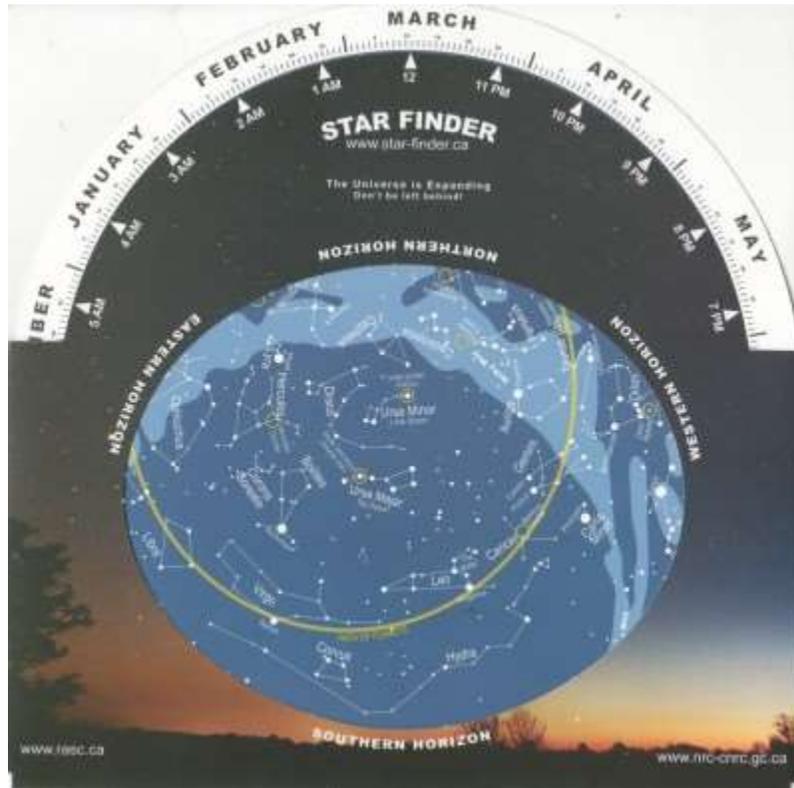


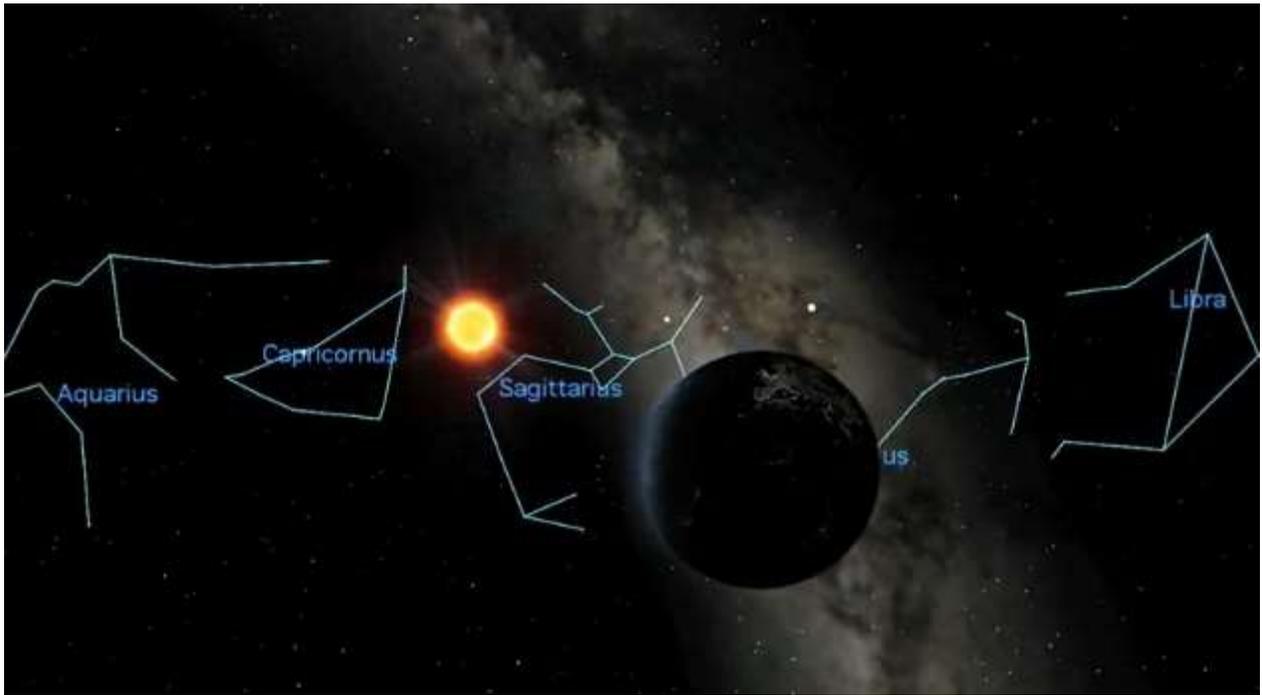
The Night Sky of Spring

Spring Observing:

West (late Winter) to South East (Spring)



- To see the stars in the Spring Constellations, the Earth's orbit is in a locations such that night side points away from the Sun, towards the Constellations of Leo and Virgo.



- Because we are both orbiting the sun and rotating as we orbit, this motion causes stars to rise almost 4 minutes earlier each night. After a month, they rise and set about two hours earlier than the previous month.

Leo will be setting in the West end of May, but it is due South in April.

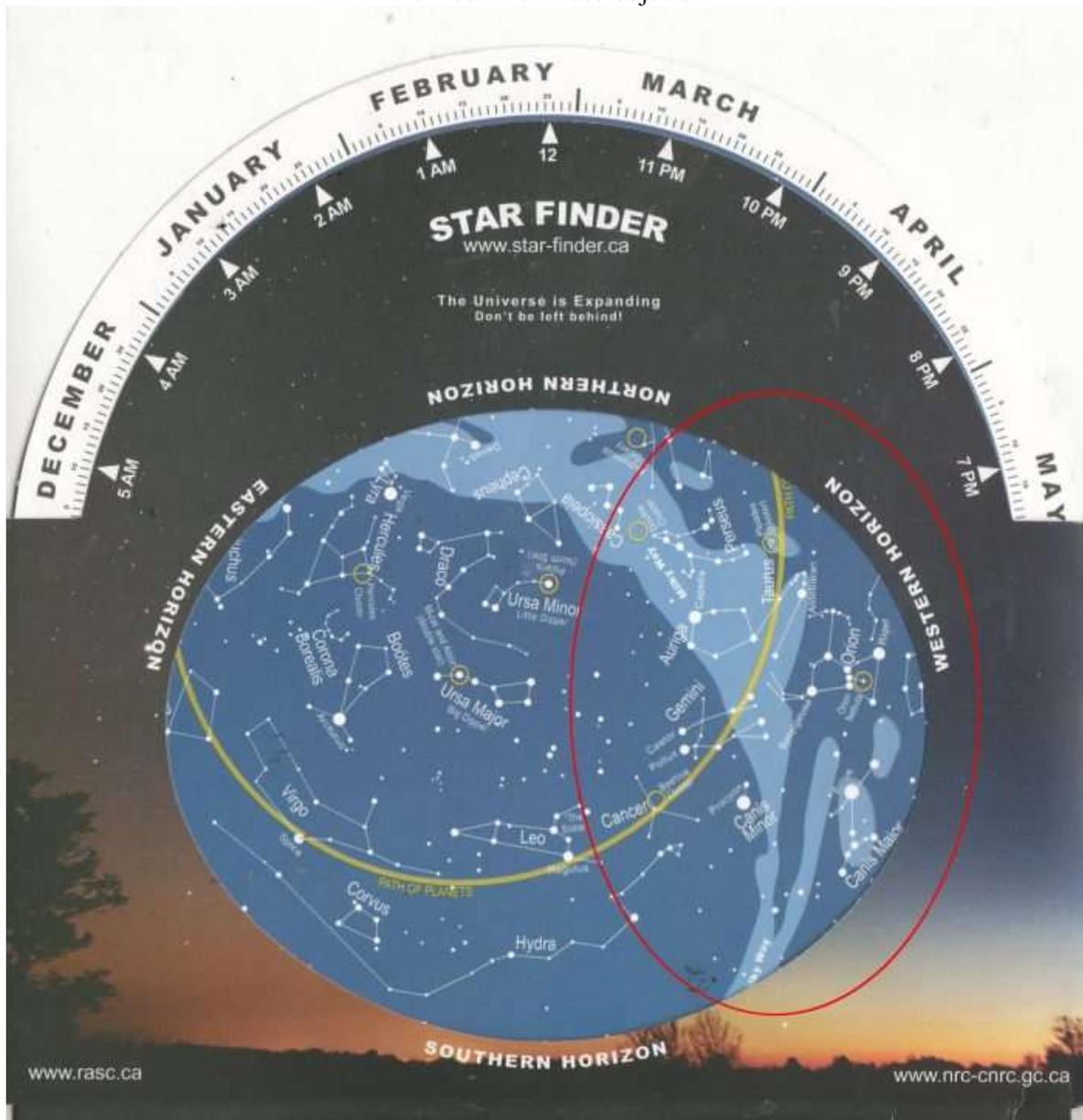
The cardinal direction (West, East, South) shows us the constellations that are prominent in different Seasons.

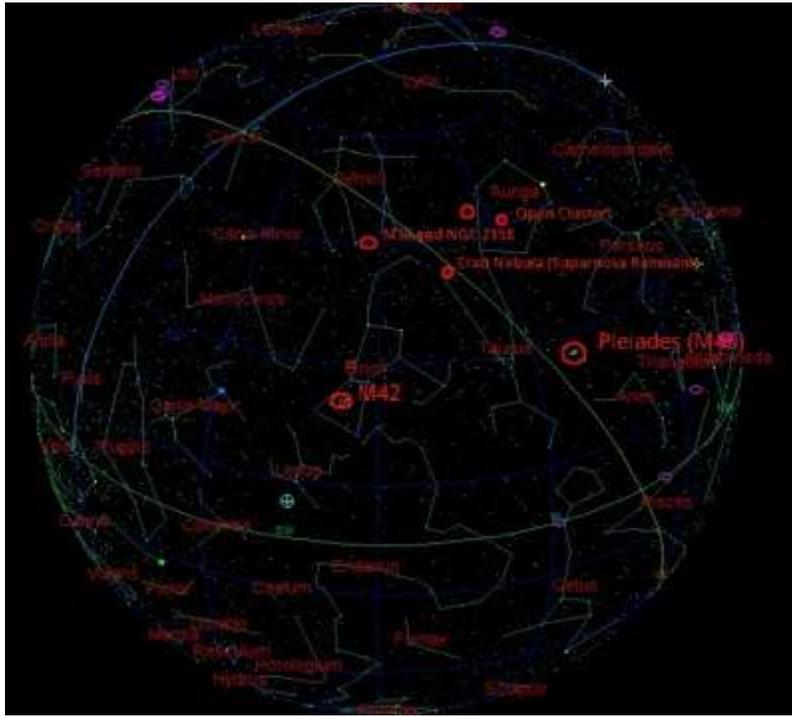
- In April, the three cardinal directions represent 3 Seasons of the Night Sky :
- Winter constellations setting in the **West**.
- Spring constellations culminating on our **Southern** meridian
- Summer constellations rising in the **East**
- Note: Northern constellations, are circumpolar, and continue to appear in the Night Sky all year round

Looking West – Observe the Winter Milky Way

Behold: the brilliance of the bright stars and the Winter Milky Way band in the South West. The collection of stars that we see in the Winter Sky are particularly bright for one of two reasons:

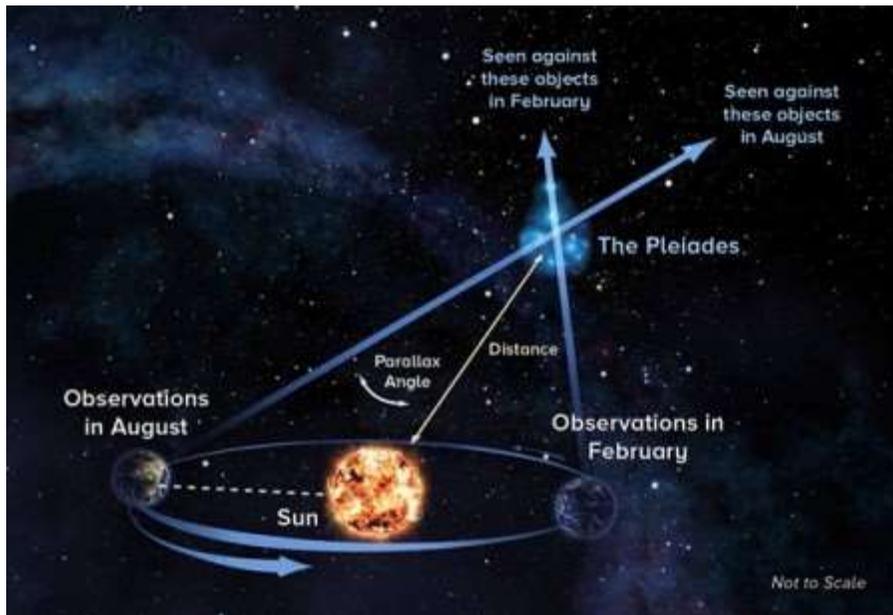
- Proximity (e.g. Sirius (9 light years or Procyon (11 light years))
- Intrinsic Luminosity Betelgeuse (red supergiant), Rigel(blue-white hot supergiant)) Here we see the bright giant stars of Orion, and with some optical aids, many open Clusters lying in the dusty lanes of the Milky Way Galaxy. Next month around about this time, the Winter Milky Way will be setting earlier: last chance to view some of these objects.





Constellation Taurus: Naked Eye – The Pleiades The 7 Sisters (Nearby Star Cluster)





Although naked eye, radio astronomers have gauged the distance to this cluster roughly 440 Light years. See www.astronomy.com/news/2014/08/radio-telescopes-settle-controversy-over-distance-to-pleiades

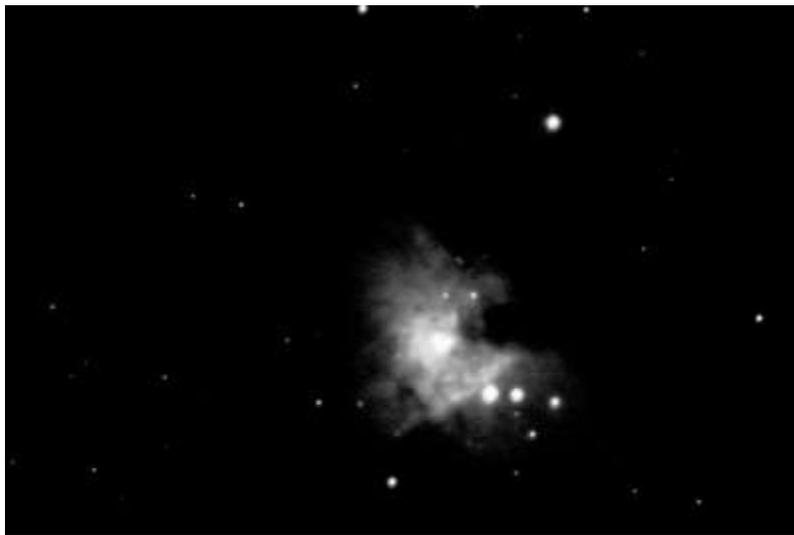
M1 – The Crab Nebula (M1) (Supernova Remnant)

This star exploded in 1054 . This star was massive, and so the explosion was super!- result is a Supernova Remnant



-courtesy P. Browne 2014

Constellation Orion: Open Cluster and Interstellar Nebulae



M 42 (Nebula) – (image right) The Trapezium inside the Great Orion Nebula -image courtesy P.Browne 2014

(The Great Orion Nebula (M42) – a Stellar Nursery of young stars within a Molecular Cloud See [Stars in the Orion Nebula](#))

2013 January 3

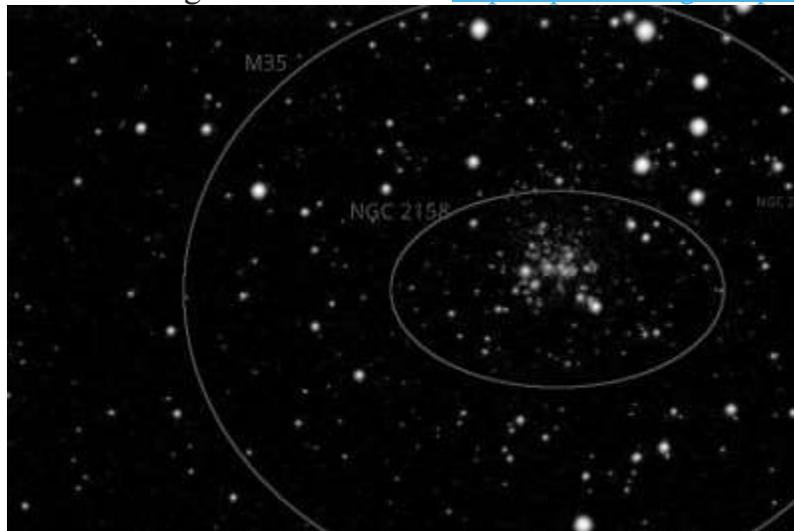


Open Star Clusters M35 and NGC 2158
Image Credit & Copyright: Dieter Willasch (Astron-Cabinett)

Explanation: Open clusters of stars can be near or far, young or old, and diffuse or compact. Found near the plane of our Milky Way galaxy, they contain from 100 to 10,000 stars, all of which formed at nearly the same time. Bright blue stars frequently distinguish younger open clusters. M35, on the upper left is relatively nearby at 2800 light years distant, relatively young at 150 million years old, and relatively diffuse, with about 2500 stars spread out over a volume 30 light years across. An older and more compact open cluster, NGC 2158, is at the lower right. NGC 2158 is four times more distant than M35, over 10 times older, and much more compact with many more stars in roughly the same volume of space. NGC 2158's bright blue stars have self-destructed leaving cluster light to be dominated by older and yellower stars. Both clusters are seen toward the constellation of Gemini.

Constellation Gemini (the Twins)

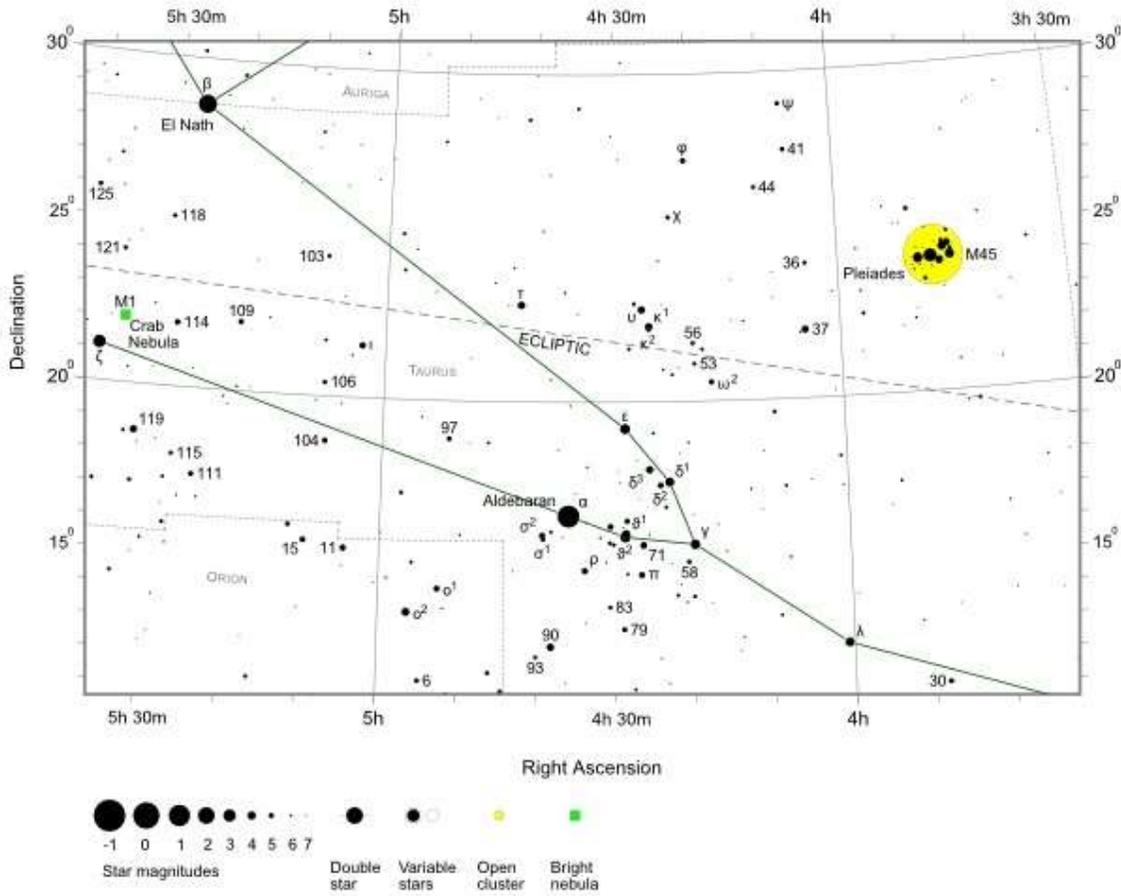
At the foot of one of the twins – there is a large, young Open Cluster M35, relatively nearby at 2800 light years distance. In the same line of sight, we see NGC 2158, four times more distant than M35 and much much older – almost a globular cluster ... <http://apod.nasa.gov/apod/ap021129.html>



Open Cluster M35 (2800ly) and more distant compact star cluster NGC 2158 (11000ly) – courtesy P. Browne 2014

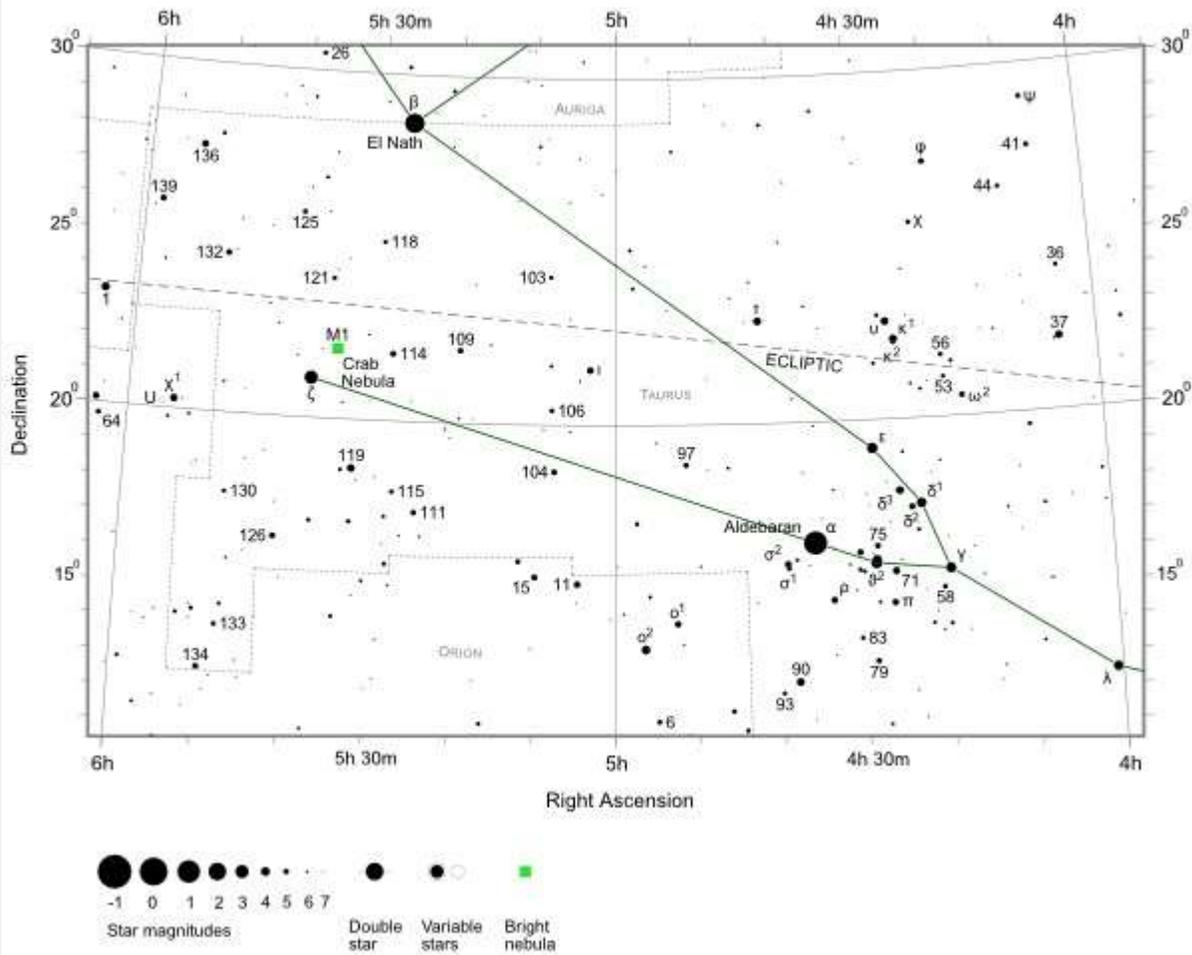
Summary: Winter Constellations in the West: Taurus, Gemini, Orion

Messier Finder Chart for M45 Pleiades
Also shown M1 Crab Nebula



Taurus: Pleiades (M45) (Open Cluster),

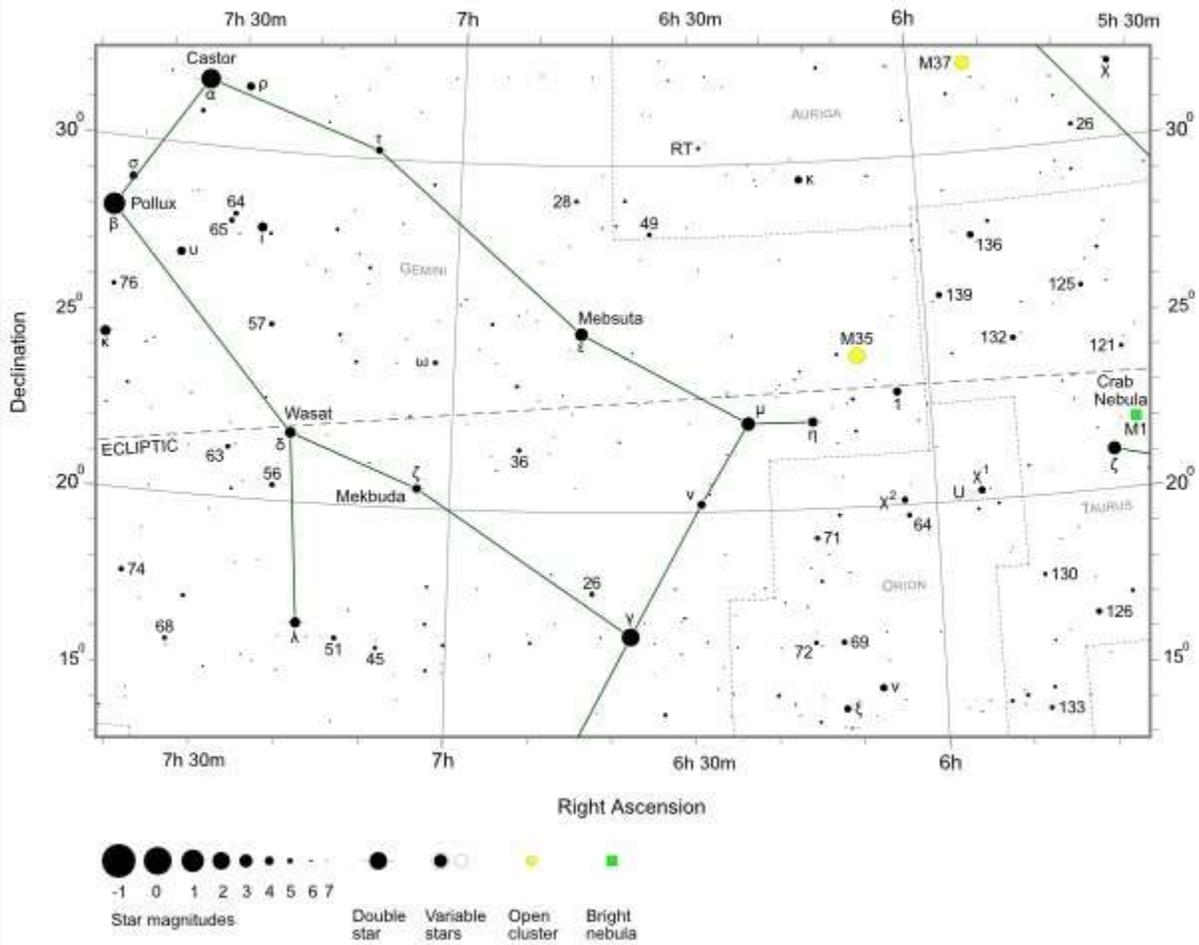
Messier Finder Chart for M1 Crab Nebula



Taurus: Crab Nebula (M1) (Supernova Remnant)

Messier Finder Chart for M35

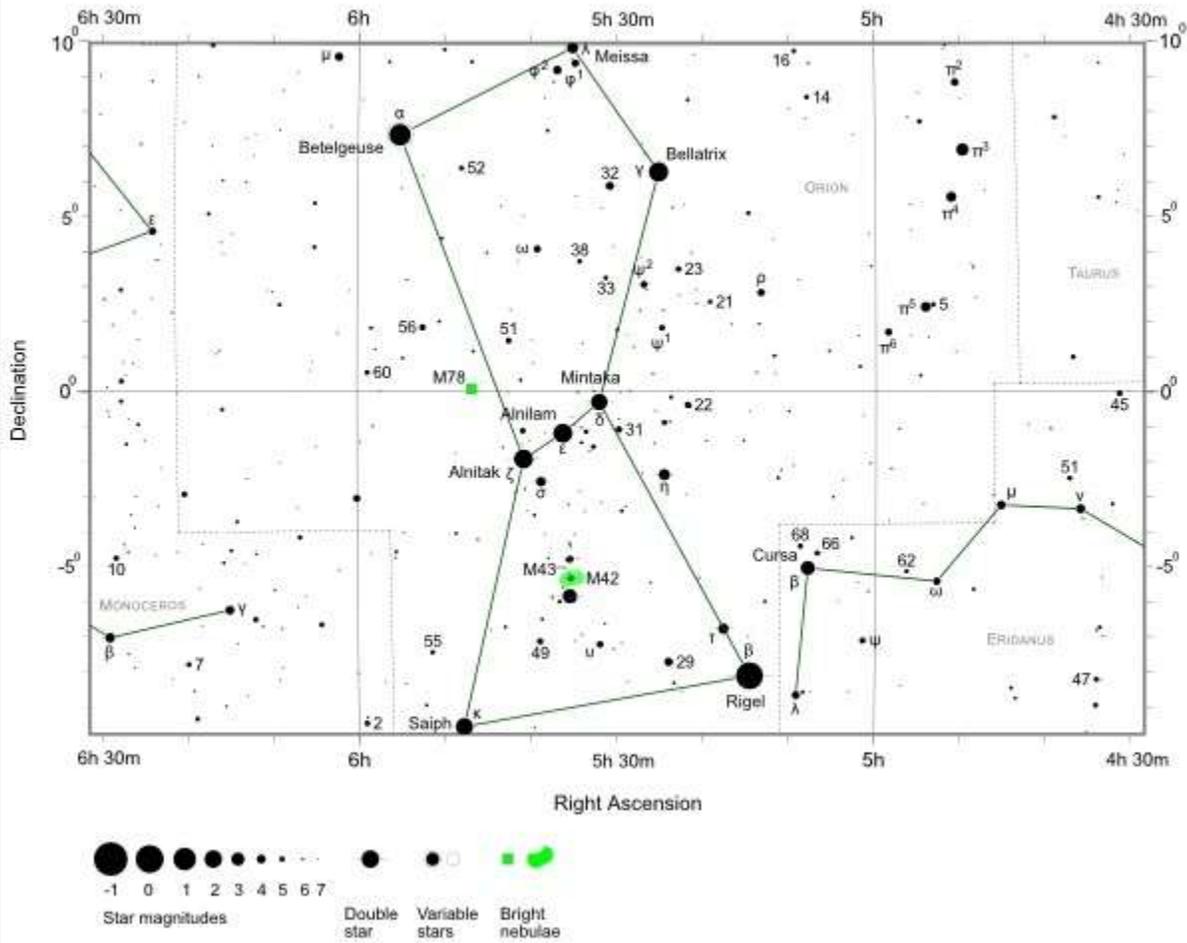
Also shown M1 Crab Nebula and M37



Gemini: Open Cluster (M35) Distance ~ 2800 ly

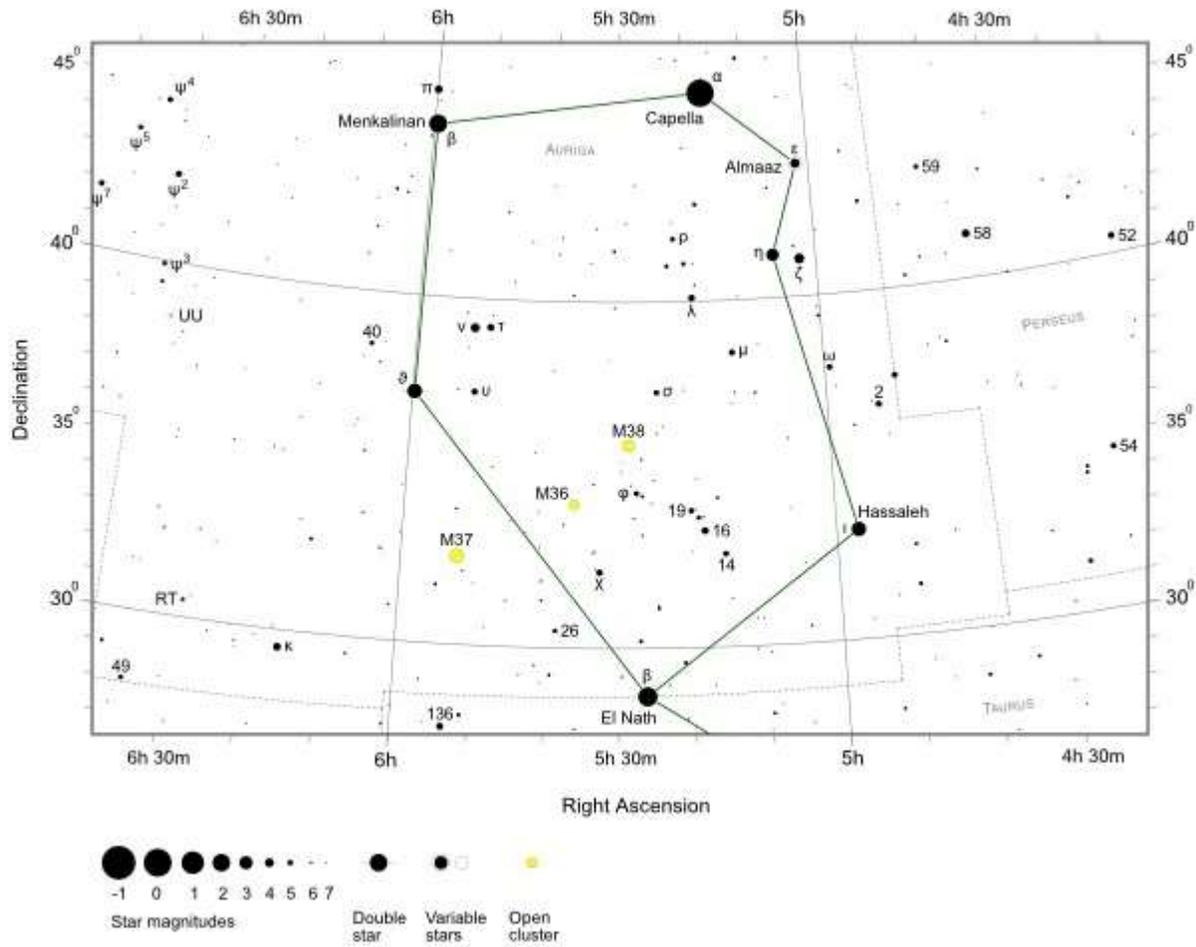
Open Cluster (NGC 2158) Distance ~ 11000 ly

Messier Finder Chart for M42 Great Orion Nebula, M43 De Mairan's Nebula and M78



Orion: Great Orion Nebula (M42)

Messier Finder Chart for M36, M37 and M38



Auriga (Bonus) M36, M37, M38 - Open Clusters in Winter Milky Way



[See Astronomy Motions in the Sky](http://oneminuteastronomer.com/147/m44-beehive-star-cluster) Here we can see the Great Beehive Open Cluster (M44)
<http://oneminuteastronomer.com/147/m44-beehive-star-cluster>

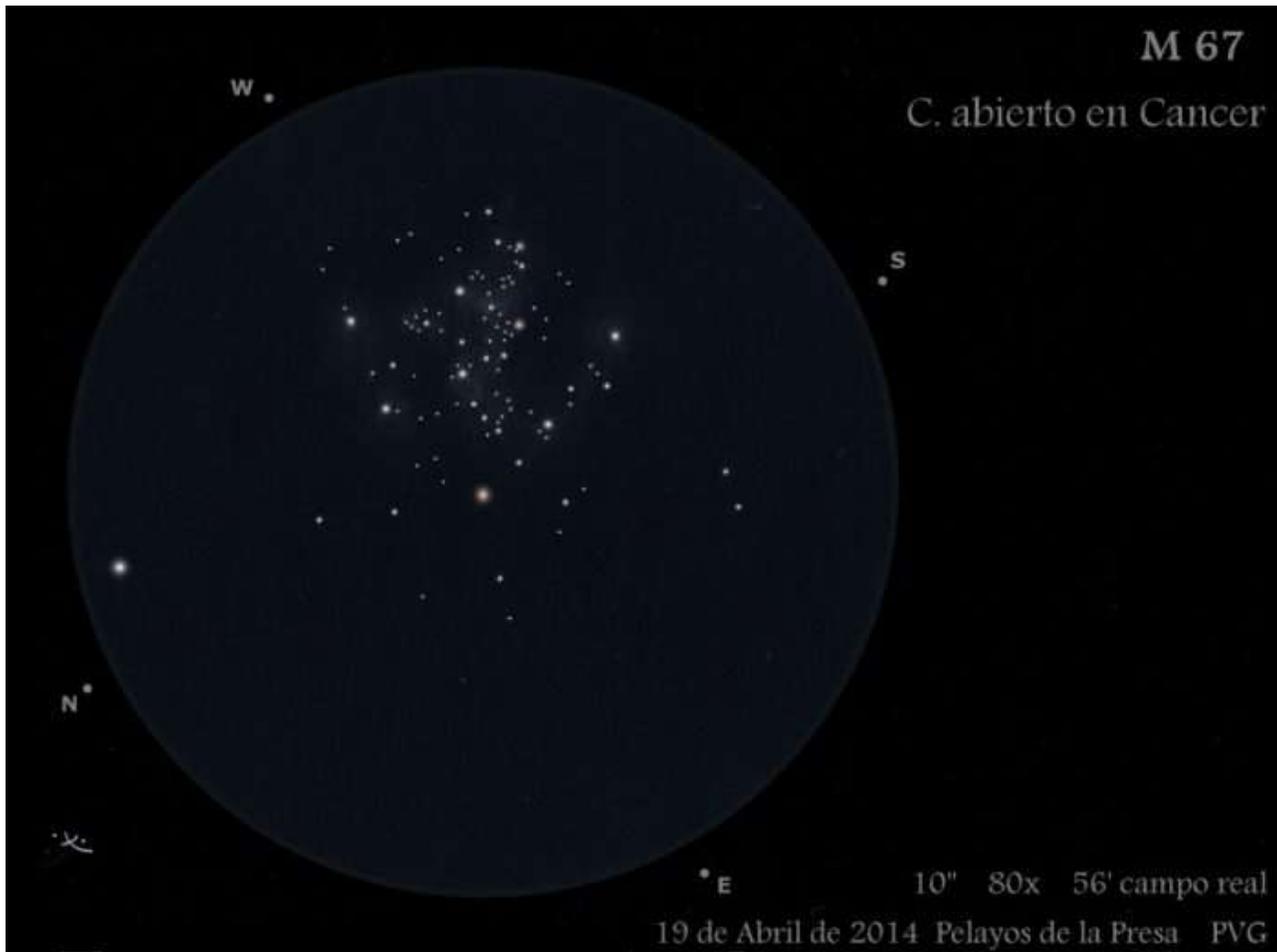
Color in Stars

The Beehive contains a larger star population than most other nearby clusters. Under dark skies the Beehive Cluster looks like a nebulous object to the naked eye; thus it has been known since ancient times. We often find it, rather than the constellation it is found in (Cancer).

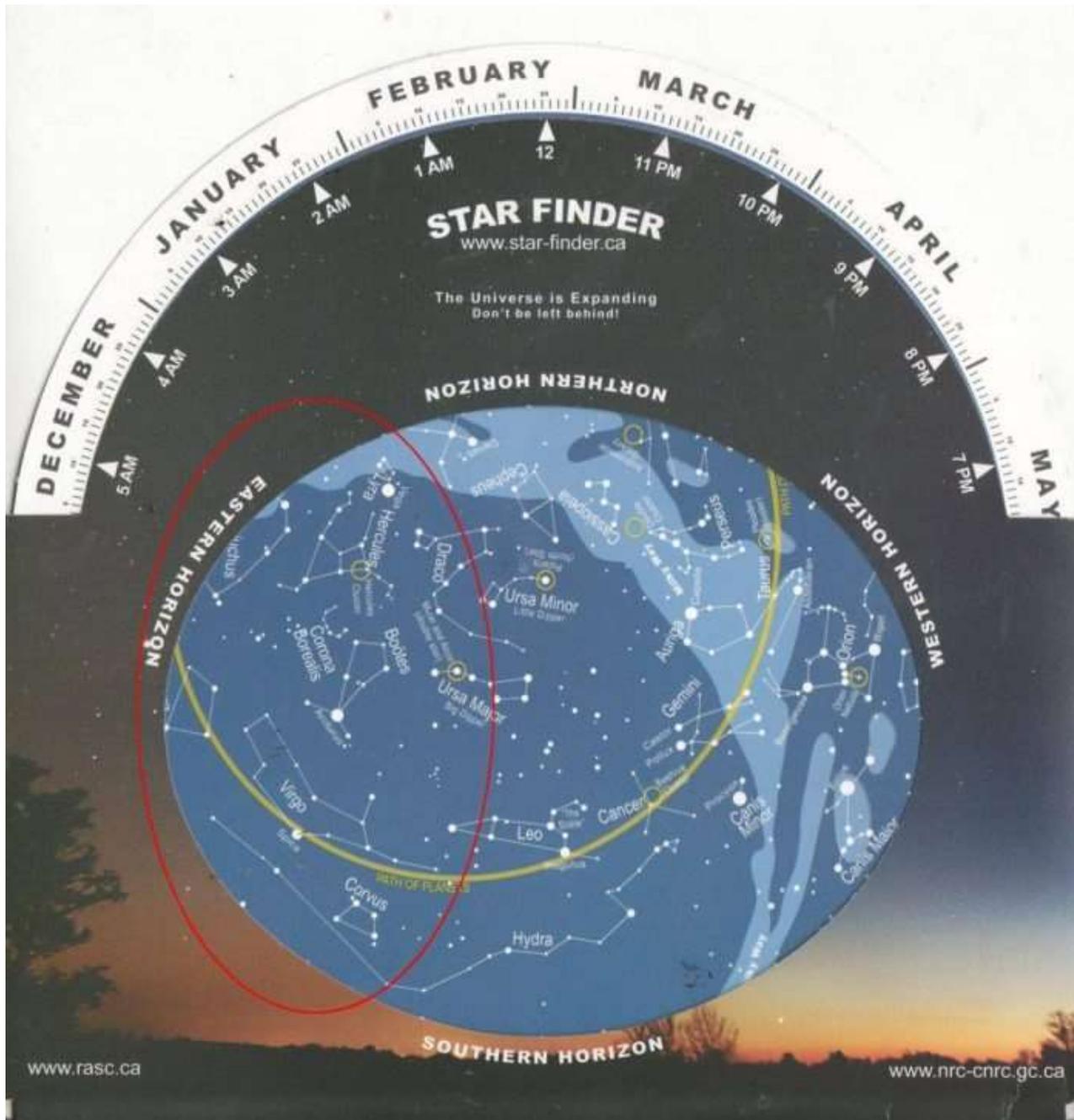
From Wikipedia:

The cluster's age and proper motion coincide with those of the Hyades open cluster, suggesting that both share a similar origin. Both clusters also contain red giants and white dwarfs, which represent later stages of stellar evolution, along with main sequence stars of spectral classes A, F, G, K, and M. Age of the cluster is estimated to 700 million years (when the cluster formed out of proto-stars). The cluster's distance is often cited to lie between 520-610 light years

Just inside the left of this 'wishbone' asterism of Cancer is the much more distant Open Cluster M67. You will notice the difference!



Turning our gaze a few degrees East, the Spring Sky announces distant Globular Clusters (10s of 1000s of lightyears) and nearby Star Clouds in the direction of the North Galactic Pole



■ Naked Eye

– Coma Star Cloud Rising in Coma Berenices (toward the North Galactic Pole)

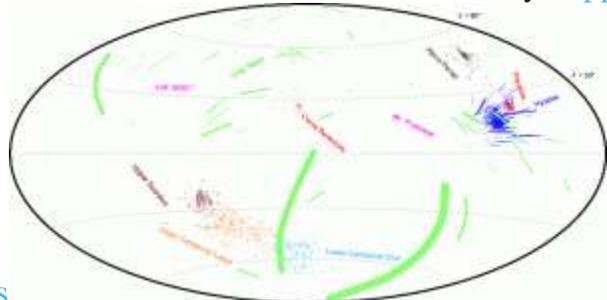
Although Coma Berenices is a small constellation it does contain one of the densest concentrations of external galaxies in the sky. However its most outstanding feature is not a galaxy but an extremely large and loose naked eye open cluster called Melotte 111 or the Coma Star Cluster.



Melotte -111 – Coma Star Cloud (Open Cluster)

Although conspicuous and easily visible to the naked eye the cluster was not included in both the Messier or NGC catalogues due to its loose nature, large apparent size and unproven status as a genuine open cluster. It was only in 1938 that a study of 40 stellar members showed that these stars had a common proper motion through space. M3 lies in the southern part of Canes Venatici, practically on the border with Boötes. It's located 12 degrees northwest of orange giant star [Arcturus \(\$\alpha\$ Boo – mag. - 0.05\)](#) and about halfway along an imaginary line connecting Arcturus with Cor Caroli (α CVn – mag. +2.9). The area of sky surrounding M3 is rather barren, but when observed through binoculars a number of 6th and 7th magnitude stars are visible along with the cluster itself. One such 6th magnitude star is located just 0.5 degrees southwest of M3.-description courtesy freestarcharts.com

Map of the full sky, showing those stars in nearby open clusters and associations – courtesy [Hipparcos](#)



[measurements of nearby star clusters and associations](#)

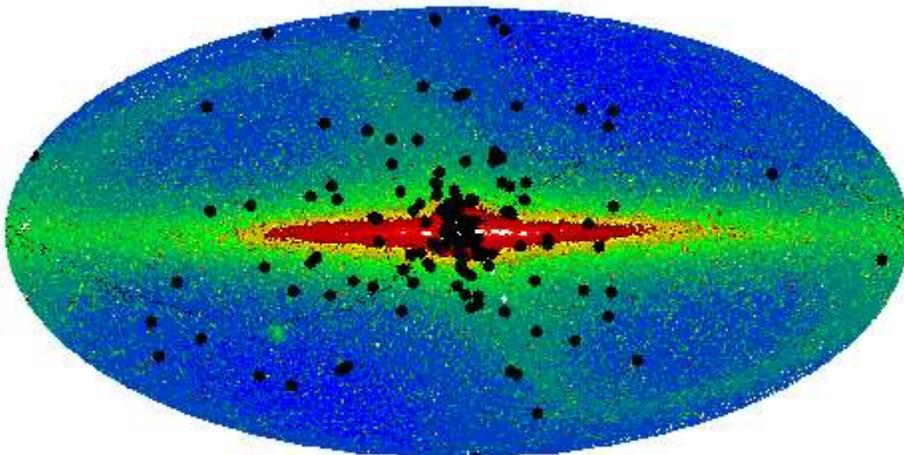
Messier Object M3 – Globular Cluster in Canes Venatici. 1/2 million stars in a sphere 200 light years in diameter Distance: 33000 light Years-

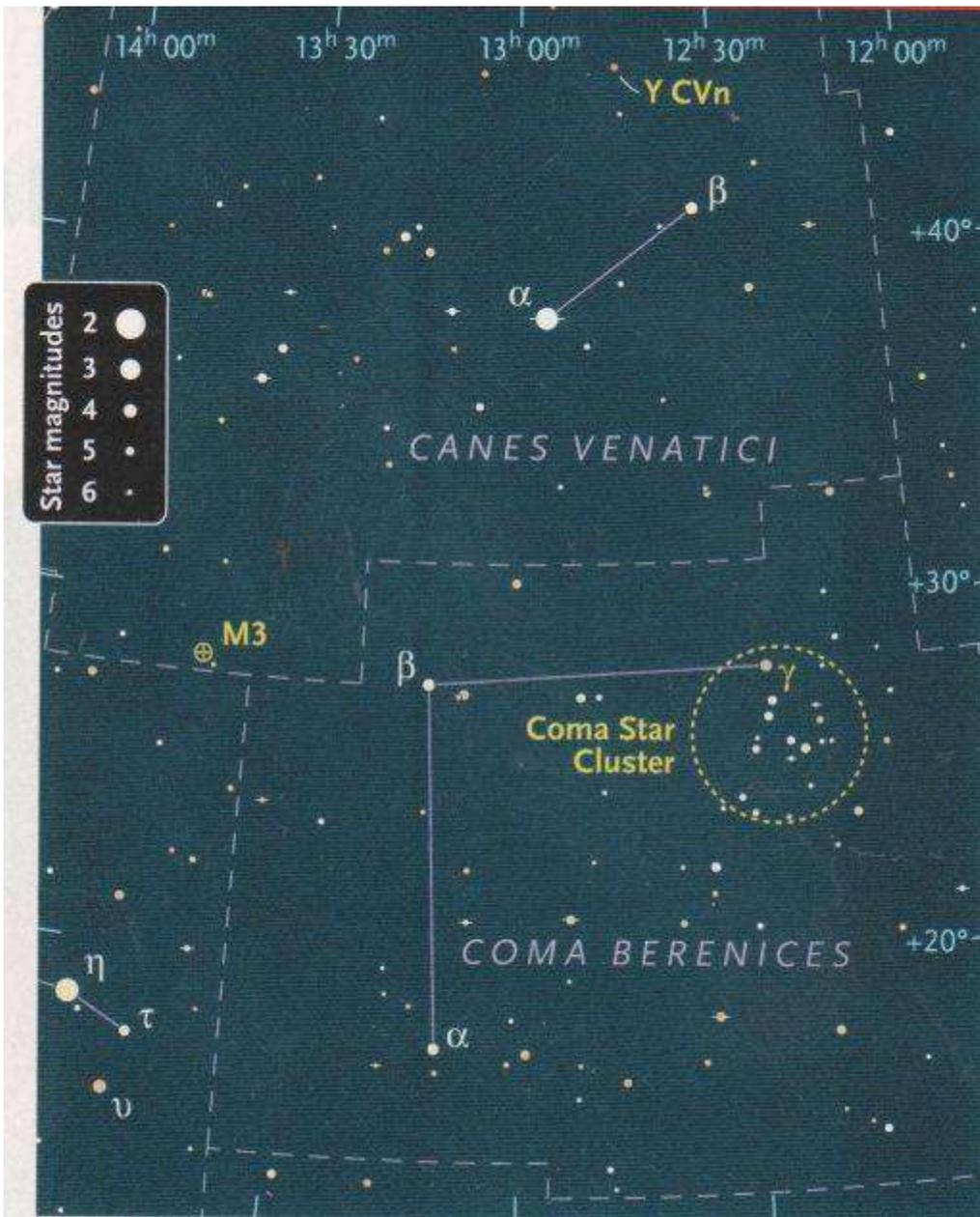


image courtesy P. Browne, Spring 2014

Globular cluster distribution about the galaxy. – courtesy <http://relativity.livingreviews.org/Articles/lrr-2013-4/articlese2.html>

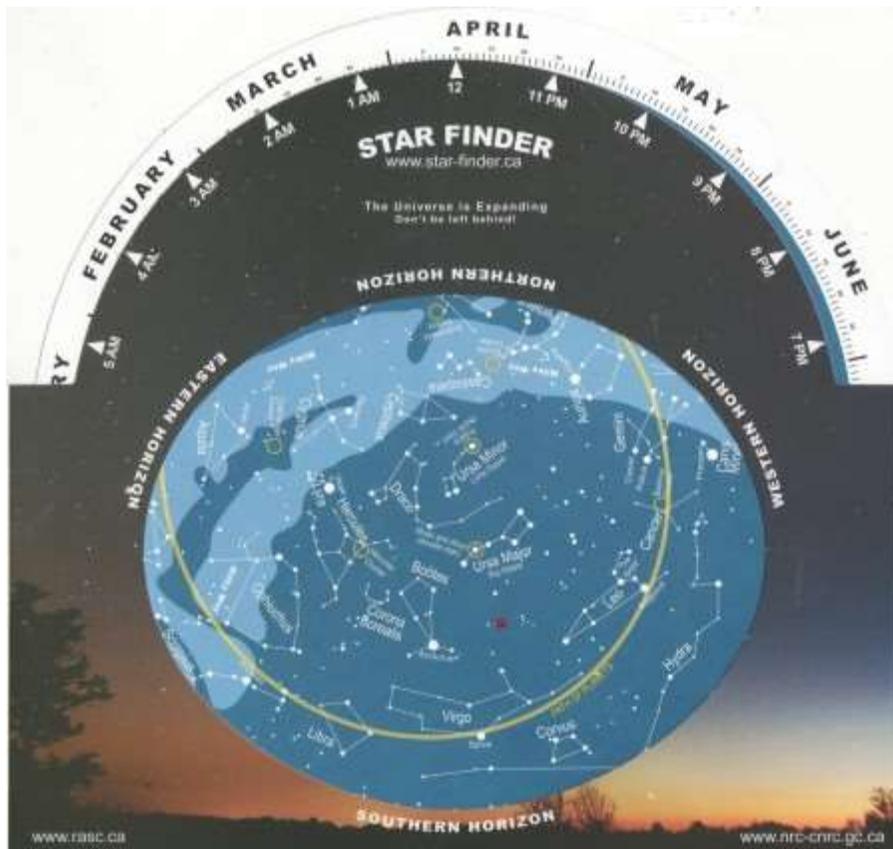
Note: Globular clusters are distributed in a halo around our galaxy: Globular clusters are normally associated with a host galaxy and most galaxies, including the Milky Way, are surrounded and penetrated by a globular cluster system





Map showing location of very local Open Cluster Coma Star Cluster and very distant Globular Cluster M3 – courtesy Sue French

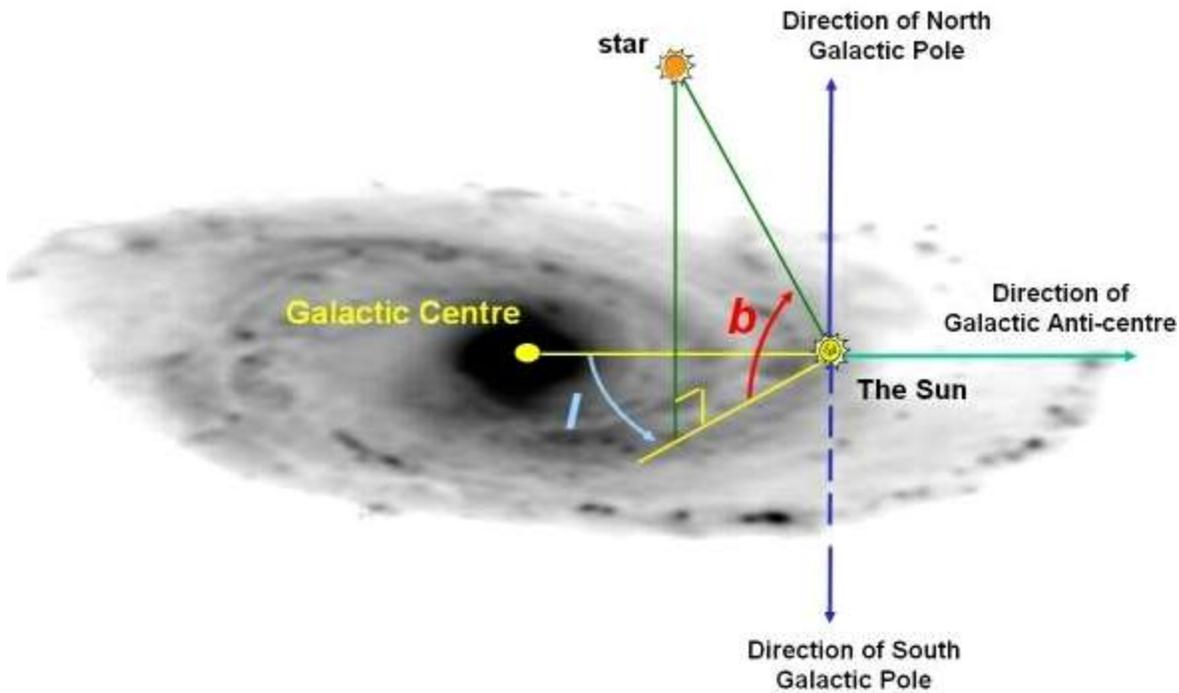
Looking in the Direction of the NGP: The North Galactic Pole



The North Galactic Pole is actually in the constellation Coma Berenices:

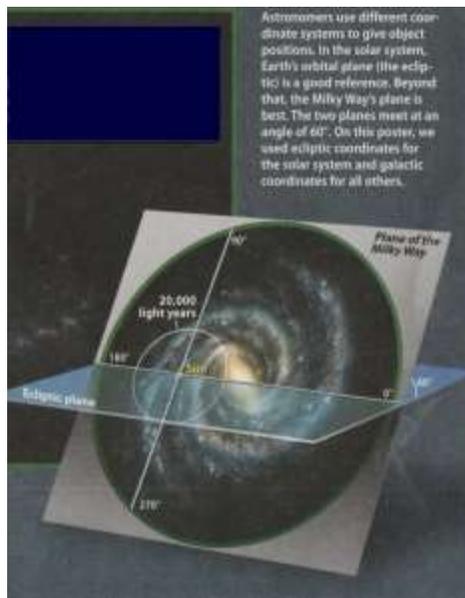
Galactic Pole	right ascension	declination	constellation
north pole (+90° latitude)	12 ^h 49 ^m (12 ^h 51.4 ^m)	+27°.4(+27°.13)	Coma Berenices

See <http://millstonenews.com/2015/06/night-sky-observing-how-far-south-do-we-see.html>

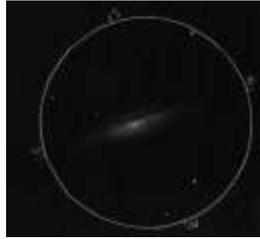


Now our outward gaze is pointing upwards out of the disk of our galaxy towards the North Galactic Pole. This allows us to see further in deep space; first towards the Globular Clusters, like M3 and M53 – massive collections of very old stars that form a halo around the disk of the Milky Way.

Beyond that, we can now see the area known as the Realm of the Galaxies – Constellation Virgo . With the aid of a small telescope, we can view Galaxies and Clusters of Galaxies, as we are looking out of the plane of our own Milky Way Galaxy



Looking out of the plane of our galaxy we can peer into space and see galaxies racing away from us...



sketch courtesy Anne Ebeling (Messier 104)



In a small scope you can barely tease out the details... In the middle you can start to see an elongated spindle... image and image manipulation courtesy P. Browne

M104 more commonly known as the Sombrero Galaxy is an almost edge-on, spiral galaxy located in Virgo. At magnitude +8.4, the Sombrero appears in binoculars as a small patch of nebulosity. One feature that can be observed with a medium sized telescope is the bulge of the galaxy and a hint of a dust lane encapsulating the bulge. M104 was one of the first galaxies to have its spectra and velocity measured by Vesto Slipher in 1912. He noted that the object was redshifted and therefore receding from us, the current accepted rate being 900 km/s. Slipher's redshift calculation of M104 along with similar observations from other galaxies pointed towards an expanding Universe- confirming Hubble's formulation. The Sombrero Galaxy is located very close to the constellation boundary between Virgo and Corvus. – text courtesy freestarcharts.com

Galaxies beyond our Galaxy in Leo



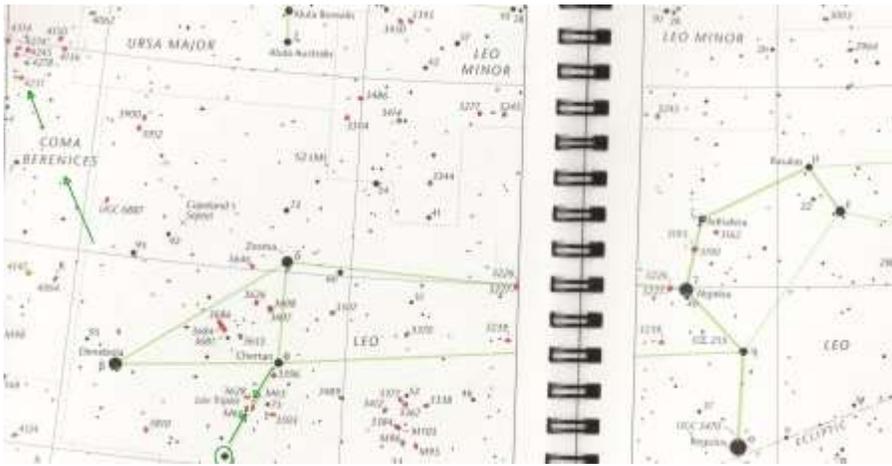
M65 part of the Leo Triplet of Galaxies – courtesy P. Browne 2014



NGC 3628 – Top Galaxy of the Leo Triplet -P. Browne 2014

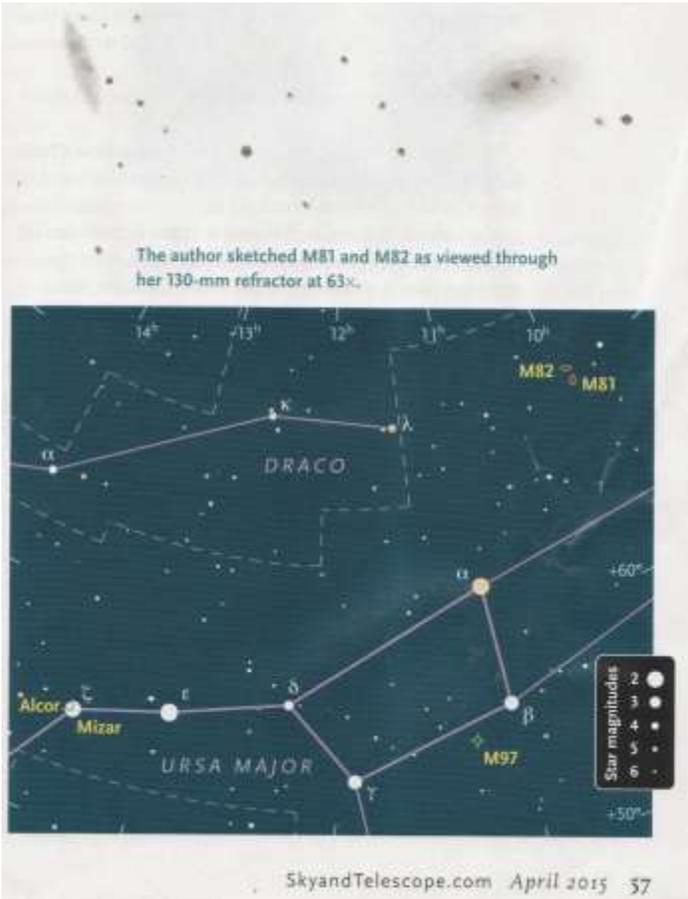
Star Hop to the Leo Triplet

Leo Triplet is 1/2 way between the star Chertan (theta) and iota Leonis.



Galactic Pair in the Big Dipper

When we look North, we see the Big Dipper. This constellation (Ursa Major, “Great Bear”) rotates around as it circles around Polaris the sky over the year. But never sets – just appears in different orientations each season. Here are the Pair of galaxies M81 and M82 in Ursa Major.



Astronomy students discovered a Supernova

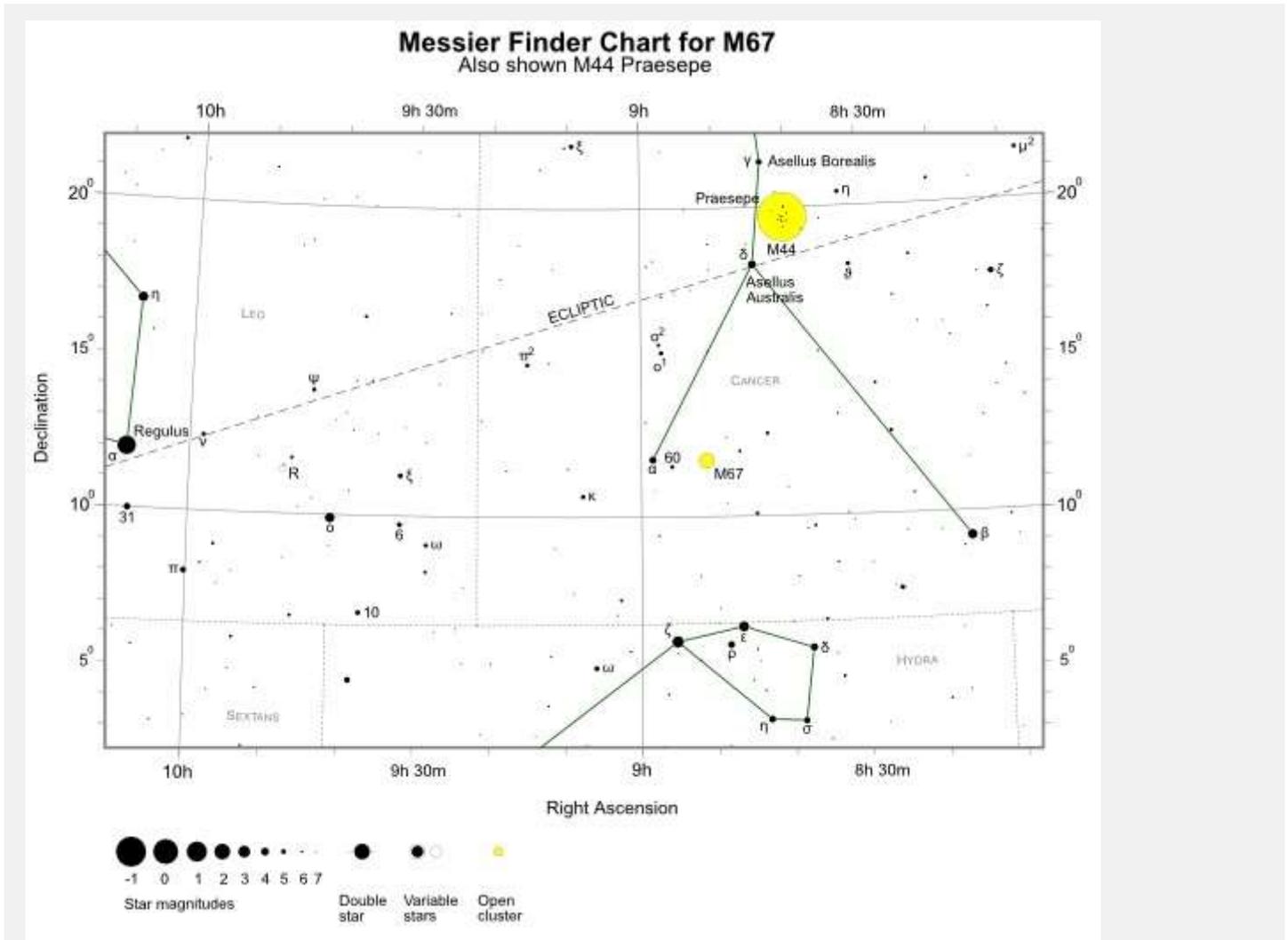


Explosion in M82 in 2014.

M82 – Galaxy in Ursa Major – Recent Supernova brightening detected (2014) -courtesy P. Browne

Summary – Spring Constellation Targets in South and East

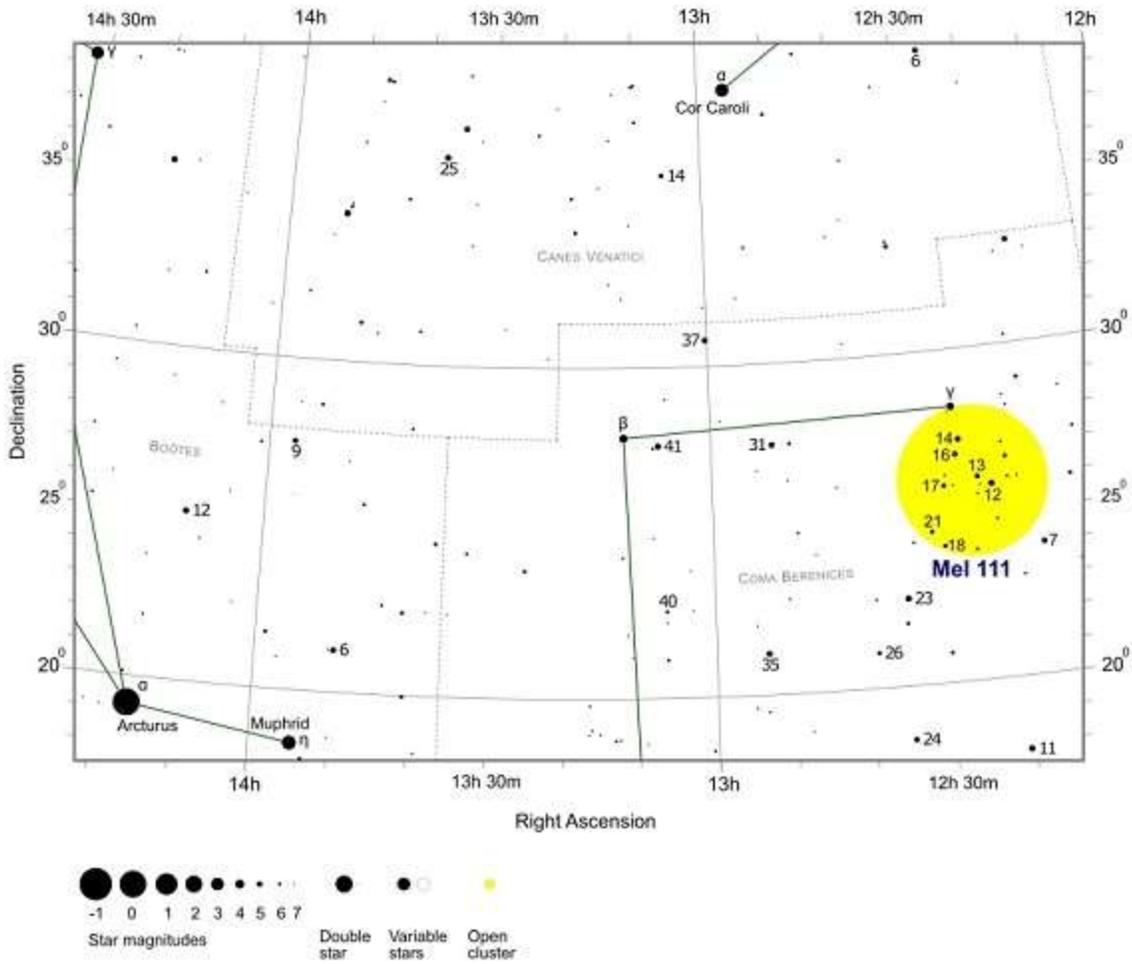
Constellation Cancer – M44 and the more distant M67



(Finder Chart Courtesy – freestarcharts.com)

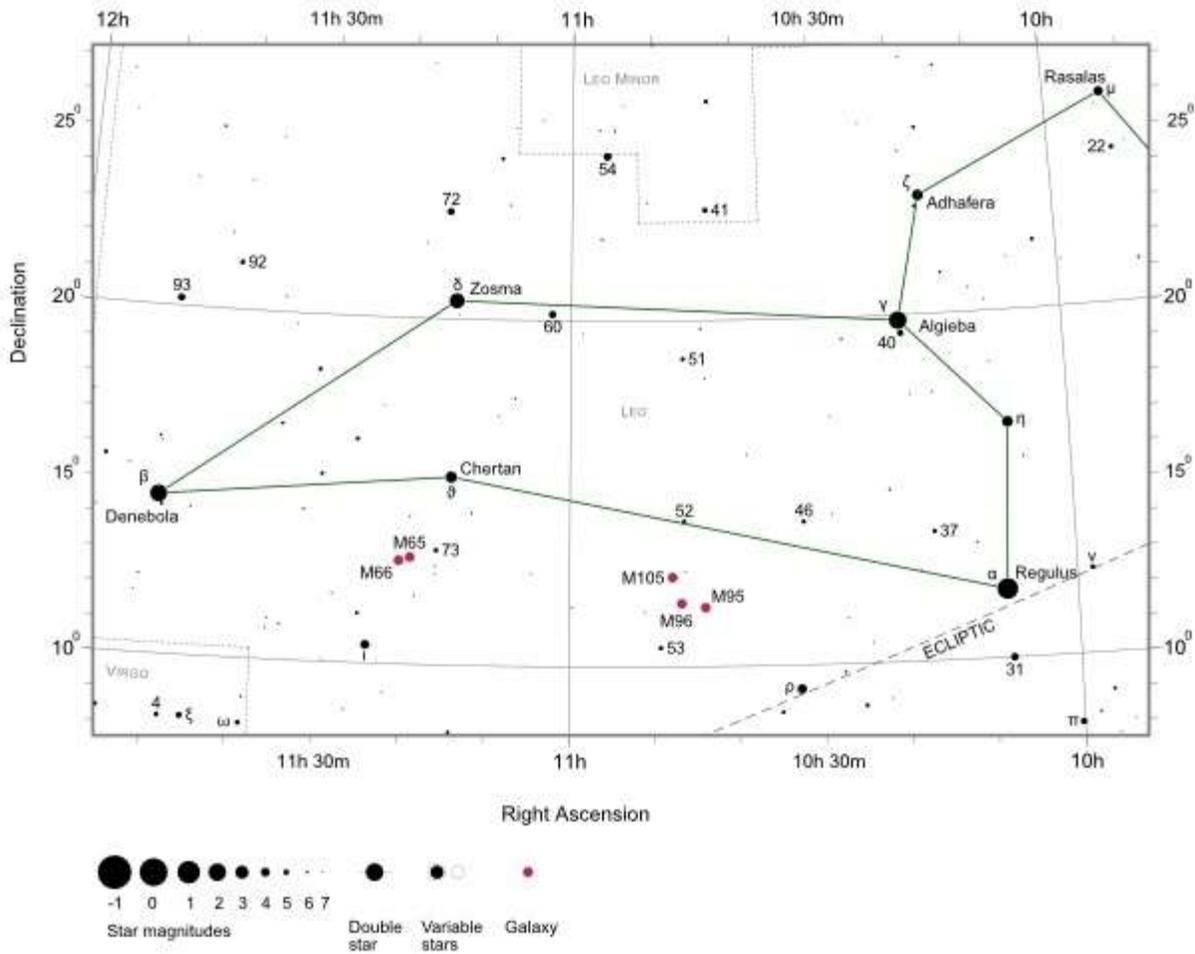
Turning South Observe Naked Eye – M44-Praesepe (the Beehive), Open Cluster M45 and much fainter open cluster M67

Melotte 111 - Mel 111 - The Coma Star Cluster (Open Cluster)



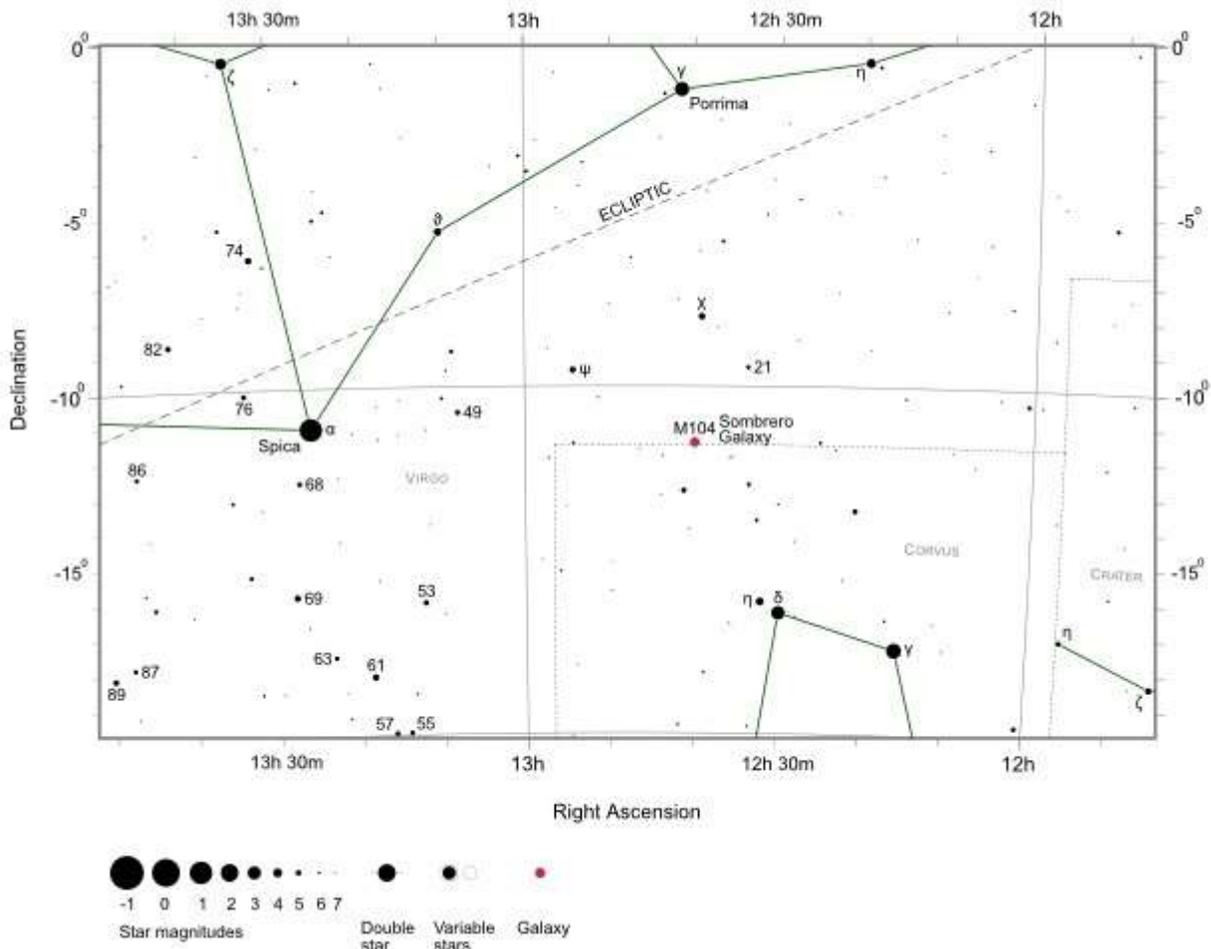
Constellation Coma Berenices – Naked Eye Coma Star Cloud (Open Cluster) **Melotte 111**

Messier Finder Chart for M65, M66, M95, M96 and M105

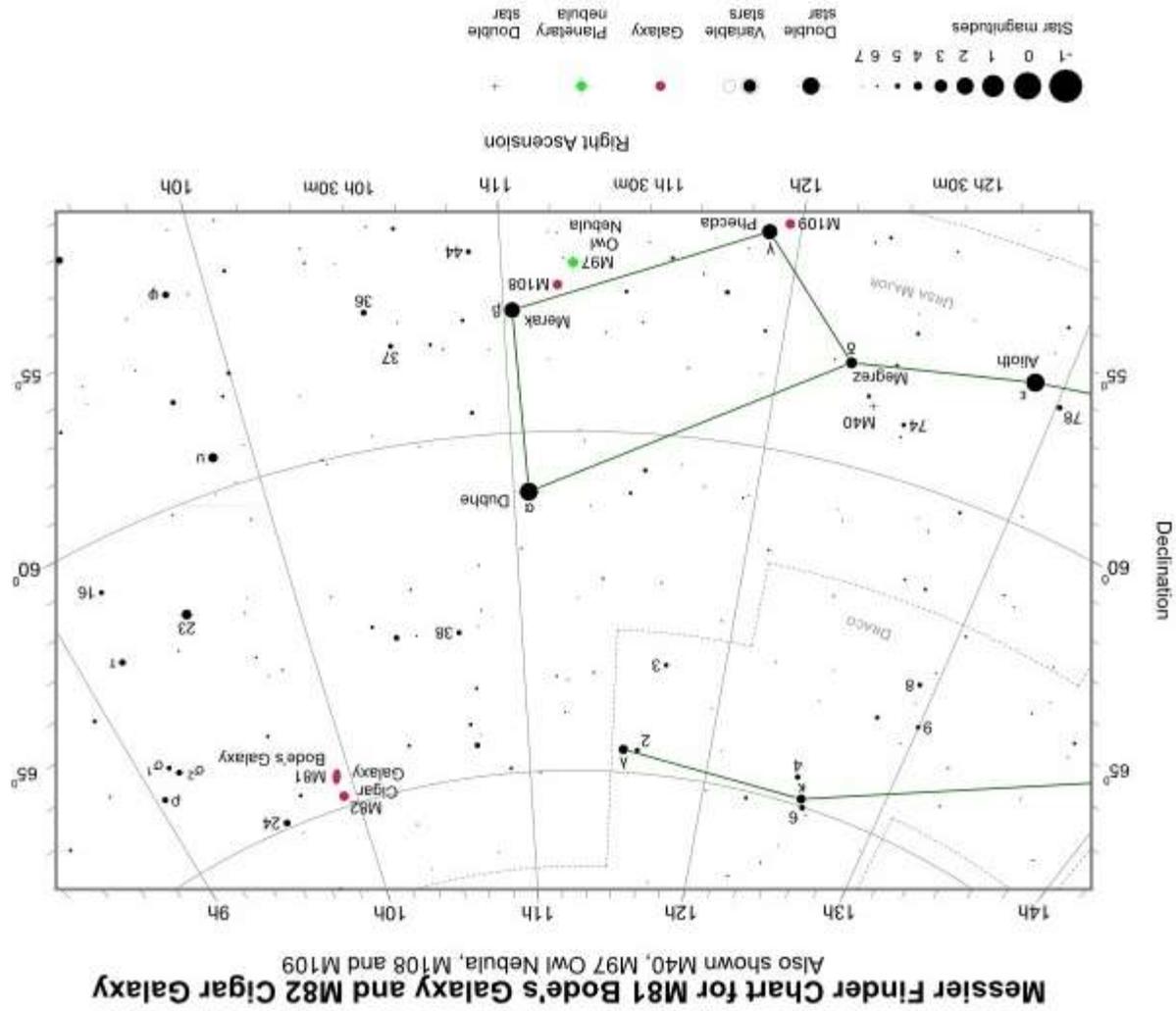


Constellation Leo Leo Triplet of Galaxies

Messier Finder Chart for M104 Sombrero Galaxy



Constellation Virgo – M104 Sombrero Galaxy – Unbarred Spiral



Constellation Ursa Major - Galaxy pair M81(Spiral Galaxy) and M82 (Starburst Galaxie)

Spring Orientation!

In the same region of sky, in the asterism of the Big Dipper, there is a famous double called Alcor and Mizar:

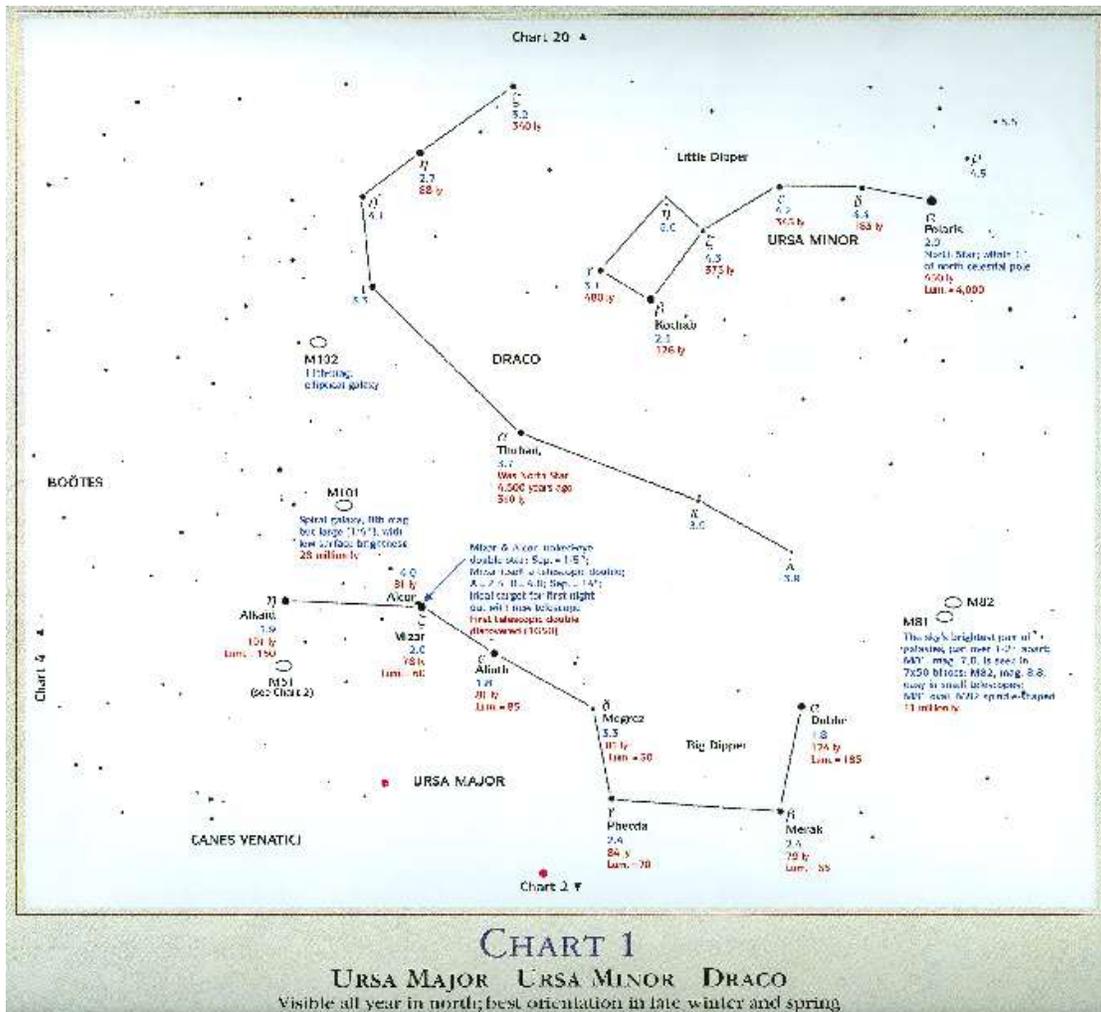


You can observe this any time of the year because these stars are circumpolar!

Direction North – Circumpolar Constellations

North Circumpolar Constellations never disappear behind the glare of the sun.

Here's an overview from Terrence Dickonson's NightWatch – Chart 1 – Polestar Polaris upper right



– image courtesy NightWatch by Terrence Dickonson

At right angles to the Alkaid, the last star of the big dipper is actually a pair of interacting Galaxies: The Whirlpool Galaxy (M51 and NGC 5194). M51 is considered to be a ‘grand design’ spiral galaxy with ” prominent and well-defined spiral arms, as opposed to multi-arm and “flocculent” spirals which have subtler structural features. The spiral arms of a grand design galaxy extend clearly around the galaxy through and can be observed over a large fraction of the galaxy’s radius.

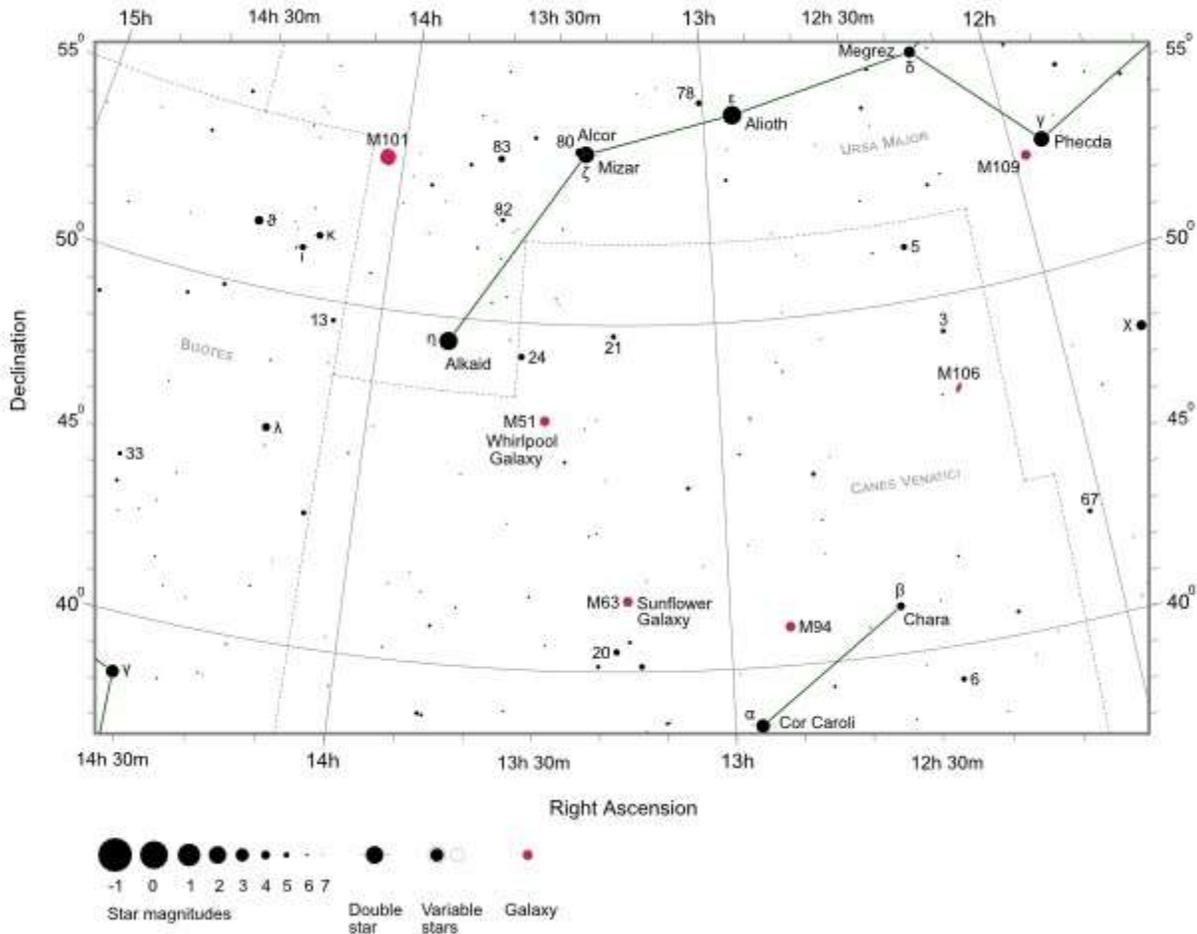


image (and image manipulation) courtesy H. and P. Browne

Density wave theory is the preferred explanation for the well-defined structure of grand design spirals. According to this theory, the spiral arms are created inside density waves that turn around the galaxy at different speeds from the stars in the galaxy's disk. Stars are clumped in these dense regions due to gravitational attraction towards the dense material, **though their location in the spiral arm may not be permanent**. When they come close to the spiral arm, they are pulled towards the dense material by the force of gravity; and as they travel through the arm, they are slowed from exiting by the same gravitational pull. This causes material to clump in the dense regions. At the center of these galaxies are supermassive black holes. – courtesy wikipedia M51

Messier Finder Chart for M51 Whirlpool Galaxy, M63 Sunflower Galaxy, M94, M101 and M106

Also shown M109

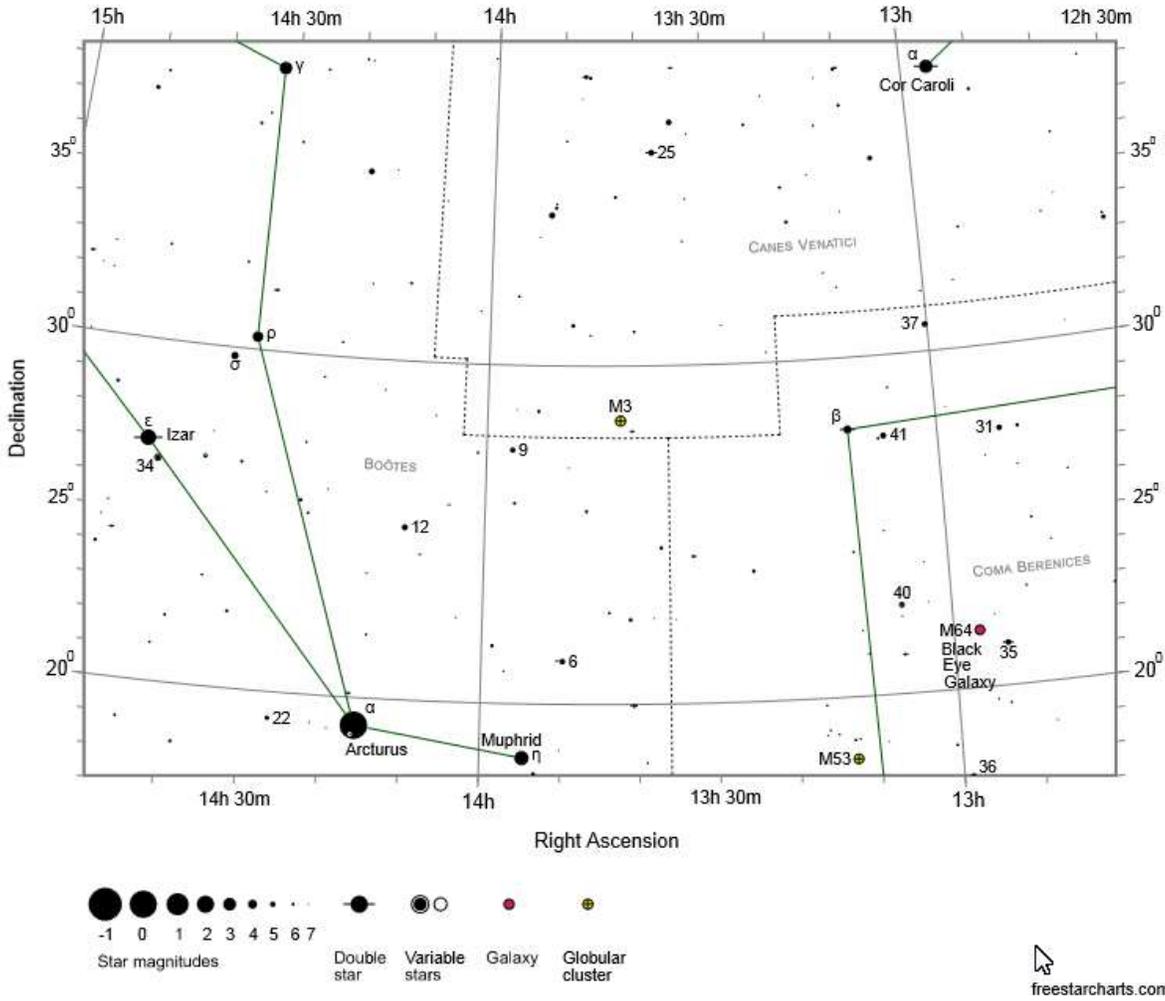


Constellation Ursa Major – M101(Spiral), M109 (Barred spiral)

Constellation Canes Venatici - M51(Spiral), M63 (Spiral), M94 (Spiral), M106 (Spiral)

Messier Finder Chart for M3

Also shown M53 and M64 Black Eye Galaxy

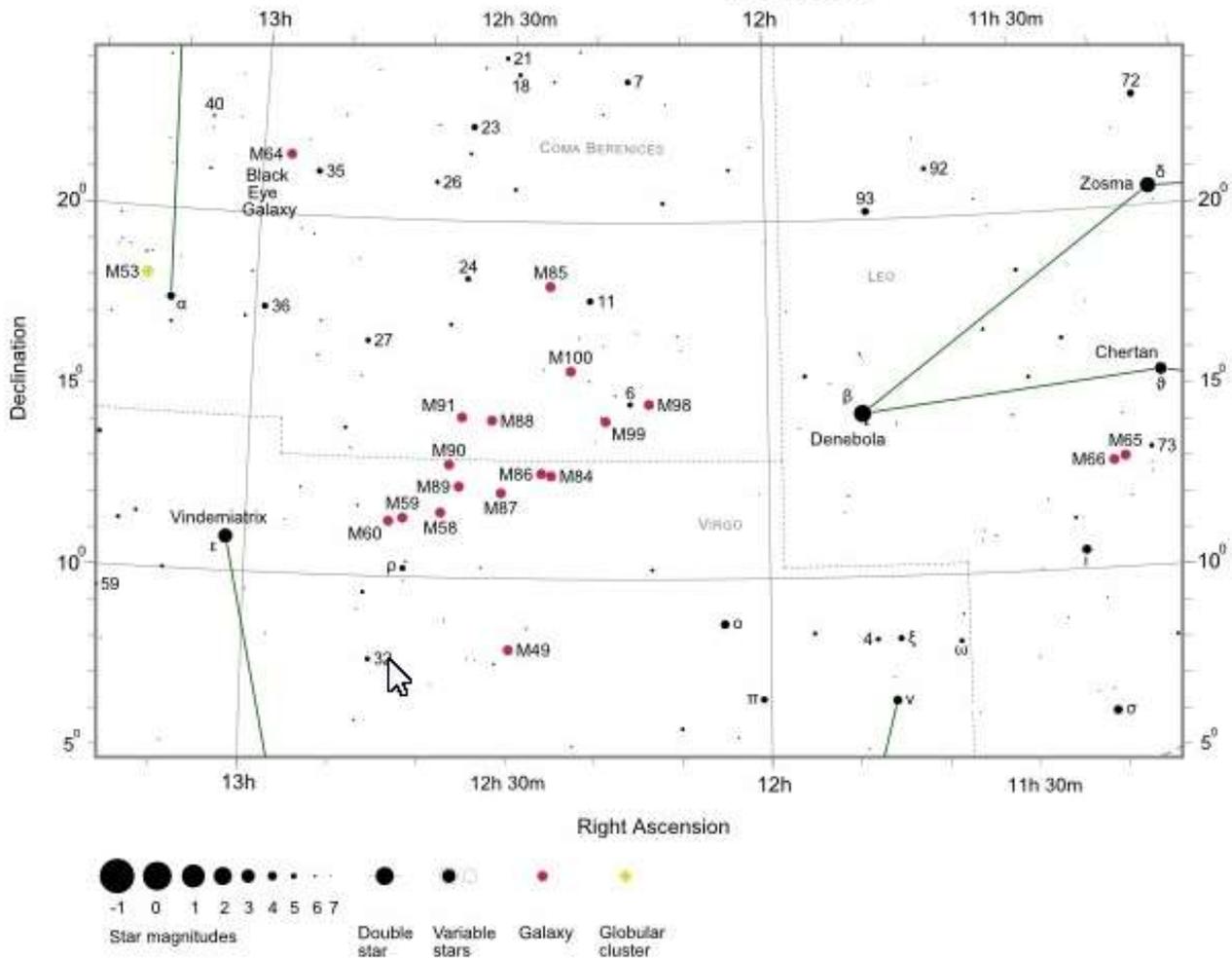


Constellation Canes Venatici - M3 (Globular Cluster)

Constellation Coma Berenices – M53 (Globular Cluster), M64 (Spiral)

Messier Finder Chart for M49, M58, M59, M60, M84, M85, M86, M87, M88, M89, M90, M91, M98, M99 and M100

Also shown M53, M64 Black Eye Galaxy, M65 and M66

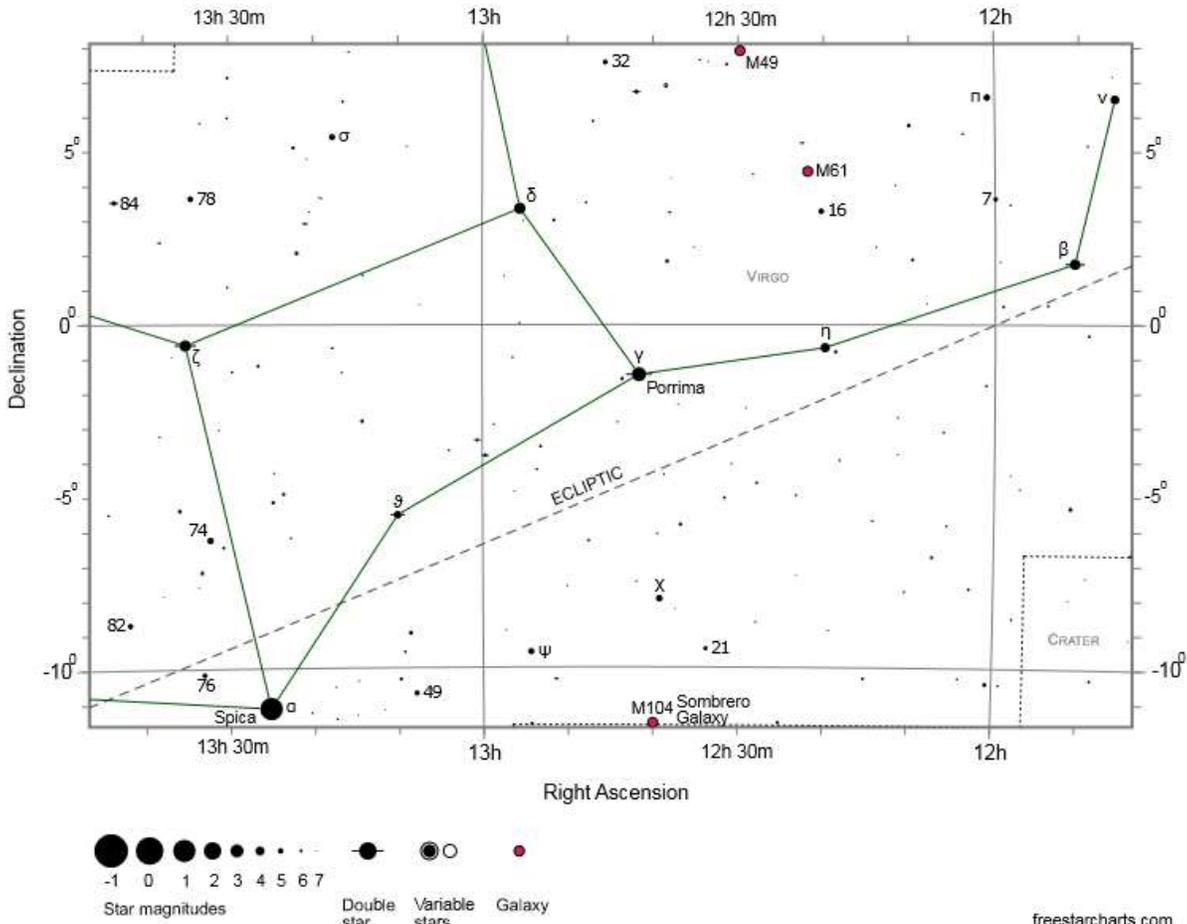


Constellation Coma Berenices - M53 (Globular Cluster), M64 (Spiral), M85 (Lenticular), M88 (Spiral), M90 (Spiral), M91 (Barred Spiral), M98 (Spiral), M99 (Spiral), M100 (Spiral)

Constellation Leo – M65 (Barred Spiral), M66 (Barred Spiral)

Constellation Virgo – M49(Elliptical), M58(Barred spiral), M60 (Elliptical), M84 (Lenticular), M87 (Elliptical), M90 (Spiral)

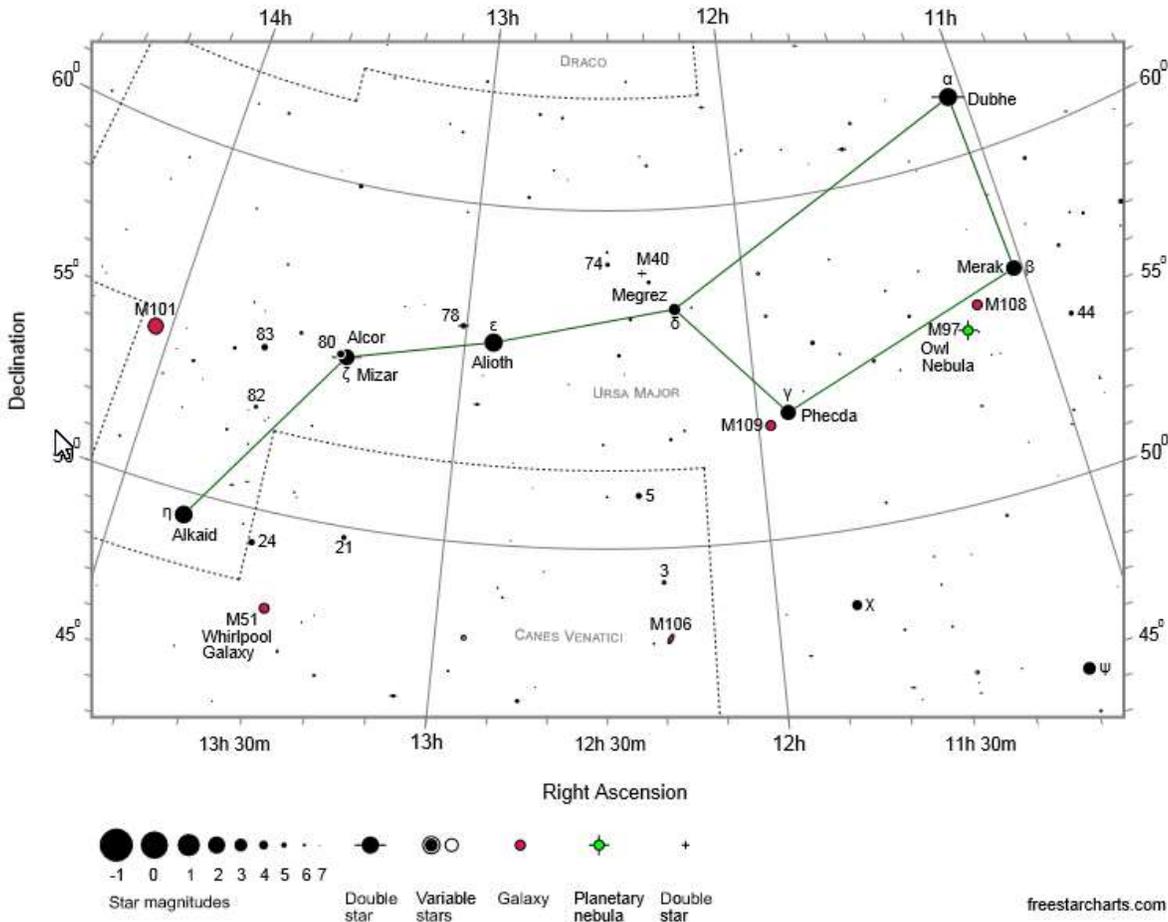
Messier Finder Chart for M61 Also shown M49 and M104 Sombrero Galaxy



Constellation Virgo – M104 Sombrero Galaxy (Unbarred Spiral) , M61(Spiral Galaxy), M49 (Elliptical Galaxy).

Messier Finder Chart for M40, M97 Owl Nebula, M108 and M109

Also shown M51 Whirlpool Galaxy, M101 and M106



Constellation Ursa Major – M40 (Double Star), M101 (Spiral), M108 (Barred Spiral), M109 (Barred Spiral)

Constellation Canes Venatici – M51 (Spiral), M106 (Spiral)