69° 0-14.9'	8.6	variable star	308, 310
519	S Gem	07h 43.0'	+23° 27.0'	8.0	variable star	117
520	S Gru	22h 26.1'	-48° 0-26.2'	6.0	variable star	302
521	S Her	16h 51.9'	+14° 56.5'	6.4	variable star	240
522	S Hya	08h 53.6'	+3° 04.1'	7.2	variable star	143, 143
523	S Pav	19h 55.2'	-59° 0-11.6'	6.6	variable star	303
524	S Scl	00h 15.4'	-32° 0-2.6'	5.5	variable star	76
525	S Sct	18h 50.3'	-7° 0-53.9'	7.3	carbon star	248, 248, 253
526	S Ser	15h 21.7'	+14° 18.9'	7.0	variable star	217
527	S Vir	13h 33.0'	-7° 0-11.6'	6.3	variable star	220
528	Sculptor	01h 00.2'	-33° 0-42.9'	10.5	irregular galaxy	76, 77
529	Segue 3	21h 21.5'	+19° 07.0'	14.9	globular cluster	289
530	SMC	00h 52.6'	-72° 0-47.9'	2.7	Magellanic barred spiral galaxy	307, 309, 307
531	SS Cyg	21h 42.7'	+43° 35.2'	7.7	variable star	279
532	SS Sgr	18h 30.4'	-16° 0-53.9'	9.0	carbon star	254
533	SS Vir	12h 25.3'	+0° 42.0'	6.0	carbon star	183, 190
534	ST Cas	00h 17.6'	+50° 18.0'	9.0	carbon star	60, 61, 65
535	SU Cyg	19h 44.8'	+29° 15.9'	6.44	variable star	281
536	SU Sco	16h 40.6'	-32° 0-23.9'	8.0	carbon star	261, 261
537	SU Tau	05h 49.1'	+19° 04.4'	9.1	variable star	114, 118
538	SX Sco	17h 47.5'	-35° 0-41.9'	8.5	carbon star	262, 266, 267
539	T Cen	13h 41.8'	-33° 0-35.7'	5.5	variable star	225, 229
540	T Cep	21h 09.5'	+68° 29.5'	5.2	variable star	55, 51

	Name	RA	DEC	Mag.	Type	Page
541	T Cet	00h 21.8'	-20° 0-3.4'	5.0	variable star	73
542	T Cnc	08h 56.7'	+19° 48.0'	7.8	carbon star	140, 140, 140, 140
543	T Col	05h 19.3'	-33° 0-42.4'	6.6	variable star	132
544	T CrB	15h 59.5'	+25° 55.2'	2.0	variable star	214, 214, 215
545	T Eri	03h 55.2'	-24° 0-1.8'	7.2	variable star	97
546	T Gem	07h 49.3'	+23° 44.1'	8.0	variable star	117
547	T Lyr	18h 32.3'	+37° 00.0'	7.5	carbon star	236
548	T Nor	15h 44.1'	-54° 0-59.1'	6.2	variable star	230, 226
549	T Sct	18h 55.4'	-8° 0-5.9'	8.9	carbon star	248
550	T Tau	04h 22.0'	+19° 32.1'	9.3	variable star	91
551	T UMa	12h 36.4'	+59° 29.2'	6.6	variable star	171
552	Terzan 6	17h 50.8'	-31° 0-16.4'	13.85	globular cluster	266
553	TU Gem	06h 10.9'	+26° 00.0'	7.5	carbon star	113
554	TW Peg	22h 04.0'	+28° 18.0'	7.0	carbon star	285
555	TX Psc	23h 46.4'	+3° 29.2'	4.79	variable star	70
556	U Ant	10h 35.2'	-39° 0-35.9'	5.7	carbon star	199
557	U Ara	17h 53.6'	-51° 0-41.1'	7.7	variable star	269, 270
558	U Ari	03h 11.1'	+14° 48.0'	7.2	variable star	92
559	U Cep	01h 02.3'	+81° 52.5'	6.75	variable star	51, 53, 54
560	U Cet	02h 33.7'	-13° 0-8.8'	6.8	variable star	96
561	U CrB	15h 18.2'	+31° 38.8'	7.66	variable star	211, 211
562	U Cyg	20h 19.6'	+47° 53.7'	5.9	variable star	275
563	U Del	20h 45.5'	+18° 05.4'	7.6	variable star	288, 289
564	u Her	17h 17.3'	+33° 06.0'	4.69	variable star	237
565	U Hor	03h 52.8'	-45° 0-49.7'	7.8	variable star	102
566	U Hya	10h 37.6'	-13° 0-23.0'	7.0	variable star	193, 193
567	U Mic	20h 29.3'	-40° 0-24.9'	7.0	variable star	301, 301
568	U Mon	07h 30.8'	-9° 0-46.5'	6.1	variable star	147, 148, 151
569	U Ori	05h 55.8'	+20° 10.5'	4.8	variable star	118, 113
570	U Sge	19h 18.8'	+19° 36.6'	6.45	variable star	240
571	U Sgr	18h 31.9'	-19° 0-7.4'	6.28	variable star	249, 250, 254, 255, 256
572	UU Aur	06h 36.5'	+38° 30.0'	5.1	carbon star	107, 107

	Name	RA	DEC	Mag.	Type	Page
573	UV Aql	18h 58.6'	+14° 24.0'	8.6	carbon star	241
574	UX Dra	19h 21.6'	+76° 36.0'	6.2	carbon star	50
575	V Aql	19h 04.4'	-5° 0-41.9'	6.6	carbon star	248, 248, 253
576	V Ari	02h 15.0'	+12° 12.0'	8.0	carbon star	92
577	V CrB	15h 49.5'	+39° 34.3'	6.9	variable star	210
578	V Cyg	20h 41.3'	+48° 12.0'	7.8	carbon star	275, 275
579	V Hya	10h 51.6'	-21° 0-17.9'	6.5	carbon star	195
580	V Mon	06h 22.7'	-2° 0-11.6'	6.0	variable star	127, 127
581	V Oph	16h 26.7'	-12° 0-25.5'	7.3	variable star	249, 220
582	V1942 Sgr	19h 19.2'	-15° 0-53.9'	6.7	carbon star	296
583	VV Ori	05h 33.5'	-1° 0-9.3'	5.31	variable star	123, 120, 123, 124, 128
584	VX And	00h 19.9'	+44° 42.0'	8.0	carbon star	61, 62, 65, 65, 66
585	VX Sgr	18h 08.1'	-22° 0-13.3'	6.52	variable star	250, 251, 252, 256, 257
586	VY CMa	07h 23.0'	-25° 0-46.0'	6.5	variable star	130, 126, 126, 130, 130
587	VY UMa	10h 45.0'	+67° 24.0'	6.0	carbon star	49, 49, 50, 53
588	W Cas	00h 54.9'	+58° 33.8'	7.8	variable star	59, 60, 64
589	W Cet	00h 02.1'	-14° 0-40.5'	7.1	variable star	72, 73
590	W CMa	07h 08.0'	-11° 0-53.9'	7.0	carbon star	124, 125, 129
591	W CrB	16h 15.4'	+37° 47.7'	7.8	variable star	209, 210
592	W Cyg	21h 36.0'	+45° 22.5'	6.8	variable star	279, 279
593	W Ori	05h 05.4'	+1° 12.0'	6.5	carbon star	120
594	W UMa	09h 43.8'	+55° 57.2'	7.75	variable star	136, 137
595	WLM	00h 01.9'	-15° 0-26.9'	11.03	irregular galaxy	72, 73
596	WW Cas	01h 33.5'	+57° 48.0'	9.1	carbon star	64, 81, 85, 85
597	WZ Cas	00h 01.3'	+60° 21.3'	6.3	variable star	59, 60
598	WZ Sge	20h 07.6'	+17° 42.2'	7.0	variable star	286, 286
599	X Cnc	08h 55.4'	+17° 13.9'	5.6	variable star	140, 140
600	X Cyg	20h 43.4'	+35° 35.3'	5.85	variable star	276, 276, 277
601	X Her	16h 02.7'	+47° 14.4'	6.0	variable star	209
602	X Oph	18h 38.4'	+8° 50.0'	5.9	variable star	241, 242, 243, 241
603	X Peg	21h 21.0'	+14° 27.0'	8.8	variable star	287, 289
604	X Per	03h 55.4'	+31° 02.8'	6.03	variable star	84

	Name	RA	DEC	Mag.	Type	Page
605	X Sge	20h 05.1'	+20° 36.0'	8.7	carbon star	286, 286, 288
606	X Vel	09h 55.5'	-41° 0-29.9'	8.4	carbon star	160
607	Y Cvn	12h 45.1'	+45° 24.0'	5.0	carbon star	172, 173, 173, 169
608	Y Lyn	07h 28.2'	+46° 00.0'	6.9	carbon star	106
609	Y Per	03h 27.7'	+44° 12.0'	8.1	carbon star	83
610	Y Tau	05h 45.7'	+20° 42.0'	7.1	carbon star	114, 118
611	Z Psc	01h 16.1'	+25° 48.0'	7.0	carbon star	68
612	Z UMa	11h 56.5'	+57° 52.3'	6.2	variable star	171, 172, 167
613	β Dor	05h 33.6'	-62° 0-29.3'	3.46	variable star	134
614	o Cet	02h 19.3'	-2° 0-58.6'	2.0	variable star	96
615	χ Cyg	19h 50.6'	+32° 54.8'	3.3	variable star	281, 280

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