

Messier 53 Globular Cluster and M64-M85-M100

Messier 53 (also known as M53 or NGC 5024) is a globular cluster in the Coma Berenices constellation. It was discovered by **Johann Elert Bode** in 1775. M53 is one of the more outlying globular clusters, being about 60,000 light-years away from the Galactic Centre, and almost the same distance (about 58,000 light-years from the Solar system). The cluster has a core radius of 2.18 pc, a half-light radius of 5.84 pc, and a tidal radius of 239.9 pc.

OBSERVATION DATA (J2000 epoch)

Constellation Coma Berenices

Right ascension 13h 12m 55.25s

Declination +18° 10' 05.4"

Distance 58×10^3 ly

Apparent magnitude (V) +8.33

Apparent dimensions (V) 13.0'

Mass $8.26 \times 10^5 M_{\odot}$, Estimated age 12.67 Gyr

This is considered a metal-poor cluster and at one time was thought to be the most metal-poor cluster in the Milky Way. Abundance measurements of cluster members on the red giant branch show that most are first-generation stars. That is, they did not form from gas recycled from previous generations of stars. This differs from the majority of globular clusters that are more dominated by second generation stars. The second generation stars in NGC 5024 tend to be more concentrated in the core region. Overall, the stellar composition of cluster members is similar to members of the Milky Way halo.

The cluster displays various tidal-like features including clumps and ripples around the cluster, and tails along the cluster's orbit in an east-west direction. A tidal bridge-like structure appears to connect M53 with the close, very diffuse neighbor NGC 5053, as well as an envelope surrounding both clusters. These may indicate a dynamic tidal interaction has occurred between the two clusters; a possibly unique occurrence within the Milky Way since there are no known binary clusters within the galaxy. In addition, M53 is a candidate member of the Sagittarius dwarf galaxy tidal stream.

Among the variable star population in the cluster, there are 55 known to be RR Lyrae variables. Of these, a majority of 34 display behavior typical of the Blazhko effect, including 23 of type RRc – the largest known population of the latter in any globular cluster. There are also at least three variables of type SX Phe and a semi-regular red giant.

Messier 64 (Black Eye Galaxy)

M64 (NGC 4826) is known as the Black Eye Galaxy because of the prominent dark dust lane in front of the galaxy's bright nucleus. Also known as the Sleeping Beauty and Evil Eye galaxy, it is about 24 million light-years away. Recent studies indicate that the interstellar gas in the galaxy's outer regions rotates in the opposite direction from that in the inner regions, leading astronomers to believe that at least one satellite galaxy collided with it less than a billion years ago.

Observation data, Epoch J2000

Constellation Coma Berenices

Right ascension 12h 56m 43.7s

Declination +21° 40' 58"

Apparent dimension (V) 10.71×5.128 moa

Apparent magnitude (V) 9.36

Spiral galaxy Malin 1 discovered in 1986 is the first known giant low-surface-brightness galaxy. With UGC 1382, it is also one of the largest low-surface-brightness galaxies.

In 2006 a dwarf galaxy, also named Coma Berenices, was discovered in the constellation. The galaxy is a faint satellite of the Milky Way. Two satellite galaxies named NGC 4323--connected with M100 by a bridge of luminous matter--and NGC 4328 surround M100.



Messier 53 by the Hubble Space Telescope in the constellation Coma Berenices



Messier 85 (also known as M85 or NGC 4382) is a lenticular galaxy in the Coma Berenices constellation. It is 60 million light-years away, and it is estimated to be 125,000 light-years across. It was discovered by **Pierre Méchain** in 1781. It is the northernmost outlier of the Virgo cluster discovered.

M85 is extremely poor in neutral hydrogen and has a very complex outer structure with shells and ripples that are thought to have been caused by a merger with another galaxy that took place between 4 and 7 billion years ago, as well as a relatively young stellar population on its centermost region, some of it in a ring, that may have been created by a late starburst.

While indirect methods imply that Messier 85 should contain a central supermassive black hole of around 100 million solar masses, velocity dispersion observations imply that the galaxy may entirely lack a central massive black hole.

The type I supernova, 1960R was discovered in M85 on December 20, 1960 and reached an apparent magnitude of 11.7.

This galaxy has also been the host of the first luminous red nova identified as such, M85 OT2006-1. It was discovered on January 7 of 2006 and took place on the outskirts of this galaxy.

M85 is interacting with the nearby spiral galaxy NGC 4394, and a small elliptical galaxy called MCG 3-32-38.



Messier 100 (also known as NGC 4321) is an example of a grand design intermediate spiral galaxy located within the southern part of constellation Coma Berenices. It is one of the brightest and largest galaxies in the Virgo Cluster, located approximately 55 million light-years distant from Earth and has a diameter of 107,000 light years. It was discovered by Pierre Méchain on March 15, 1781 and was subsequently entered in Messier's catalogue of nebulae and star clusters after Charles Messier made observations of his own on April 13, 1781. The galaxy was one of the first spiral galaxies to be discovered.



Messier 100 Galaxy. The galaxy was one of the first spiral galaxies to be discovered

Constellation Coma Berenices

Right ascension 12h 22m 54.9s -

Declination +15° 49' 21" - Redshift 1571 ± 1 km/s

Distance 55 Mly - Apparent magnitude (V) 9.5 - Group or cluster Virgo Cluster

After the discovery of M100 by Méchain, Charles Messier made observations of the galaxy depicting it as a nebula without a star. He pointed out that it was difficult to recognize the nebula because of its faintness. **William Herschel** was able to identify a bright cluster of stars within the nebula during observations he did before **John Herschel** expanded the findings in 1833. With the advent of better telescopes, John was able to see a round, brighter galaxy; however, he also mentioned that it was barely visible through clouds. **William Henry Smyth** extended the studies of M100, detailing it as a pearly white nebula and pointing out diffuse spots.

Messier 100 is considered a starburst galaxy with the strongest star formation activity concentrated in its centre, within a ring - actually two tightly wound spiral arms attached to a small nuclear bar with a radius of 1 kilo-parsec – where star formation has been taking place since at least 500 million years ago in separate bursts.

As usual on spiral galaxies of the Virgo Cluster, in the rest of the disk both star formation and neutral hydrogen, of which M100 is deficient compared to isolated spiral galaxies of similar Hubble type, are truncated within the galaxy's disk, which is caused by interactions with the intracluster medium of Virgo.

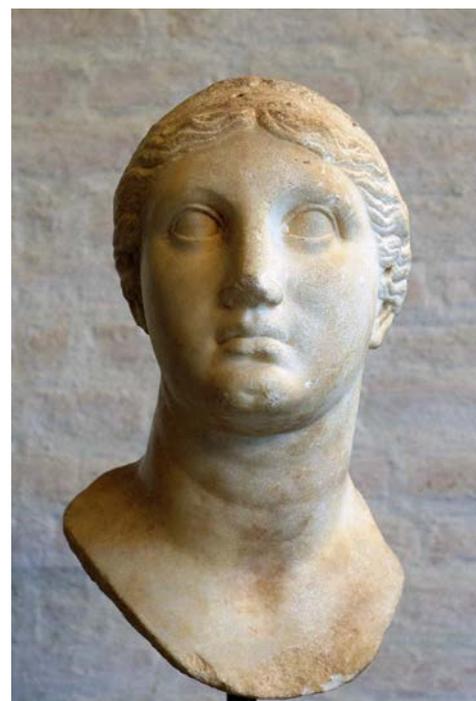
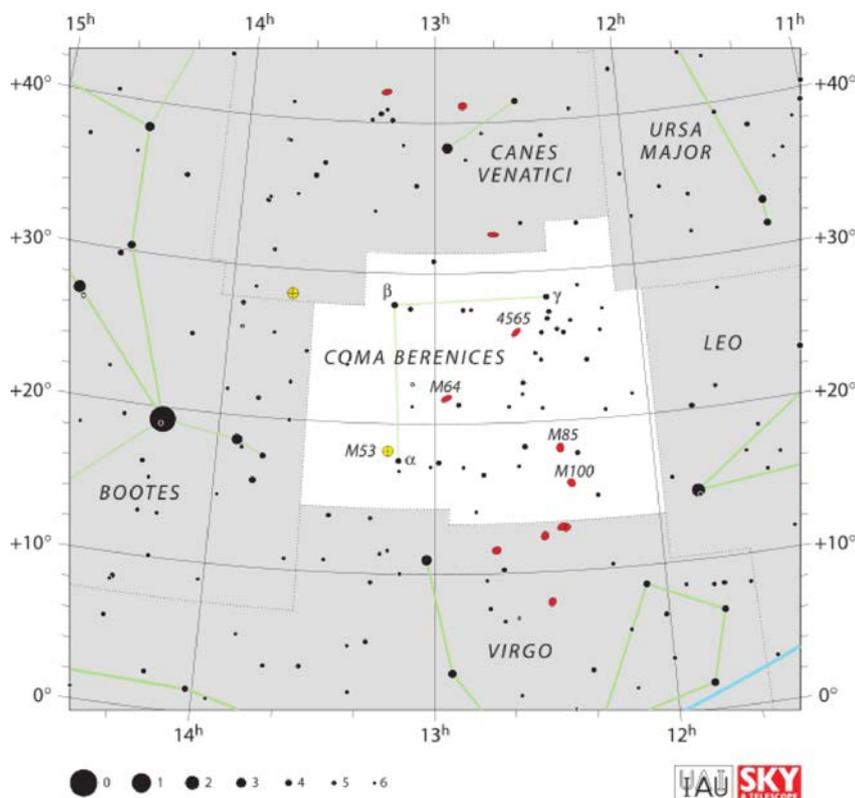
Five supernovae have been identified in M100. In March 1901 the first supernova of M100 was found, SN 1901B, a type I supernova found when magnitude 15.6 at a distance from its nucleus. SN 1914A was then discovered in February to March 1914; its type was undeterminable but was found when magnitude 15.7 at some distance from the centre.

Coma Berenices is an ancient asterism in the northern sky which has been defined as one of the 88 modern constellations. It is located in the fourth galactic quadrant, between Leo and Boötes, and is visible in both hemispheres. Its name means "Berenice's Hair" in Latin and refers to Queen Berenice II of Egypt, who sacrificed her long hair as a votive offering. It was introduced to Western astronomy during the third century BC by Conon of Samos and was further corroborated as a constellation by Gerardus Mercator and Tycho Brahe. Coma Berenices is the only modern constellation named for an historic figure.

Three of the constellation's stars are brighter than magnitude 4.5: Alpha, Beta and Gamma Berenices. They form a 45-degree triangle, from which Berenice's imaginary tresses, formed by the Coma Star Cluster, hang. The constellation's brightest star is a 4.2-magnitude main sequence star similar to the Sun. **Coma Berenices contains the North Galactic Pole and one of the richest known galaxy clusters, the Coma Cluster, part of the Coma Supercluster.** Supernova SN 2005ap discovered in Coma Berenices is the second-brightest known, and SN 1940B was the first observed example of a type II supernova. The constellation is the radiant of meteor shower Coma Berenicids, which has one of the fastest meteor speeds, up to 65 kilometres per second.

Coma Berenices has been recognized as an asterism since the Hellenistic period, and is the only modern constellation named for an historic figure. It was introduced to Western astronomy during the third century BC by Conon of Samos, the court astronomer of Egyptian ruler **Ptolemy III Euergetes**, to honour Ptolemy's consort, Berenice II. **Berenice vowed to sacrifice her long hair as a votive offering if Ptolemy returned safely from battle during the Third Syrian War. She made the sacrifice after Ptolemy's safe return around May 245 BC and dedicated her tresses "to all the gods" in the temple of Arsinoe II (identified later with Aphrodite) at Zephyrium. According to De astronomica, by the next morning the tresses had disappeared and it was proposed that Aphrodite had placed the tresses in the sky as an acknowledgement of Berenice's sacrifice. Eratosthenes (3rd century BC) called it "Berenice's Hair" and recognized it as a distinct constellation, but astronomer Ptolemy did not consider it one of his 48 constellations in the Almagest.**

Coma Berenices became popular during the 16th century. In 1536 it appeared on a celestial globe by **Caspar Vopel** as a constellation. **Tycho Brahe** is also credited with Coma's designation as a constellation. He included it in his 1602 star catalogue, recording fourteen stars in the constellation; **Johannes Hevelius** increased this number to twenty-one, and **John Flamsteed** to forty-three. Coma Berenices also appeared in Johann Bayer's 1603 Uranometria, and a few other 17th-century celestial maps followed suit. Coma Berenices exemplified a trend in astronomy in which globe- and map-makers continued to rely on the ancients for data. This trend ended at the turn of the 16th century with observations of the southern sky and the work of Tycho Brahe.



Bust of Berenice II of Egypt