



# MESSIER CATALOG

## THE GREENBERG COMPANION

### 2026

*All Images by Chanan Greenberg*



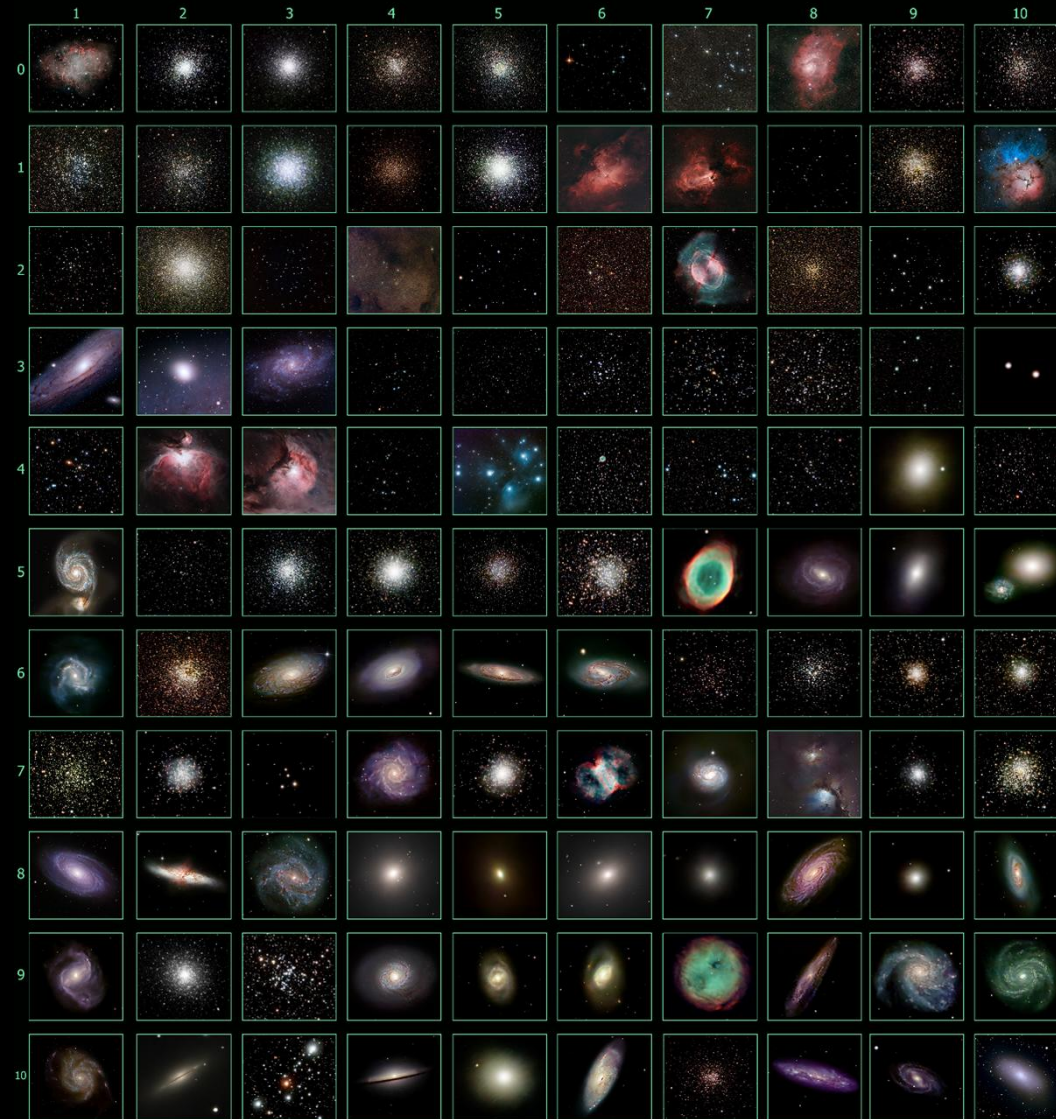
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# Messier Catalog

Images by Chanan Greenberg



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# M1 Crab Nebula

Object Type: Supernova Remnant  
Distance: 6,500 LY  
Image : 120 minutes exp.  
Scope: 8" SCT

## Information

The Crab Nebula is a supernova remnant in the constellation of Taurus. The nebula was observed by John Bevis in 1731; it corresponds to a bright supernova recorded by Chinese and Arab astronomers in 1054. At X-ray and gamma-ray energies above 30 KeV, the Crab is generally the strongest persistent source in the sky. Located at a distance of about 6,500 light-years (2 kpc) from Earth, the nebula has a diameter of 11 ly (3.4 pc) and expands at a rate of about 1,500 kilometers per second.

At the center of the nebula lies the Crab Pulsar, a rotating neutron star, which emits pulses of radiation from gamma rays to radio waves with a spin rate of 30.2 times per second. The nebula was the first astronomical object identified with a historical supernova explosion.

In October 2023 the James Webb Space Telescope imaged M1 with its NIRCам and MIRI instruments, producing the most detailed infrared view of the remnant obtained to date. The observations mapped the warm dust throughout the nebula for the first time and traced its cage-like structure of ionized sulfur filaments.

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# M2

Object Type: Globular Cluster  
Distance: 37,500 LY  
Image : 75 minutes exp.  
Scope: SCT 9.25"

## Information

M2 is a globular cluster in the constellation Aquarius. It was discovered by Jean-Dominique Maraldi in 1746 while observing a comet with Jacques Cassini and is one of the largest known globular clusters.

Charles Messier rediscovered it in 1760 but thought it a nebula without any stars associated with it. William Herschel was the first to resolve individual stars in the cluster, in 1794.

At 175 light-years in diameter, it is one of the larger globular clusters known. The cluster is rich, compact, and significantly elliptical. It is 13 billion years old and one of the older globulars associated with the Milky Way Galaxy.

M2 contains about 150,000 stars, including 21 known variable stars. Its brightest stars are red and yellow giants.



# M3

Object Type: Globular Cluster  
Distance: 33,900 LY  
Image : 60 minutes exp.  
Scope: AP 5"

## Information

Messier 3 is a globular cluster in the constellation Canes Venatici. It was discovered by Charles Messier in 1764, and resolved into stars by William Herschel around 1784. This cluster is one of the largest and brightest, and is made up of around 500,000 stars. It is located at a distance of about 33,900 light-years away from Earth. M3 has an apparent magnitude of 6.2, making it visible to the naked eye under dark conditions. From a moderate-sized telescope, the cluster is fully defined. It is estimated to be 8 billion years old.

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# M4

Object Type: Globular Cluster  
Distance: 5,500 LY  
Image : 25 minutes exp.  
Scope: Newtonian 10"

## Information

Messier 4 is a globular cluster in the constellation of Scorpius. It was discovered by Philippe Loys de Chéseaux in 1746 and cataloged by Charles Messier in 1764. It was the first globular cluster in which individual stars were resolved. It is one of the easiest globular clusters to find, being located only 1.3 degrees west of the bright star Antares, with both objects being visible in a wide field telescope. Modestly sized telescopes will begin to resolve individual stars of which the brightest in M4 are of apparent magnitude 10.8. M4 is a rather loosely concentrated cluster measures 75 light years across. At least 43 variable stars have been observed within M4.

M4 is approximately 5,500 light years away making it one of the closest globular clusters to our Solar System. It has an estimated age of 12.2 billion years. It is following an orbit through the Milky Way that has a period of 116 million years. When passing through the disk, this cluster does so at distances of less than 5 kpc from the galactic nucleus. The cluster undergoes tidal shock during each passage, which can cause the repeated shedding of stars. Thus the cluster may have been much more massive in the past. Photographs taken with the Hubble Space Telescope in 1995 have revealed white dwarf stars in M4 that are among the oldest known stars in the Milky Way Galaxy at an age of 13 billion years. One such white dwarf has been found to be a binary star with a pulsar companion, PSR B1620-26 and a planet orbiting it with a mass of 2.5 times that of Jupiter. In 1987 a millisecond pulsar was discovered in M4 with a period ten times faster than the Crab Pulsar.

In 2023 astronomers reported that twelve years of Hubble Space Telescope observations of the core of M4 indicate a concentration of about 800 solar masses in a very small volume, a possible intermediate-mass black hole. The result is not conclusive, since a tight group of stellar remnants could produce a similar signature.



# M5

Object Type: Globular Cluster  
Distance: 24,500 LY  
Image : 40 minutes exp.  
Scope: SCT 9.25"

## Information

Messier 5 is a globular cluster in the constellation Serpens. It was discovered by Gottfried Kirch in 1702. It should not be confused with the much fainter and more distant globular cluster Palomar 5, which is situated nearby in the sky.

Charles Messier also noted it in 1764, but thought it a nebula without any stars associated with it. William Herschel was the first to resolve individual stars in the cluster in 1791, counting roughly 200.

M5 is 165 light-years in diameter, M5 is one of the larger globular clusters known. The gravitational sphere of influence of M5, (ie. the volume of space in which stars are gravitationally bound to it rather than being torn away by the Milky Way's gravitational pull) has a radius of some 200 light-years.

At 13 billion years old it, M5 is also one of the older globulars associated with the Milky Way Galaxy. Its distance is about 24,500 light-years from Earth and the cluster contains more than 100,000 stars, as many as 500,000 according to some estimates.

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# M6 Butterfly Cluster

Object Type: Open Cluster  
Distance: 1,600 LY  
Image : 30 minutes exp.  
Scope: Newtonian 10"

## Information

The Butterfly Cluster (cataloged as Messier 6 or M6, and as NGC 6405) is an open cluster of stars in the constellation of Scorpius. Its name derives from the vague resemblance of its shape to a butterfly.

The first astronomer to record the Butterfly Cluster's existence was Giovanni Battista Hodierna in 1654. However, Robert Burnham, Jr has proposed that the 1st century astronomer Ptolemy may have seen it with the naked eye while observing its neighbor the Ptolemy Cluster (M7). Charles Messier cataloged the cluster as M6 in 1764. It was not till the 20th century that star counts, distance, and other properties were measured.

Most of the bright stars in this cluster are hot, blue B type stars but the brightest member is a K type orange giant star, BM Scorpii, which contrasts sharply with its blue neighbors in photographs. BM Scorpii, is classed as a semiregular variable star, its brightness varying from magnitude +5.5 to magnitude +7.0.

Estimates of the Butterfly Cluster's distance have varied over the years, with a mean value of around 1,600 light years, giving it a spatial dimension of some 12 light years. Modern measurements show its total visual brightness to be magnitude 4.2.



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# M7 Ptolemy Cluster

Object Type: Open Cluster  
Distance: 980 LY  
Image : 14 minutes exp.  
Scope: Newtonian 10"

## Information

Messier 7 or M7, also designated NGC 6475 and sometimes known as the Ptolemy Cluster, is an open cluster of stars in the constellation of Scorpius. The cluster is easily detectable with the naked eye, close to the "stinger" of Scorpius.

M7 has been known since antiquity; it was first recorded by the 1st-century Greek-Roman astronomer Ptolemy, who described it as a nebula in 130 AD. Italian astronomer Giovanni Batista Hodierna observed it before 1654 and counted 30 stars in it. In 1764, French astronomer Charles Messier cataloged the cluster as the seventh member in his list of comet-like objects. English astronomer John Herschel described it as "coarsely scattered clusters of stars".

Telescopic observations of the cluster reveal about 80 stars within a field of view of  $1.3^\circ$  across. At the cluster's estimated distance of 980 light years this corresponds to an actual diameter of 25 light years. The age of the cluster is around 200 million years while the brightest member star is of magnitude 5.6. In terms of composition, the cluster contains a similar abundance of elements other than hydrogen and helium as the Sun.



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## **M8 Lagoon Nebula**

Object Type: Emission Nebula  
Distance: 5,000 LY  
Image : 120 minutes exp.  
Scope: 80mm APO

### **Information**

The Lagoon Nebula is a giant interstellar cloud in the constellation Sagittarius. It is classified as an emission nebula and as an H II region. The Lagoon Nebula was discovered by Guillaume Le Gentil in 1747 and is one of only two star-forming nebulae faintly visible to the naked eye from mid-northern latitudes. Seen with binoculars, it appears as a distinct oval cloudlike patch with a definite core. A fragile star cluster appears superimposed on it.

The Lagoon Nebula is estimated to be between 4,000-6,000 light-years from the Earth. In the sky of Earth, it spans 90' by 40', translates to an actual dimension of 110 by 50 light years. Like many nebulae, it appears pink in time-exposure color photos but is gray to the eye peering through binoculars or a telescope. The Lagoon Nebula also contains at its center a structure known as the "Hourglass Nebula" (so named by John Herschel), which should not be confused with the better-known Hourglass Nebula in the constellation of Musca. In 2006 the first four Herbig-Haro objects were detected within the Hourglass, also including HH 870. This provides the first direct evidence of active star formation by accretion within it.

The Lagoon Nebula was chosen as the subject of the Hubble Space Telescope's 28th anniversary image, released in April 2018. The visible and infrared views centered on the young star Herschel 36, whose radiation and winds are carving the surrounding gas.



# M9

Object Type: Globular Cluster  
Distance: 25,800 LY  
Image : 18 minutes exp.  
Scope: 14" SCT

## Information

Messier 9 or M9 (also designated NGC 6333) is a globular cluster in the constellation of Ophiuchus. It was discovered by Charles Messier in 1764.

M9 is one of the nearer globular clusters to the center of the Milky Way Galaxy with a distance of around 5,500 light-years. Its distance from Earth is 25,800 light-years.

The total luminosity of this cluster is around 120,000 times that of the Sun, the absolute magnitude being -8.04. The brightest individual stars in M9 are of apparent magnitude 13.5, making them visible in moderately sized telescopes. There have been 13 variable stars found in M9.

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# M10

Object Type: Globular Cluster  
Distance: 14,300 LY  
Image : 15minutes exp.  
Scope: C-9.25" SCT

## Information

Messier 10 (also designated NGC 6254) is a globular cluster in the constellation of Ophiuchus.

The object was discovered by Charles Messier on May 29, 1764, who cataloged it as number 10 in his list. He described it as a "nebula without stars", but later study revealed it as a globular cluster of thousands of stars.

M10 has an apparent diameter of some 20 arcminutes, about two-thirds of the apparent diameter of the Moon. Viewed through medium-sized telescopes it appears about half that size (8' to 9'), as its bright core is only 35 light-years across. M10 has a spatial diameter of 83 light-years and is estimated to be 14,300 light-years away from Earth. Four variable stars have been discovered in this cluster.

This cluster completes an orbit through the Milky Way galaxy about every 140 million years, during which it crosses the plane of the galactic disk every 53 million years.



# M11 Wild Duck Cluster

Object Type: Open Cluster  
Distance: 6,200 LY  
Image : 40 minutes exp.  
Scope: SCT 9.25"

## Information

Messier 11 (M11, NGC 6705) is one of the richest and most compact of the galactic (open) clusters, M11 contains an estimated 2900 stars, about 500 of which are brighter than mag 14. An observer at the center of M11 would see several hundred first magnitude stars!

The age of the Wild Duck cluster has been estimated to amount 220 million years, as its brightest and hottest main sequence stars are of spectral type B8.

M11 was discovered by the German astronomer Gottfried Kirch of the Berlin observatory in 1681. It was apparently first resolved into stars by William Derham about 1733. Charles Messier included it in his catalog on May 30, 1764.



# M12

Object Type: Globular Cluster  
Distance: 23,000 LY  
Image : 35 minutes exp.  
Scope: C-9.25"

## Information

Messier 12 is a globular cluster in the constellation of Ophiuchus. It was discovered by Charles Messier on May 30, 1764.

Located roughly  $3^\circ$  in the sky from the cluster M10, M12 is about 23,000 light-years from Earth and has a spatial diameter of about 75 light-years. The brightest stars of M12 are of 12th magnitude. It is rather loosely packed for a globular and was once thought to be a tightly concentrated open cluster. Thirteen variable stars have been recorded in this cluster.

A study published in 2006 concluded that this cluster has an unusually low number of low mass stars. The authors surmise that they were stripped from the cluster by the gravitational influence of the Milky Way.



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# M13 Great Globular Cluster in Hercules

Object Type: Globular Cluster  
Distance: 25,100 LY  
Image : 30 minutes exp.  
Scope: C-9.25"

## Information

M13 (also known as the Great Globular Cluster in Hercules) is a globular cluster in the constellation of Hercules. M13 was discovered by Edmond Halley in 1714, and cataloged by Charles Messier on June 1, 1764. It has an apparent magnitude of 5.8, it is barely visible with the naked eye on a very clear night. Its diameter is about 23 arc minutes and it is readily viewable in small telescopes.

M13 is about 145 light-years in diameter, and it is composed of several hundred thousand stars. M13 is 25,100 light-years away from Earth.

The Arecibo message of 1974, designed to communicate the existence of human life to hypothetical extraterrestrials, was transmitted toward M13. The reason was that with a higher star density, the chances of a life harboring planet with intelligent life forms, were higher. Today we know M13 is mainly made of second generation stars which are very old and low on heavy elements which actually is a poor indication for the existence of planets or life. In his original entry Messier said this about M13: "a beautiful nebula in which I am certain there are no stars".



# M14

Object Type: Globular Cluster  
Distance: 30,000 LY  
Image : 50 minutes exp.  
Scope: C-9.25"

## Information

Messier 14 (also known as M14 or NGC 6402) is a globular cluster in the constellation Ophiuchus. It was discovered by Charles Messier in 1764. At a distance of about 30,000 light-years, M14 contains several hundreds of thousands of stars. At an apparent magnitude +7.6 it can be easily observed with binoculars.

The total luminosity of M14 is in the order of 400,000 times that of the Sun corresponding to an absolute magnitude of -9.12. The shape of the cluster is decidedly elongated. M14 is about 100 light-years across.

Slightly over 3° southwest of M14 lies the faint globular cluster NGC 6366.



# M15

Object Type: Globular Cluster  
Distance: 33,600 LY  
Image : 95 minutes exp.  
Scope: C-9.25"

## Information

Messier 15 or M15 (also designated NGC 7078) is a globular cluster in the constellation Pegasus. It was discovered by Jean-Dominique Maraldi in 1746 and included in Charles Messier's catalog of comet-like objects in 1764. At an estimated 13.2 billion years old, it is one of the oldest known globular clusters.

M15 is about 33,600 light-years from Earth. It has an absolute magnitude of -9.2 which translates to a total luminosity of 360,000 times that of the Sun. Messier 15 is one of the most densely packed globulars known in the Milky Way galaxy. Its core has undergone a contraction known as 'core collapse' and it has a central density cusp with an enormous number of stars surrounding what may be a central black hole.

Messier 15 contains 112 variable stars, a rather high number. It also contains at least 8 pulsars, including one double neutron star system, M15 C. Moreover, M15 houses Pease 1, one of only four planetary nebulae known to reside within a globular cluster, which was discovered in 1928.



# M16 Eagle Nebula

Object Type: Emission Nebula  
Distance: 6,500 LY  
Image : 2 hours and 45 minutes.  
Scope: AP 5"

## Information

The Eagle Nebula is a young open cluster of stars in the constellation Serpens, discovered by Jean-Philippe de Cheseaux in 1745-46. Its name derives from its shape which resembles an eagle. It is the subject of a famous photograph by the Hubble Space Telescope, which shows pillars of star-forming gas and dust within the nebula. The Eagle Nebula is part of a diffuse emission nebula, or H II region, which is cataloged as IC 4703. This region of active current star formation is about 6,500 light-years distant. The tower of gas that can be seen coming off the nebula is approximately 57 trillion miles (97 trillion km) high.

In October 2022 the James Webb Space Telescope imaged the Pillars of Creation within M16, first with its Near-Infrared Camera and then with its Mid-Infrared Instrument. The infrared views revealed newly formed stars embedded in and around the columns that were not visible in the 1995 Hubble image.



# M17 Omega (Swan) Nebula

Object Type: Emission Nebula  
Distance: 5,500 LY  
Image : 120 minutes exp.  
Scope: AP 5"

## Information

The Omega Nebula, also known as the Swan Nebula and the Horseshoe Nebula is an H II region in the constellation Sagittarius. It was discovered by Philippe Loys de Chéseaux in 1745. Charles Messier cataloged it in 1764. It is located in the rich star fields of the Sagittarius area of the Milky Way.

The Omega Nebula is between 5,000 and 6,000 light-years from Earth and it spans some 15 light-years in diameter. The cloud of interstellar matter of which this nebula is a part is roughly 40 light-years in diameter. The total mass of the Omega Nebula is an estimated 800 solar masses.

An open cluster of 35 stars lies embedded in the nebulosity and causes the gases of the nebula to shine due to radiation from these hot, young stars.

# M18

Object Type: Open Cluster  
Distance: 4,900 LY  
Image : 18 minutes exp.  
Scope: 14" SCT

## Information

Messier 18 or M18 (also designated NGC 6613) is an open cluster of stars in the constellation Sagittarius. It was discovered by Charles Messier in 1764 and included in his list of comet-like objects. From the perspective of Earth, M18 is situated between the Omega Nebula (M17) and the Sagittarius Star Cloud (M24). Its age is estimated at 32 million years. It is 4,900 light-years away.



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# M19

Object Type: Globular Cluster  
Distance: 28,700 LY  
Image : 16 minutes exp.  
Scope: 10" Newtonian

## Information

Messier 19 or M19 (also designated NGC 6273) is a globular cluster in the constellation Ophiuchus. It was discovered by Charles Messier on June 5, 1764 and added to his catalog of comet-like objects that same year. It was resolved into individual stars by William Herschel in 1784. His son, John Herschel, described it as "a superb cluster resolvable into countless stars".

M19 is one of the most oblate of the known globular clusters. This flattening may not accurately reflect the physical shape of the cluster because the emitted light is being strongly absorbed along the eastern edge. This is the result of extinction caused by intervening gas and dust. When viewed in the infrared, the cluster shows almost no flattening. It lies at a distance of about 28.7 kly (8.8 kpc) from the Solar System, and is quite near to the Galactic Center at only about 6.5 kly (2.0 kpc) away.

This cluster contains an estimated 1,100,000 times the mass of the Sun and it is around 11.9 billion years old. The stellar population includes four Cepheids and RV Tauri variables, plus at least one RR Lyrae variable for which a period is known.



# M20 Trifid Nebula

Object Type: Emission / Reflection & Dark Nebula

Distance: 5,000 LY

Image : 240 minutes exp.

Scope: AP 5"

## Information

The Trifid Nebula is an H II region located in Sagittarius. Its name means 'divided into three lobes'. The object is an unusual combination of an open cluster of stars, an emission nebula (red portion), a reflection nebula (blue portion) and a dark nebula (the apparent 'gaps' within the emission nebula that cause the trifid appearance; these are also designated Barnard 85). Viewed through a small telescope, the Trifid Nebula is a bright and colorful object, and is thus a perennial favorite of amateur astronomers.

A stellar jet protrudes from the head of the cloud and is about 0.75 light-years long. The jet's source is a young stellar object deep within the cloud. Jets are the exhaust gasses of star formation. Radiation from the nebula's central star makes the jet glow.

In January, 2005, NASA's Spitzer Space Telescope discovered 30 embryonic stars and 120 newborn stars not seen in visible light images.



# M21

Object Type: Open Cluster  
Distance: 4,250 LY  
Image : 45 minutes exp.  
Scope: 80mm APO

## Information

Messier 21 or M21 is an open cluster of stars in the constellation of Sagittarius. It was discovered and cataloged by Charles Messier on June 5, 1764.

M21 is a relatively young cluster of a mere 4.6 million years of age. It is tightly packed but contains about 57 stars. A few blue giant stars have been identified in the cluster, but Messier 21 is composed mainly of small dim stars. With a magnitude of 6.5, M21 is not visible to the naked eye; however, with the smallest binoculars it can be easily spotted on a dark night.



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## M22

Object Type: Globular Cluster  
Distance: 10,600 LY  
Image : 20 minutes exp.  
Scope: 10" Newtonian

### Information

Messier 22 (also known as M22 or NGC 6656) is an elliptical globular cluster in the constellation Sagittarius, near the Galactic bulge region. It is one of the brightest globulars that is visible in the night sky.

M22 was one of the first globulars to be discovered in 1665 by Abraham Ihle and it was included in Charles Messier's catalog of comet-like objects on June 5, 1764.

It was one of the first globular clusters to be carefully studied first by Harlow Shapley in 1930. He discovered roughly 70,000 stars and found it had a dense core.

M22 is one of the nearer globular clusters to Earth at a distance of about 10,600 light-years away. It spans 32' on the sky which translates to a spatial diameter of  $99 \pm 9$  light-years. 32 variable stars have been recorded in M22. It is projected in front of the galactic bulge and is therefore useful for its microlensing effect on the background stars in the bulge.

Despite its relative proximity to us, this metal-poor cluster's light is limited by dust extinction, giving it an apparent magnitude of 5.5 making it the brightest globular cluster visible from mid-northern latitudes (e.g. Europe and most of North America). However, due to its southerly declination, M22 never rises high in the sky and so appears less impressive than other summer sky globulars such as M13 and M5.



# M23

Object Type: Open Cluster  
Distance: 2,150 LY  
Image : 18 minutes exp.  
Scope: 14" SCT

## Information

Messier 23 (also known as NGC 6494) is an open cluster in the constellation Sagittarius. It was discovered by Charles Messier on June 20, 1764.

M23 is at a distance of about 2,150 light-years away from Earth, its radius is around 15-20 light years. There are some 150 identified members in this cluster, the brightest being of magnitude 9.2. M23 can be found with a modestly sized telescope in the rich star fields of the Sagittarius Milky Way.

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## M24 Sagittarius Star Cloud

Object Type: Star Cloud  
Distance: 10,000 LY  
Image : 35 minutes exp.  
Scope: APO 80mm

### Information

The Sagittarius Star Cloud (also known as Delle Caustiche, Messier 24, IC 4715) is a star cloud in the constellation of Sagittarius, approximately 600 light years wide, which was discovered by Charles Messier in 1764. It is sometimes known as the Small Sagittarius Star Cloud to distinguish it from the Great Sagittarius Star Cloud located to the north of Gamma Sagittarii and Delta Sagittarii.

The stars, clusters and other objects comprising M24 are part of the Sagittarius or Sagittarius-Carina arms of the Milky Way galaxy. Messier described M24 as a "large nebulosity containing many stars" and gave its dimensions as being some 1.5° across. Some sources, improperly, identify M24 as the faint cluster NGC 6603. This star field also included a superb example of a dark nebula Barnard 92.

M24 fills a space of significant volume to a depth of 10,000 to 16,000 light-years. This is the most dense concentration of individual stars visible using binoculars, with around 1,000 stars visible within a single field of view.



## M25

Object Type: Open Cluster  
Distance: 2,000 LY  
Image : 18 minutes exp.  
Scope: 14" SCT

### Information

Open Cluster M25 (also known as Messier Object 25 or IC 4725) is an open cluster in the constellation Sagittarius. It was discovered by Philippe Loys de Chéseaux in 1745 and included in Charles Messier's list in 1764.

M25 is at a distance of about 2,000 light-years away from Earth. The spatial dimension of this cluster is about 19 light years across.



## M26

Object Type: Open Cluster  
Distance: 5,000 LY  
Image : 20 minutes exp.  
Scope: APO 80mm

### Information

Open Cluster M26 (also known as Messier Object 26 or NGC 6694) is an open cluster in the constellation Scutum. It was discovered by Charles Messier in 1764.

M26 spans about 22 light years across and is at a distance of 5,000 light years from the Earth. The brightest star is of magnitude 11.9 and the age of this cluster has been calculated to be 89 million years. An interesting feature of M26 is a region of low star density near the nucleus, most likely caused by an obscuring cloud of interstellar matter between us and the cluster.



# M27 Dumbbell Nebula

Object Type: Planetary Nebula  
Distance: 1,300 LY  
Image : 240 minutes exp.  
Scope: Ap 5"

## Information

The Dumbbell Nebula is a planetary nebula (PN) in the constellation Vulpecula, at a distance of about 1,360 light years.

This object was the first planetary nebula to be discovered; by Charles Messier in 1764. At its brightness of visual magnitude 7.5 and its diameter of about 8 arcminutes, it is easily visible in binoculars, and a popular observing target in amateur telescopes.

This PN appears to be shaped like an prolate spheroid and is viewed from our perspective along the plane of its equator. In 1992, Moreno-Corral computed that the rate of expansion in the plane of the sky of this PN was no more than 2".3 per century. From this, an upper limit to the age of 14,600 yr may be determined.

The central star, a white dwarf, is larger than any other known white dwarf.



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## M28

Object Type: Globular Cluster  
Distance: 17,900 LY  
Image : 14 minutes exp.  
Scope: APO 80mm

### Information

Messier 28 (also known as M28 or NGC 6626) is a globular cluster in the constellation Sagittarius. It was discovered by French astronomer Charles Messier on July 27, 1764. He briefly described it as a "nebula containing no star..."

In the sky it is less than a degree to the northwest of the 3rd magnitude star Kaus Borealis. This cluster is faintly visible as a hazy patch with a pair of binoculars and can be readily found in a small telescope with a 8 cm (3.1 in) aperture, showing as a nebulous feature spanning 11.2 arcminutes. At 15 cm (5.9 in), the core becomes visible and a few individual stars can be resolved along the periphery. Larger telescopes will provide greater resolution, with a 25 cm (9.8 in) telescope revealing a 2' core.

M28 is at a distance of about 17,900 light-years away from Earth. It has a combined 551,000 times the mass of the Sun and is 12 billion years old. 18 RR Lyrae type variable stars have been observed in this cluster. In 1986, M28 became the first globular cluster where a millisecond pulsar, PSR B1821-24, was discovered with the Lovell Telescope at Jodrell Bank Observatory. A total of 11 additional millisecond pulsars have since been detected in the cluster with the Green Bank Telescope. As of 2011, this is the third largest known population of pulsars in a cluster following Terzan 5 and 47 Tucanae.



## M29

Object Type: Open Cluster  
Distance: 4,000 LY  
Image : 5 minutes exp.  
Scope: C-14"

### Information

Messier 29 (also known as M 29 or NGC 6913) is an open cluster in the Cygnus constellation. It was discovered by Charles Messier in 1764, and can be seen from Earth by using binoculars.

M29 is a rather coarse and less impressive cluster, situated in the highly crowded area of Milky Way near Gamma Cygni, at a distance of 4,000.

Its age is estimated at 10 million years, as its five hottest stars are all giants of spectral class B0. The linear diameter was estimated at only 11 light years.

This cluster can be seen in binoculars. In telescopes, lowest powers are best.



# M30

Object Type: Globular Cluster  
Distance: 29,400 LY  
Image : 20 minutes exp.  
Scope: 8" Newtonian

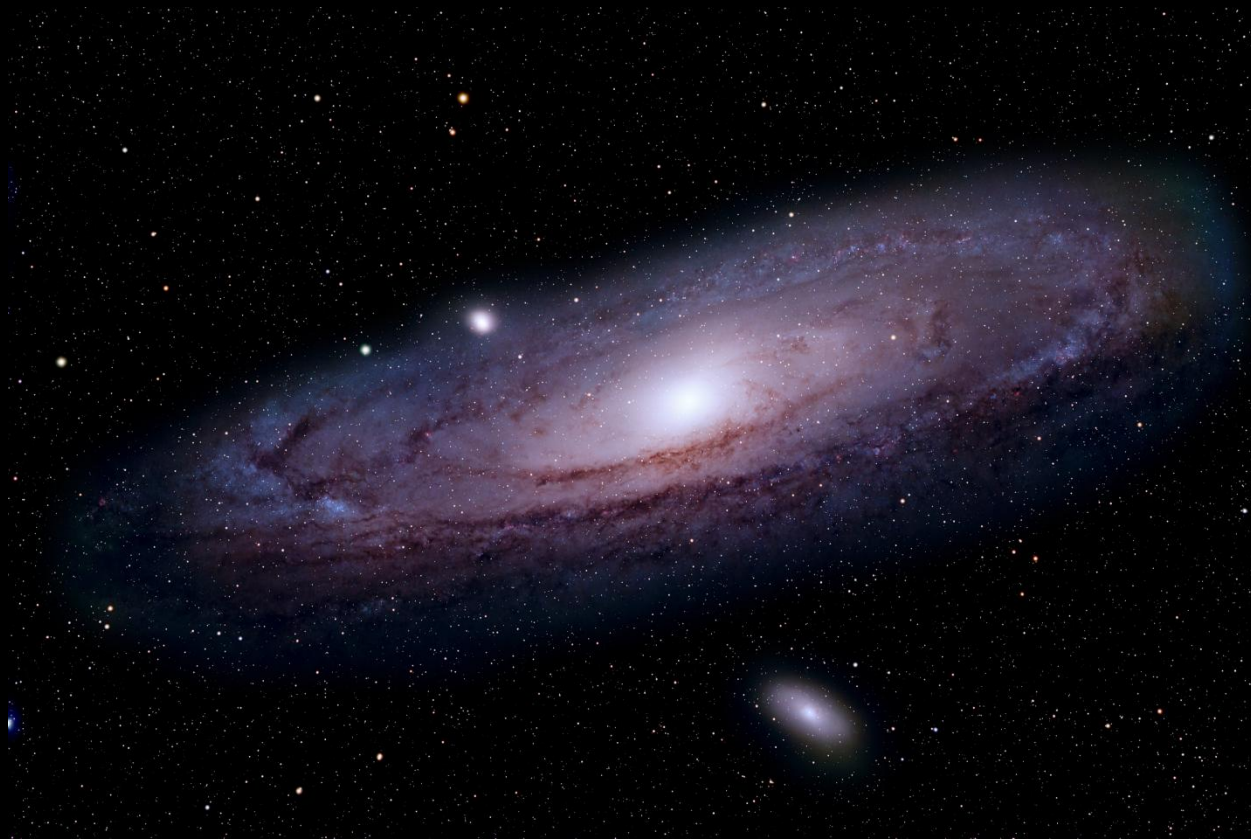
## Information

Messier 30 (also known as M30 or NGC 7099) is a globular cluster of stars in the southern constellation of Capricornus. It was discovered by the French astronomer Charles Messier in 1764, who described it as a circular nebula without a star. In the New General Catalogue, compiled during the 1880s, it was described as a "remarkable globular, bright, large, slightly oval." This cluster can be easily viewed with a pair of 10×50 binoculars, forming a patch of hazy light some 4 arcminutes wide that is slightly elongated along the east-west axis. With a larger instrument, individual stars can be resolved and the cluster will cover an angle of up to 12 arcminutes across with a compressed core one arcminute wide. It is best observed around August.

M30 is located at a distance of about 29,400 light-years from Earth, and is about 93 light-years across. The estimated age is roughly 12.93 billion years and it has a combined mass of about 160,000 times the mass of the Sun. The cluster is following a retrograde orbit through the inner galactic halo, suggesting that it was acquired from a satellite galaxy rather than forming within the Milky Way. It is currently located at a distance of about 22.2 kly (6.8 kpc) from the center of the galaxy, compared to an estimated 26 kly (8.0 kpc) for the Sun.

The M30 cluster has passed through a dynamic process called core collapse and now has a concentration of mass at its core of about a million times the Sun's mass per cubic parsec. This makes it one of the highest density regions in the Milky Way galaxy. Stars in such close proximity will experience a high rate of interactions that can create binary star systems, as well as a type of star called a blue straggler that is formed by mass transfer. A process of mass segregation may have caused the central region to gain a greater proportion of higher mass stars, creating a color gradient with increasing blueness toward the middle of the cluster.

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## M31 Andromeda Galaxy

Object Type: Galaxy

Distance: 2.5 MLY

Image : 960 minutes exp.

Scope: 80mm APO

### Information

The Andromeda Galaxy is a spiral galaxy approximately 2,500,000 light-years away in the constellation Andromeda. Andromeda is the nearest spiral galaxy to our own, the Milky Way. As it is visible as a faint smudge on a moonless night, it is one of the farthest objects visible to the naked eye, and can be seen even from urban areas with binoculars. The 2006 observations by the Spitzer Space Telescope revealed that M31 contains one trillion stars, more than the number of stars in our own galaxy, which is estimated to be 200-400 billion. Although it appears more than six times as wide as the full Moon when photographed through a larger telescope, only the brighter central region is visible with the naked eye.

The earliest recorded observation of the Andromeda Galaxy was in 964 CE by the Persian astronomer, Abd al-Rahman al-Sufi who described it as a "small cloud" in his Book of Fixed Stars. The first description of the object based on telescopic observation was given by Simon Marius in 1612. Charles Messier cataloged it as object M31 in 1764 and incorrectly credited Marius as the discoverer.

In 1925 Edwin Hubble identified extragalactic Cepheid variable stars for the first time on astronomical photos of M31. His measurement demonstrated conclusively that this feature was not a cluster of stars and gas within our Galaxy, but an entirely separate galaxy located a significant distance from our own. Like the Milky Way, Andromeda Galaxy has satellite galaxies, consisting of 14 known dwarf galaxies. The best known and most readily observed satellite galaxies are M32 and M110. The Andromeda Galaxy is approaching the Sun at about 100 to 140 kilometres per second, so it is one of the few blue shifted galaxies. The Andromeda Galaxy and the Milky Way are thus expected to collide in perhaps 2.5 billion years. A likely outcome of the collision is that the galaxies will merge to form a giant elliptical galaxy.

In January 2025 astronomers released the largest photomosaic ever assembled from Hubble Space Telescope data, a panorama of M31 built from more than 600 separate fields collected over more than a decade. The mosaic spans roughly 2.5 billion pixels and resolves about 200 million individual stars.

A study published in Nature Astronomy in 2025 reanalyzed Hubble and Gaia measurements of M31's motion and included the gravitational influence of M33 and the Large Magellanic Cloud. It concluded that a merger with the Milky Way is far from certain, with roughly a 50 percent chance of the two galaxies merging within the next 10 billion years.

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## M32

Object Type: Galaxy  
Distance: 2.65 MLY  
Image : 960 minutes exp.  
Scope: 80mm APO

### Information

M32 (seen in this image right above the Andromeda Galaxy) Messier 32 is a dwarf elliptical galaxy about 2.65 million light-years away in the constellation Andromeda. M32 is a satellite galaxy of the famous Andromeda Galaxy (M31) and was discovered by Le Gentil in 1749. Like most elliptical galaxies, M32 contains mostly older faint red and yellow stars with practically no dust or gas and consequently no current star formation. It does, however, show hints of star formation in the relatively recent past.

At least two techniques have been used to measure distances to M32. The infrared surface brightness fluctuations distance measurement technique estimates distances to spiral galaxies based on the graininess of the appearance of their bulges. The distance measured to M32 using this technique is  $2.46 \pm 0.09$  Mly. However, M32 is close enough that the tip of the red giant branch (TRGB) method may be used to estimate its distance. The estimated distance to M32 using this technique is  $2.51 \pm 0.13$  Mly. Averaged together, these distance measurements give a distance estimate of  $2.49 \pm 0.08$  Mly.

Work published in Nature Astronomy in 2018 proposed that M32 is the surviving core of a once-large galaxy, designated M32p, that merged with Andromeda about two billion years ago. On this account M32p was at least 20 times more massive than any galaxy the Milky Way has absorbed.



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# M33 Triangulum Galaxy

Object Type: Galaxy  
Distance: 3 MLY  
Image : 120 minutes exp.  
Scope: Ap 5"

## Information

The Triangulum Galaxy is a spiral galaxy at approximately 3 million light years distance in the constellation Triangulum. M33 is a member of the Local Group of galaxies, which includes the Milky Way Galaxy, the Andromeda Galaxy and about 30 other smaller galaxies. M33 was probably discovered by the Italian astronomer Giovanni Battista Hodierna before 1654. The galaxy was independently discovered by Charles Messier on the night of August 25–26, 1764. When William Herschel compiled his extensive catalog of nebulae, he was careful not to include most of the objects identified by Messier. However, M33 was an exception and he cataloged this object on September 11, 1784 as H V-17. Herschel also cataloged The Triangulum Galaxy's brightest and largest H II region (diffuse emission nebula containing ionized hydrogen) as H III.150 separately from the galaxy itself, which eventually obtained NGC number 604. As seen from Earth NGC 604 is located northeast of the galaxy's central core, and is one of the largest H II regions known with a diameter of nearly 1500 light-years and a spectrum similar to the Orion Nebula. With a diameter of about 50,000 light years, M33 is the third largest member of the Local Group and may be home to 40 billion stars, compared to 400 billion for the Milky Way, and about a trillion stars for Andromeda.

# M34

Object Type: Open Cluster  
Distance: 1,500 LY  
Image : 75 minutes exp.  
Scope: C-9.25"

## Information

Messier 34 (also known as M 34 or NGC 1039) is an open cluster in the constellation Perseus. It was probably discovered by Giovanni Batista Hodierna before 1654 and included by Charles Messier in his catalog of comet-like objects in 1764. Messier described it as, "A cluster of small stars a little below the parallel of  $\gamma$  (Andromedae). In an ordinary telescope of 3 feet one can distinguish the stars."

Based on the distance modulus of 8.38, this cluster is located at a distance of about 470 parsecs, or 1,500 light years. For stars in the range from 0.12 to 1.0 solar masses, M34 contains an estimated 400 members. It spans about 35' on the sky which translates to a true radius of 7 light years. The cluster is just visible to the naked eye in very dark conditions, well away from city lights. It is well seen in binoculars.

The age of this cluster lies between the respective ages of the Pleiades open cluster at 100 million years and the Hyades open cluster at 800 million years. At least 19 members of this cluster are white dwarfs.



## M35

Object Type: Open Cluster  
Distance: 2,800 LY  
Image : 15 minutes exp.  
Scope: C-9.25"

### Information

Messier 35 (also known as M 35, or NGC 2168) is an open cluster in the constellation Gemini. It was discovered by Philippe Loys de Chéseaux in 1745 and independently discovered by John Bevis before 1750. The cluster is scattered over an area of the sky almost the size of the full moon and is located 850 parsecs (2,800 light-years) from Earth.

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# M36

Object Type: Open Cluster  
Distance: 4,100 LY  
Image : 90 minutes exp.  
Scope: 80mm APO

## Information

Open Cluster M36 (also known as Messier Object 36, Messier 36, M36, or NGC 1960) is an open cluster in the Auriga constellation. It was discovered by Giovanni Batista Hodierna before 1654. M36 is at a distance of about 4,100 light years away from Earth and is about 14 light years across. There are at least sixty members in the cluster. The cluster is very similar to the Pleiades cluster (M45), and if it were the same distance from Earth it would be of similar magnitude.



# M37

Object Type: Open Cluster  
Distance: 4,400 LY  
Image : 32 minutes exp.  
Scope: C-9.25"

## Information

Messier 37 is the richest open cluster in the constellation Auriga. It was discovered by Hodierna before 1654.

Messier 37 is the brightest of the three open clusters in Auriga. M37 was missed by Le Gentil when he rediscovered M36 and M38 in 1749. Charles Messier independently rediscovered M37 in September of 1764 but all three clusters were recorded by Hodierna before 1654.

M37 is roughly 300 million years old and contains over 500 stars with roughly 150 stars brighter than magnitude 12.5. M37 also contains at least a dozen red giants with the hottest main sequence star of spectral type B9V. Its distance is between 3,600 to 4,700 light years and the apparent diameter of 24' corresponds to a linear extension of about 20 to 25 light years.



# M38 Starfish Cluster

Object Type: Open Cluster  
Distance: 3,420 LY  
Image : 100 minutes exp.  
Scope: 80mm APO

## Information

Messier 38 (also known as M38 or NGC 1912) is an open cluster in the Auriga constellation. It was discovered by Giovanni Batista Hodierna before 1654 and independently found by Le Gentil in 1749. M36 and M37, also discovered by Hodierna, are grouped together with M38 at a distance of about 3,420 light years away from Earth.

The cluster's brightest stars form a pattern resembling the Greek letter Pi or, according to Webb, an "oblique cross." At its distance of 4,200 light years, its angular diameter of about 20' corresponds to about 25 light years, similar to that of its more distant neighbor M37. It is of intermediate age (about 220 million years, according to Sky Catalog 2000) and features a yellow giant of apparent magnitude +7.9 and spectral type G0 as its brightest member. This corresponds to an absolute magnitude of -1.5, or a luminosity of 900 suns. For comparison, the Sun would appear as a faint magnitude +15.3 star from the distance of M38.



# M39

Object Type: Open Cluster  
Distance: 800 LY  
Image : 60 minutes exp.  
Scope: C-9.25"

## Information

Open Cluster M39 (also known as Messier Object 39, Messier 39, M39, or NGC 7092) is an open cluster in the Cygnus constellation. It was discovered by Charles Messier in 1764. M39 is at a distance of about 800 light years away from Earth. Its age is estimated to be from 200 to 300 million years.

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# M40 Winnecke 4

Object Type: Double Star

Distance: 510 LY

Image : 18 minutes exp.

Scope: C-9.25

## Information

Also known as Winnecke 4, it is a double star in the constellation Ursa Major. It was discovered by Charles Messier in 1764 while he was searching for a nebula that had been reported in the area by Johann Hevelius. Not seeing any nebulae, Messier cataloged this double star instead. It was subsequently rediscovered by Friedrich August Theodor Winnecke in 1863. Burnham calls M40 "one of the few real mistakes in the Messier catalog," faulting Messier for including it when all he saw was a double star, not a nebula of any sort. The faint galaxy next to M40 called NGC 4290 at 12.7 mag and 144 million light years away from earth was too faint for Messier to pickup with his 3.5-inch refractor, it just appears as a smudge in this image.

Data gathered by astronomers Brian Skiff (2001) and Richard L. Nugent (2002) strongly suggest that this is merely an optical double star rather than a physically connected system.



# M41

Object Type: Open Cluster  
Distance: 2,300 LY  
Image : 50 minutes exp.  
Scope: 80mm APO

## Information

Messier 41 (also known as M41 or NGC 2287) is an open cluster in the Canis Major constellation. It was discovered by Giovanni Batista Hodierna before 1654 and was perhaps known to Aristotle about 325 BC.

M41 lies about four degrees almost exactly south of Sirius. It contains about 100 stars including several red giants, the brightest being a spectral type K3 giant near the cluster's center. The cluster is estimated to be moving away from us at 23.3 km/s. The diameter of the cluster is between 25 and 26 light years. Its age is estimated at between 190 and 240 million years old.



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# M42 Orion Nebula

Object Type: Emission Nebula  
Distance: 1,500 LY  
Image : 20 minutes exp.  
Scope: 10 Inch Newtonian

## Information

The Orion Nebula is a diffuse nebula situated south of Orion's Belt. It is one of the brightest nebulae, and is visible to the naked eye in the night sky. M42 is located at a distance of 1,344  $\pm$  20 light years and is the closest region of massive star formation to Earth. The M42 nebula is estimated to be 24 light years across.

The Orion Nebula is one of the most scrutinized and photographed objects in the night sky, and is among the most intensely studied celestial features. The nebula has revealed much about the process of how stars and planetary systems are formed from collapsing clouds of gas and dust. Astronomers have directly observed protoplanetary disks, brown dwarfs, intense and turbulent motions of the gas, and the photo-ionizing effects of massive nearby stars in the nebula. There are also supersonic "bullets" of gas piercing the dense hydrogen clouds of the Orion Nebula. Each bullet is ten times the diameter of Pluto's orbit and tipped with iron atoms glowing bright blue. They were probably formed one thousand years ago from an unknown violent event.

The Nebula is in fact part of a much larger nebula that is known as the Orion Molecular Cloud Complex. The Orion Molecular Cloud Complex extends throughout the constellation of Orion and includes Barnard's Loop, the Horsehead Nebula, M43, M78 and the Flame Nebula. Stars are forming throughout the Orion Nebula, and due to this heat-intensive process the region is particularly prominent in the infrared. The Orion Nebula is an example of a stellar nursery where new stars are being born. Observations of the nebula have revealed approximately 700 stars in various stages of formation within the nebula.

The Orion Nebula contains a very young open cluster, known as the Trapezium due to the asterism of its primary four stars. Two of these can be resolved into their component binary systems on nights with good seeing, giving a total of six stars. The stars of the Trapezium, along with many other stars, are still in their early years. The Trapezium may be a component of the much-larger Orion Nebula Cluster, an association of about 2,000 stars within a diameter of 20 light years.

The James Webb Space Telescope observed the inner Orion Nebula and Trapezium Cluster in September 2022, producing a mosaic of about 300 megapixels. The near-infrared data penetrate the dust that hides the youngest stars and their surrounding disks.



# M43 De Mairan's Nebula

Object Type: H II Region

Distance: 1,600 LY

Image : 20 minutes exp.

Scope: 10 Inch Newtonian

## Information

Messier 43 (also known as M43, De Mairan's Nebula, and NGC 1982) is an H II region in the Orion constellation. It was discovered by Jean-Jacques Dortous de Mairan before 1731. The De Mairan's Nebula is part of the Orion Nebula, separated from the main nebula by a lane of dust. It is part of the much larger Orion Molecular Cloud Complex.

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# M44 Beehive Cluster

## (Praesepe)

Object Type: Open Cluster  
Distance: 560 LY  
Image : 42 minutes exp.  
Scope: 80mm APO

### Information

The Beehive Cluster, M44, is an open cluster in the constellation Cancer. It is one of the nearest open clusters to the Solar System, and it 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. The classical astronomer Ptolemy called it "the nebulous mass in the breast of Cancer," and it was among the first objects that Galileo studied with his telescope. Currently there is no consensus on the cluster's distance, with recent sources suggesting 160 to 187 parsecs (520-610 light years). There is better agreement on its age, at about 600 million years.

Galileo was the first to observe the Beehive in a telescope, in 1609, and was able to resolve it into 40 stars. Charles Messier added it to his famous catalog in 1769 after precisely measuring its position in the sky. Along with the Orion Nebula and the Pleiades cluster, Messier's inclusion of the Beehive has been noted as curious, as most of Messier's objects were much fainter and more easily confused with comets. One possibility is that Messier simply wanted to have a larger catalog than his scientific rival Lacaille, whose 1755 catalog contained 42 objects, and so he added some bright, well-known objects to boost his list.

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# M45 Pleiades (Seven Sisters)

Object Type: Open Cluster  
Distance: 440 LY  
Image : 100 minutes exp.  
Scope: 80mm APO

## Information

The Pleiades, or Seven Sisters (Messier object 45), is an open star cluster containing middle-aged hot B-type stars located in the constellation of Taurus. It is among the nearest star clusters to Earth and is the cluster most obvious to the naked eye in the night sky. Pleiades has several meanings in different cultures and traditions.

The cluster is dominated by hot blue and extremely luminous stars that have formed within the last 100 million years. Dust that forms a faint reflection nebulosity around the brightest stars was thought at first to be left over from the formation of the cluster (hence the alternate name Maia Nebula after the star Maia), but is now known to be an unrelated dust cloud in the interstellar medium that the stars are currently passing through. Astronomers estimate that the cluster will survive for about another 250 million years, after which it will disperse due to gravitational interactions with its galactic neighborhood.

The long-standing disagreement over the cluster's distance has been settled. Very long baseline radio interferometry published in 2014 gave 136.2 parsecs, and Gaia parallaxes have since agreed, placing M45 at about 136 parsecs, or roughly 440 light-years. The shorter figure of about 120 parsecs derived from Hipparcos is no longer accepted.



# M46

Object Type: Open Cluster  
Distance: 5,500 LY  
Image : 50 minutes exp.  
Scope: 80mm APO

## Information

Messier 46 (also known as M 46 or NGC 2437) is an open cluster in the constellation of Puppis. It was discovered by Charles Messier in 1771. Dreyer described it as "very bright, very rich, very large." M46 is about 5,500 light-years away with an estimated age on the order of several 100 million years.

The planetary nebula NGC 2438 appears to lie within the cluster near its northern edge, but it is most likely unrelated since it does not share the cluster's radial velocity. The case is yet another example of a superposed pair, joining the famed case of NGC 2818.

M46 is about a degree east of M47 in the sky, so the two fit well in a binocular or wide-angle telescope field.



# M47

Object Type: Open Cluster  
Distance: 1,600 LY  
Image : 50 minutes exp.  
Scope: 80mm APO

## Information

Open Cluster M47 (also known as Messier Object 47 or NGC 2422) is an open cluster in the constellation Puppis. It was discovered by Giovanni Batista Hodierna before 1654 and independently discovered by Charles Messier on February 19, 1771.

There is actually no cluster in the position indicated by Messier, which he expressed in terms of its right ascension and declination with respect to the star 2 Puppis. However, if the signs of Messier's coordinate differences are changed, the position matches that of NGC 2422.

M47 is at a distance of about 1,600 light-years from Earth with an estimated age of about 78 million years. There are about 50 stars in this cluster, the brightest one being of magnitude +5.7.



# M48

Object Type: Open Cluster  
Distance: 2,500 LY  
Image : 50 minutes exp.  
Scope: 80mm APO

## Information

Messier 48 (also known as M 48 or NGC 2548) is an open cluster in the Hydra constellation. It was discovered by Charles Messier in 1771.

There is actually no cluster in the position indicated by Messier. The value that he gave for the right ascension matches that of NGC 2548, however, his declination is off by five degrees. Credit for discovery is sometimes given instead to Caroline Herschel in 1783.

M48 is visible to the naked eye under good atmospheric conditions. Its age is estimated to amount 300 million years.

# M49

Object Type: Galaxy  
Distance: 60 MLY  
Image : 50 minutes exp.  
Scope: C-9.25"

## Information

Elliptical galaxy Messier 49 is one of the brightest member galaxies of the Virgo cluster. M49 was the first member of the Virgo cluster of galaxies to be discovered, by Charles Messier, who cataloged it on February 19, 1771. Eight years later, on April 22, 1779, on the occasion of following the comet of that year, and on the hunt for finding more nebulous objects in competition to other observers, Barnabas Oriani independently rediscovered this "nebula." In his Bedford Catalogue of 1844, Admiral William H. Smyth confused this finding with Messier's discovery and erroneously stated, "This object was discovered by Oriani in 1771." This error was repeated by John Herschel in his General Catalogue of 1864 (GC), who also erroneously assigned this object to "1771 Oriani," and also found its way into J.L.E. Dreyer's NGC. M49 is one of the brightest Virgo Cluster member galaxies with its mag 8.5, which corresponds to an absolute magnitude of approximately -22.8, regarding its distance of about 60 million light years. It is one of the giant elliptical galaxies in this great cluster. It is yellower than most galaxies in the Virgo cluster. Longer exposures show a system of globular cluster. According to W.E. Harris' list, this galaxy has a system of 6300 +/- 1900 globulars. The fuzzy nebulosity near the brighter star in the upper right is probably a faint, small companion. In that image, many more faint companions can be seen, among them the relatively bright peculiar galaxy NGC 4470 (photographic mag 13.0).



# M50

Object Type: Open Cluster  
Distance: 3,200 LY  
Image : 50 minutes exp.  
Scope: 80mm APO

## Information

Messier 50 (also known as M 50 or NGC 2323) is an open cluster in the constellation Monoceros. It was perhaps discovered by G. D. Cassini before 1711 and independently discovered by Charles Messier in 1772. M50 is at a distance of about 3,000 light-years away from Earth. It is described as a 'heart-shaped' figure.

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# M51 Whirlpool Galaxy

Object Type: Galaxy  
Distance: 31 MLY  
Image : 60 minutes exp.  
Scope: 10" Newtonian

## Information

The Whirlpool Galaxy is an interacting grand-design spiral galaxy located at a distance of approximately 31 million light-years in the constellation Canes Venatici. It is one of the most famous galaxies in the sky. The galaxy and its companion (NGC 5195) are easily observed by amateur astronomers, and the two galaxies may even be seen with binoculars. The Whirlpool Galaxy is also a popular target for professional astronomers, who study it to further understanding of galaxy structure (particularly structure associated with the spiral arms) and galaxy interactions.

It discovered in 1774 by Charles Messier, and is designated as M51. Its companion galaxy, NGC 5195, was discovered in 1781 by Pierre Méchain. It was however not until 1845 that the Whirlpool became the first to be recognized as a spiral. This was achieved by Lord Rosse employing a 72-inch (~1.83 m) reflecting telescope which he constructed at Birr Castle, Ireland.

In 2005 a supernova (SN 2005cs) was observed in the Whirlpool Galaxy, peaking at apparent magnitude 14. With the recent SN 2005cs derived estimate of 23 Mly distance, and an angular diameter of roughly 11.2', it can be inferred that M51's bright circular disk has a radius of about ~38,000 light-years. Its mass is estimated to be 160 billion solar masses.

Recent simulations bear out that M51's spiral structure was caused by NGC 5195 passing through the main disk of M51 about 500 to 600 million years ago. In this model, NGC 5195 came from behind M51 through the disk towards the observer and made another disk crossing as recently as 50 to 100 Myrs ago until it is where we observe it to be now, slightly behind M51.

Astronomers using the Chandra X-ray Observatory reported a brief dimming of the bright X-ray binary M51-ULS-1 that is consistent with a transiting object slightly smaller than Saturn, designated M51-ULS-1b. If confirmed it would be the first planet identified outside the Milky Way, although the next predicted transit is roughly 70 years away, so confirmation will be slow.

In August 2023 the James Webb Space Telescope released combined NIRCам and MIRI images of M51, taken as part of the FEAST program on star cluster formation. They trace warm dust and ionized gas along the spiral arms in far greater detail than earlier infrared surveys.



# M52

Object Type: Open Cluster  
Distance: 5,000 LY  
Image : 140 minutes exp.  
Scope: 10" Newtonian

## Information

Messier 52 (also known as M 52 or NGC 7654) is an open cluster in the Cassiopeia constellation. It was discovered by Charles Messier in 1774. M52 can be seen from Earth with binoculars.

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# M53

Object Type: Globular Cluster  
Distance: 60,000 LY  
Image : 100 minutes exp.  
Scope: C-9.25" SCT

## Information

Messier 53 is one of the more outlying globulars, being about 60,000 light years away from the Galactic center, and almost the same distance (about 58,000 light years) from our Solar system. It has a diameter of roughly 220 light years. It is rapidly approaching us at a velocity 112 km/s. M53 has a bright compact central nucleus, although its stars are not very concentrated toward the center when compared to other globulars. Its discoverer Johann Elert Bode, who found it on February 3, 1775, described it as a "rather vivid and round" nebula. Charles Messier, who independently rediscovered and cataloged it two years later, on February 26, 1777, found it "round and conspicuous" and that it resembles M79. William Herschel was the first to resolve it into stars, and found it similar to M10. As in all globular clusters, the stars of M53 are apparently "metal-poor", which means that they contain only little quantities of elements heavier than helium (actually mainly elements like carbon and oxygen); those of M53 are even below the average globular cluster members in "metallicity".



# M54

Object Type: Globular Cluster  
Distance: 87,000 LY  
Image : 20 minutes exp.  
Scope: C-9.25"

## Information

Messier 54 (also known as M54 or NGC 6715) is a globular cluster in the constellation Sagittarius. It was discovered by Charles Messier in 1778 and subsequently included in his catalog of comet-like objects.

Previously thought to belong to our Galaxy at a distance from Earth of about 50,000 light-years, it was discovered in 1994 that M54 most likely belongs to the Sagittarius Dwarf Elliptical Galaxy, (SagDEG), making it the first globular cluster formally thought to be part of our galaxy reassigned to extragalactic status, even if not recognized as such for nearly two and a quarter centuries.

Modern estimates now place M54 at a distance of some 87,000 light-years, translating into a true radius of 150 light-years across. It is one of the denser of the globulars, being of class III (I being densest and XII being the least dense). It shines with the luminosity of roughly 850,000 times that of the Sun and has an absolute magnitude of -10.0.

M54 is easily found on the sky, being close to the star  $\zeta$  Sagittarii. It is however, not resolvable into individual stars even with larger amateur telescopes.

In July 2009, a team of astronomers reported that they had found evidence of an intermediate-mass black hole in the core of M54.



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# M55

Object Type: Globular Cluster  
Distance: 20,000 LY  
Image : 30 minutes exp.  
Scope: APO-80mm

## Information

Messier 55 (also known as M55 or NGC 6809) is a globular cluster in the constellation Sagittarius. It was discovered by Nicolas Louis de Lacaille in June 16, 1752 while observing from South Africa. Starting in 1754, Charles Messier made several attempts to find this object from Paris, France, but the low declination meant it never rose sufficiently far above the horizon to allow for easy observation. He finally observed and cataloged it in 1778. The cluster can be seen with a pair of 50 mm binoculars, although resolving the individual stars requires a medium-sized telescope.

M55 is at a distance of about 20,000 light-years away from Earth. It has a mass of about 269,000 times that of the Sun. As with other Milky Way globular clusters, it has a low abundance of elements other than hydrogen and helium compared to the Sun—what astronomers term the metallicity of the cluster. This quantity is normally listed as the base-10 logarithm of the proportion relative to the Sun; for NGC 6809 the metallicity is given by:  $[\text{Fe}/\text{H}] = -1.94$  dex. Taking this exponent to the power of ten yields an abundance equal to 1.1% of the proportion of such elements in the Sun.

Only about 55 variable stars have been discovered in the central part of M55.



# M56

Object Type: Globular Cluster  
Distance: 32,900 LY  
Image : 56 minutes exp.  
Scope: C-9.25" SCT

## Information

Messier 56 (also known as M56 or NGC 6779) is a globular cluster in the constellation Lyra. It was discovered by Charles Messier in 1779. M56 is at a distance of about 32,900 light-years from Earth and measures roughly 84 light-years across.

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# M57 Ring Nebula

Object Type: Planetary Nebula

Distance: 2,000 LY

Image : 24 minutes exp.

Scope: 8 Inch Newtonian

## Information

The "Ring Nebula" is located in the constellation of Lyra. It is one of the most prominent examples of the deep-sky objects called planetary nebulae, often abbreviated by astronomers as simply planetaries or PN. M57 is located in Lyra, south of its brightest star Vega. This nebula was discovered by Antoine Darquier de Pellepoix in January, 1779, who reported that it was "...as large as Jupiter and resembles a planet which is fading." Later the same month, Charles Messier independently found the same nebula while searching for comets. It was then entered into his catalog as the 57th object. Messier and William Herschel also speculated that the nebula was formed by multiple faint stars that were unable to resolve with his telescope. In 1800, Count Friedrich von Hahn discovered the faint central star in the heart of the nebula. In 1864, William Huggins examined the spectra of multiple nebulae, discovering that some of these objects, including M57, displayed the spectra of bright emission lines characteristic of fluorescing glowing gases. Huggins concluded that most planetary nebulae were not composed of unresolved stars, as had been previously suspected, but were nebulosities. Planetary nebulae are formed after medium or low mass stars, such as the Sun, exhaust their hydrogen fuel in the stellar core. At this point the structure of the star changes so it can achieve a new equilibrium condition in which it can continue to burn; the outer layers of the star expand and it becomes a red giant. Further internal temperature instabilities develop from the fusion reactions, causing the outer atmosphere to be expelled by hot superwinds either continuously or in several energetic pulses. This expanding gaseous shell forms the spherical nebula, brightly illuminated by ultraviolet energy from the central star. The nebula is 2,000 light-years from Earth. It has a visual magnitude of 8.8v and photographic magnitude of 9.7p. M57 is illuminated by a central white dwarf or planetary nebula nucleus (PNN) of 15.75v visual magnitude, whose mass is approximately 1.2 solar masses. All the interior parts of this nebula have a blue-green tinge that is caused by the doubly-ionized oxygen emission lines. These observed so-called "forbidden lines" occur only in conditions of very low density containing a few atoms per cubic centimeter. In the outer region of the ring, part of the reddish hue is caused by hydrogen emission. Currently it is 200 times more luminous than the Sun, but its apparent magnitude is only +15.75.

The James Webb Space Telescope imaged the Ring Nebula in 2023, with results released in August of that year. The images resolve the intricate structure of the expanding shell and the region immediately around the central white dwarf.

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# M58

Object Type: Galaxy  
Distance: 68 MLY  
Image : 80 minutes exp.  
Scope: C-9.25" SCT

## Information

Messier 58 is a barred spiral galaxy located within the constellation Virgo, approximately 68 million light-years away from Earth. It was discovered by Charles Messier on April 15, 1779 and is one of four barred spiral galaxies that appear in Messier's catalog. Charles Messier discovered Messier 58, along with the elliptical galaxies Messier 59 and Messier 60, on April 15, 1779. M58 was reported on the chart of the Comet of 1779 as it was almost on the same parallel as the star Epsilon Virginis. Messier described M58 as a very faint nebula in Virgo which would disappear in the slightest amount of light he used to illuminate the micrometer wires.

# M59

Object Type: Galaxy  
Distance: 60 MLY  
Image : 35 minutes exp.  
Scope: C-14" SCT

## Information

Messier 59 and the nearby elliptical galaxy Messier 60 were both discovered by Johann Gottfried Koehler in April 1779 during observations of a comet in the same part of the sky. Charles Messier listed both in the Messier Catalog about three days after Koehler's discovery.

# M60

Object Type: Galaxy  
Distance: 55 MLY  
Image : 80 minutes exp.  
Scope: C-9.25"

## Information

Messier 60 (also known as NGC 4649) is an elliptical galaxy approximately 55 million light-years away in the constellation Virgo. Messier 60 and the nearby galaxy Messier 59 were both discovered by Johann Gottfried Koehler in April 1779 during observations of a comet in the same part of the sky. Charles Messier listed both in the Messier Catalog about three days after Koehler's discovery. NGC 4647 appears approximately 2'.5 away from Messier 60; the optical disks of the two galaxies overlap. Although this overlap suggests that the galaxies are interacting, photographic images of the two galaxies do not reveal any evidence for gravitational interactions between the two galaxies as would be suggested if the two galaxies were physically close to each other. This suggests that the galaxies are at different distances and are only weakly interacting if at all.

M60 is the third-brightest giant elliptical galaxy of the Virgo cluster of galaxies, and is the dominant member of a subcluster of four galaxies, which is the closest-known isolated compact group of galaxies.

# M61

Object Type: Galaxy  
Distance: 60 MLY  
Image : 20 minutes exp.  
Scope: 10" Newtonian

## Information

Messier 61 (M61, NGC 4303) is a spiral galaxy in the southernmost part of the Virgo Cluster of Galaxies.

M61 was discovered by Barnabus Oriani on May 5, 1779 when following the comet of that year, 6 days before Charles Messier's discovery, who had seen it on the same day as Oriani but mistaken it for the comet. Messier mistook it for two nights more, until he realized that it did not move. As for a small number of others, this object was assigned an own number, H I.139, by William Herschel, who normally avoided to give own numbers to Messier's objects, when he observed and cataloged it on April 17, 1786.

M61 is one of the larger galaxies in the Virgo cluster; its 6 arc minutes of diameter correspond to about 100,000 light years, similar to the diameter of the Milky Way galaxy. Its 10th magnitude corresponds to an absolute magnitude of -21.2.



# M62

Object Type: Globular Cluster  
Distance: 22,500 LY  
Image : 18 minutes exp.  
Scope: 10 Inch Newtonian

## Information

Messier 62 (also known as M62 or NGC 6266) is a globular cluster in the constellation Ophiuchus. It was discovered in 1771 by Charles Messier.

M62 is at a distance of about 22,500 light-years from Earth and measures some 100 light-years across. From studies conducted in the 1970s it is known that M62 contains the high number of 89 variable stars, many of them of the RR Lyrae type. It also contains several X-ray sources, thought to be close binary star systems, as well as millisecond pulsars in binary systems.

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# M63 Sunflower Galaxy

Object Type: Galaxy  
Distance: 27 MLY  
Image : 115 minutes exp.  
Scope: 10 Inch Newtonian

## Information

The Sunflower Galaxy (also known as Messier 63, M63, or NGC 5055) is an Spiral galaxy in the Canes Venatici constellation. It is a Spiral galaxy, consisting of a central disc surrounded by many short spiral arm segments. The Sunflower Galaxy is part of the M51 Group, a group of galaxies that also includes the Whirlpool Galaxy (M51).

The Sunflower Galaxy was discovered by Pierre Méchain on June 14, 1779. The galaxy was then listed by Charles Messier as object 63 in the Messier Catalog. In the mid-1800s, Lord Rosse identified spiral structure within the galaxy, making this one of the first galaxies in which such structure was identified.

# M64 Black Eye Galaxy

Object Type: Galaxy  
Distance: 17 MLY  
Image : 80 minutes exp.  
Scope: C-9.25"

## Information

The Black Eye Galaxy (also called Sleeping Beauty Galaxy) was discovered by Edward Pigott in March 1779, and independently by Johann Elert Bode in April of the same year, as well as by Charles Messier in 1780. It has a spectacular dark band of absorbing dust in front of the galaxy's bright nucleus, giving rise to its nicknames of the "Black Eye" or "Evil Eye" galaxy. M64 is well known among amateur astronomers because of its appearance in small telescopes. It is a spiral galaxy in the Coma Berenices constellation.

At first glance, M64 seems to be a fairly normal spiral galaxy. However, recent detailed studies have led to the remarkable discovery that the interstellar gas in the outer regions of M64 rotates in the opposite direction from the gas and stars in the inner regions. A collision of two galaxies has left a merged star system with an unusual appearance as well as bizarre internal motions. Astronomers believe that the oppositely rotating gas arose when M64 absorbed a satellite galaxy that collided with it, perhaps more than one billion years ago.

# M65

Object Type: Galaxy  
Distance: 35 MLY  
Image : 180 minutes exp.  
Scope: C-9.25"

## Information

Messier 65 (also known as NGC 3623) at the top of my image is an intermediate spiral galaxy about 35 million light-years away in the constellation Leo. It was discovered by Charles Messier in 1780.

M65 was discovered by Charles Messier and included in his Messier Objects list. However, William Henry Smyth accidentally attributed the discovery to Pierre Méchain in his popular 19th century astronomical work *A Cycle of Celestial Objects* (stating "They [M65 and M66] were pointed out by Méchain to Messier in 1780"). This error was in turn picked up by Kenneth Glyn Jones in *Messier's Nebulae and Star Clusters*.

# M66

Object Type: Galaxy  
Distance: 36 MLY  
Image : 180 minutes exp.  
Scope: C-9.25"

## Information

Messier 66 (also known as NGC 3627) at the bottom of my image is an intermediate spiral galaxy about 36 million light-years away in the constellation Leo. It was discovered by Charles Messier in 1780. M66 is about 95 thousand light-years across with striking dust lanes and bright star clusters along sweeping spiral arms. M66 is part of the famous Leo Triplet, a small group of galaxies that also includes M65 and NGC 3628.

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# M67

Object Type: Open Cluster  
Distance: 2,700 LY  
Image : 27 minutes exp.  
Scope: APO-80mm

## Information

M67 has been discovered by Johann Gottfried Koehler (1745-1801) somewhere before 1779; it seems, however, that Koehler's instruments were so inferior that he couldn't resolve this cluster. Charles Messier independently rediscovered M67, resolved it into stars, and cataloged it on April 6, 1780.

Messier 67 is an open cluster, or galactic cluster, in the constellation Cancer. Its age is estimated at between 3.2 and 5 billion years. The most recently estimated age of four billion years appears to be the most reliable; thus the stars of M67 are most likely slightly younger than the Sun. M67 is not the oldest known open cluster, but there are very few in the galaxy known to be older. M67 is the nearest old open cluster, and thus has become a standard example for studying stellar evolution.

M67 has more than 100 stars similar to the Sun, and many red giants. The total star count has been estimated at over 500. M67 contains nearly 200 white dwarfs. The cluster contains no main sequence stars bluer than spectral type F, other than perhaps some of the blue stragglers, since the brighter stars of that age have already left the main sequence. In fact, when the stars of the cluster are plotted on the Hertzsprung-Russell diagram, there is a distinct "turn-off" representing the stars which are just about to leave the main sequence and become red giants.

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# M68

Object Type: Globular Cluster

Distance: 33,000 LY

Image : 45 minute exp.

Scope: 10" Newtonian

## Information

Messier 68 (also known as M68 or NGC 4590) is a globular cluster in the Hydra constellation. It was discovered by Charles Messier in 1780. M68 is at a distance of about 33,000 light-years away from Earth.

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# M69

Object Type: Globular Cluster  
Distance: 29,700 LY  
Image : 30 minutes exp.  
Scope: APO-80mm

## Information

Messier 69 (also known as M69 or NGC 6637) is a globular cluster in the constellation Sagittarius. It was discovered by Charles Messier on August 31, 1780, the same night he discovered M70. At the time, he was searching for an object described by LaCaille in 1751-2 and thought he had rediscovered it, but it is unclear if LaCaille actually described M69.

M69 is at a distance of about 29,700 light-years away from Earth and has a spatial radius of 42 light-years. It is a close neighbor of globular cluster M70, with 1,800 light-years separating the two objects; both of these clusters lie close to the galactic center. It is one of the most metal-rich globular clusters known.



# M70

Object Type: Globular Cluster  
Distance: 29,700 LY  
Image : 30 minutes exp.  
Scope: C-14 SCT

## Information

Messier 70 (also known as M70 or NGC 6681) is a globular cluster in the constellation Sagittarius. It was discovered by Charles Messier in 1780.

M70 is at a distance of about 29,300 light years away from Earth and close to the Galactic Center. It is roughly the same size and luminosity as its neighbor in space, M69. Only two variable stars are known within this cluster.

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# M71

Object Type: Globular Cluster  
Distance: 12,000 LY  
Image : 35 minutes exp.  
Scope: 14" SCT

## Information

Messier 71 (also known as M71 or NGC 6838) is a globular cluster in the constellation Sagitta. It was discovered by Philippe Loys de Chéseaux in 1746 and included by Charles Messier in his catalog of comet-like objects in 1780. It was also noted by Koehler at Dresden around 1775.

M71 is at a distance of about 12,000 light years away from Earth and spans some 27 light years across.

M71 was long thought (until the 1970s) to be a densely packed open cluster and was classified as such by leading astronomers in the field of star cluster research due to its lacking a dense central compression, and its stars having more "metals" than is usual for an ancient globular cluster; furthermore, it's lacking the RR Lyrae "cluster" variable stars that are common in most globulars. However, modern photometric photometry has detected a short "horizontal branch" in the H-R diagram of M71, which is characteristic of a globular cluster. The shortness of the branch explains the lacking of the RR Lyrae variables and is due to the globular's relatively young age of 9-10 billion years. The relative youth of this globular also explains the abundance of "metals" in its stars. Hence today, M71 is designated as a very loosely concentrated globular cluster, much like M68 in Hydra. M71 has a luminosity of around 13,200 suns.

# M72

Object Type: Globular Cluster  
Distance: 54,570 LY  
Image : 20 minutes exp.  
Scope: 8" Newtonian

## Information

Messier 72 (also known as M72 or NGC 6981) is a globular cluster in the Aquarius constellation discovered by French astronomer Pierre Méchain on August 29, 1780. French astronomer Charles Messier looked for it on the following October 4, and included it in his catalog. Both decided that it was a faint nebula rather than a cluster. With a larger instrument, British astronomer John Herschel called it a bright "cluster of stars of a round figure". American astronomer Harlow Shapley noted a similarity to Messier 4 and Messier 12.

Based upon a 2011 census of variable stars, Messier 72 is located at a distance of  $54.57 \pm 1.17$  kly ( $16.73 \pm 0.36$  kpc) from the Sun. It has an estimated combined mass equal to 168,000 times the mass of the Sun and is around 9.5 billion years old. The core region has a density of stars that is radiating 2.26 times the luminosity of the Sun per cubic parsec. There are 43 identified variable stars in the cluster.

# M73

Object Type: Asterism  
Distance: 2,500 LY  
Image : 20 minutes exp.  
Scope: 8" Newtonian

## Information

Messier 73 (M73, also known as NGC 6994) is an asterism of four stars in the constellation of Aquarius. An asterism is composed of physically unconnected stars that appear close to each other in the sky as seen from Earth.

M73 was once treated as a potential sparsely populated open cluster, which consists of stars that are physically associated in space as well as on the sky. The question of whether the stars were an asterism or an open cluster generated a small, interesting debate.

In 2000, L. P. Bassino, S. Waldhausen, and R. E. Martinez published an analysis of the colors and luminosities of the stars in and around M73. They concluded that the four bright central stars and some other nearby stars followed the color-luminosity relation that is also followed by stars in open clusters (as seen in a Hertzsprung-Russell diagram). Their conclusion was that M73 was an old open cluster that was 9 arcmin wide. G. Carraro, however, published results in 2000 based on a similar analysis and concluded that the stars did not follow any color-luminosity relation. Carraro's conclusion was that M73 was an asterism. Adding to the controversy, E. Bica and collaborators concluded that the chance alignment of the four bright stars seen in the center of M73 as well as one other nearby star was highly unlikely, so M73 was probably a sparse open cluster. The controversy was solved in 2002, when M. Odenkirchen and C. Soubiran published an analysis of the high resolution spectra of the six brightest stars within 6 arcmin of the central position of M73. Odenkirchen and Soubiran demonstrated that the distances from the Earth to the six stars were very different from each other, and the stars were moving in different directions. Therefore, they concluded that the stars were only an asterism.

Although M73 was determined to be only a chance alignment of stars, further analysis of asterisms is still important for the identification of sparsely populated open clusters. Such clusters can be important for demonstrating how open clusters are ripped apart by the gravitational forces in the Milky Way..

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# M74 Phantom Galaxy

Object Type: Galaxy  
Distance: 32 MLY  
Image : 70 minutes exp.  
Scope: 80mm APO

## Information

Messier 74 (also known as NGC 628) is a face-on spiral galaxy in the constellation Pisces. It is at a distance of about 32 million light-years away from Earth. The galaxy's low surface brightness makes it the most difficult Messier object for amateur astronomers to observe. However, the relatively large angular size of the galaxy and the galaxy's face-on orientation make it an ideal object for professional astronomers who want to study spiral arm structure and spiral density waves. It is estimated that M74 is home to about 100 billion stars.

M74 was discovered by Pierre Méchain in 1780. Méchain then communicated his discovery to Charles Messier, who listed the galaxy in his catalog.

In August 2022 the James Webb Space Telescope's Mid-Infrared Instrument imaged the center of M74, tracing filaments of gas and dust winding inward to the nucleus. The image was among the observatory's most widely reproduced early results.

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# M75

Object Type: Globular Cluster  
Distance: 67,500 LY  
Image : 20 minutes exp.  
Scope: 8" Newtonian

## Information

Messier 75 (also known as M75 or NGC 6864) is a globular cluster in the constellation Sagittarius. It was discovered by Pierre Méchain in 1780 and included in Charles Messier's catalog of comet-like objects that same year.

M75 is at a distance of about 67,500 light years away from Earth and its apparent size on the sky translates to a true radius of some 67 light years. It is classified as class I, meaning it is one of the more densely concentrated globular clusters known. The absolute magnitude of M75 is about  $-8.5$  or some 180,000 more luminous than the Sun.

# M76 Little Dumbbell Nebula

Object Type: Planetary Nebula  
Distance: 3,400 LY  
Image : 35 minutes exp.  
Scope: 9.25" SCT

## Information

The Little Dumbbell Nebula, also known as Messier 76, NGC 650/651, the Barbell Nebula, or the Cork Nebula, is a planetary nebula in the constellation Perseus. Some consider this object the faintest and hardest to see objects in Messier's list.

It was discovered by Pierre Méchain in 1780 and included in Charles Messier's catalog of comet-like objects as number 76. It was first recognised as a planetary nebula in 1918 by the astronomer Heber Doust Curtis. However, there is some contention to this claim, as Isaac Roberts in 1891 did suggest that M76 might be similar to the Ring Nebula (M57), being instead as seen from the side view. The structure is now classed as a bipolar planetary nebula (BPNe).

Distance to M76 is currently estimated as about 1,040 parsecs or 3,400 light years, making the average dimensions about 0.378 pc. (1.23 ly.) across.

The Little Dumbbell Nebula derives its common name from its resemblance to the Dumbbell Nebula (M27) in Vulpecula. It was originally thought to consist of two separate emission nebulae and was thus given two catalog numbers in the NGC 650 and 651.

M76 was chosen as the subject of the Hubble Space Telescope's 34th anniversary image, released in April 2024. The image shows the nebula's pinched two-lobed shell and the outflow driven by its central white dwarf, one of the hottest stellar remnants known.

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# M77 Cetus A

Object Type: Galaxy  
Distance: 47 MLY  
Image : 85 minutes exp.  
Scope: 10" Newtonian

## Information

Messier 77 (also known as NGC 1068) is a barred spiral galaxy about 47 million light-years away in the constellation Cetus. Messier 77 is an active galaxy with an Active Galactic Nucleus (AGN), which is obscured from view by astronomical dust at visible wavelengths. The diameter of the molecular disk and hot plasma associated with the obscuring material was first measured at radio wavelengths by the VLBA and VLA. It is the brightest Seyfert galaxy and is of type 2.

Messier 77's diameter is 170,000 light-years.

Messier 77 was discovered by Pierre Méchain in 1780, who originally described it as a nebula. Méchain then communicated his discovery to Charles Messier, who subsequently listed the object in his catalog. Both Messier and William Herschel described this galaxy as a star cluster. Today, however, the object is known to be a galaxy.

In 2022 the IceCube Neutrino Observatory reported evidence that M77 emits high-energy neutrinos, based on an excess of roughly 80 events recorded between 2011 and 2020 at a statistical significance of 4.2 sigma. The galaxy is one of the first individual sources of astrophysical neutrinos to be identified, and the neutrinos appear to come from a region deep inside the dust-obscured active nucleus.

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# M78

Object Type: Reflection Nebula  
Distance: 1,600 LY  
Image : 4 hours and 48 minutes exp.  
Scope: Takahashi Sky 90

## Information

The nebula Messier 78 (also known as M 78 or NGC 2068) is a reflection nebula in the constellation Orion. It was discovered by Pierre Méchain in 1780 and included by Charles Messier in his catalog of comet-like objects that same year.

M78 is the brightest diffuse reflection nebula of a group of nebulae that include NGC 2064, NGC 2067 and NGC 2071. This group belongs to the Orion Molecular Cloud Complex and is about 1,600 light years distant from Earth. M78 is easily found in small telescopes as a hazy patch and involves two stars of 10th magnitude. These two stars, HD 38563A and HD 38563B, are responsible for making the cloud of dust in M78 visible by reflecting their light.

About 45 variable stars of the T Tauri type, young stars still in the process of formation as well as some 17 Herbig-Haro objects are known in M78.

The European Space Agency's Euclid telescope imaged M78 in 2024, producing the first wide and deep view of the region at infrared wavelengths. The observation revealed more than 300,000 previously uncataloged objects in the field, including candidate free-floating objects a few times the mass of Jupiter.



# M79

Object Type: Globular Cluster  
Distance: 41,000 LY  
Image : 60 minutes exp.  
Scope: 80mm APO

## Information

Messier 79 (also known as M79 or NGC 1904) is a globular cluster in the Lepus constellation. It was discovered by Pierre Méchain in 1780. M79 is at a distance of about 41,000 light years away from Earth and 60,000 light years away from the Galactic Center.

Like Messier 54 (the other extragalactic globular on Messier's list), it is thought that M79 is not native to the Milky Way galaxy at all, but instead to the Canis Major Dwarf Galaxy which is currently experiencing a very close encounter with the Milky Way—one it is unlikely to survive intact. This is, however, a contentious subject as astronomers are still debating the nature of the Canis Major dwarf galaxy itself.



# M80

Object Type: Globular Cluster  
Distance: 28,000 LY  
Image : 60 minutes exp.  
Scope: 9.25" SCT

## Information

Messier 80 is a globular cluster in the constellation Scorpius. It was discovered by Charles Messier in 1781. M80 is located midway between  $\alpha$  Scorpii (Antares) and  $\beta$  Scorpii in a field in the Milky Way that is rich in nebulae. It can be viewed with modest amateur telescopes as a mottled ball of light. M80 is at an estimated distance of 28,000 light-years, M80's spatial diameter is about 95 light-years. It contains several hundred thousand stars, and is among the more densely populated globular clusters in the Milky Way Galaxy. M80 contains a relatively large number of blue stragglers, stars that appear to be much younger than the cluster itself. It is thought these stars have lost part of their outer layers due to close encounters with other cluster members or perhaps the result of collisions between stars in the dense cluster. Images from the Hubble Space Telescope have shown districts of very high blue straggler densities, suggesting that the center of the cluster is likely to have a very high capture and collision rate. On May 21, 1860, a nova was discovered in M80 that attained a magnitude of +7.0. The nova, variable star designation T Scorpii, reached an absolute magnitude of -8.5, briefly outshining the entire cluster.

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# M81 Bode's Galaxy

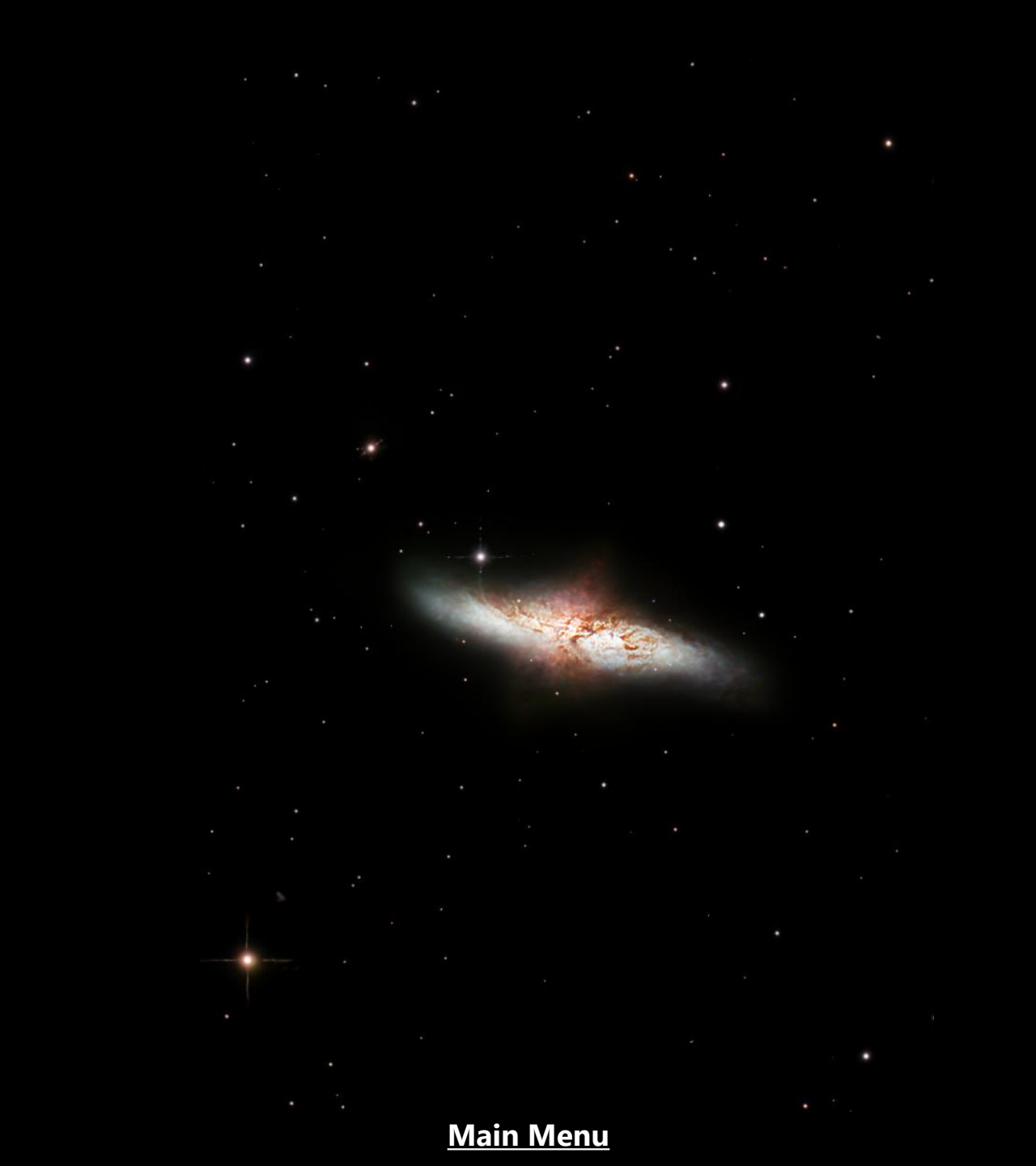
Object Type: Galaxy  
Distance: 12 MLY  
Image : 120 minutes exp.  
Scope: Takahashi 90mm

## Information

Messier 81 is a spiral galaxy about 12 million light-years away in the constellation Ursa Major. M81 is one of the most striking examples of a grand design spiral galaxy, with near perfect arms spiraling into the very center. Because of its proximity to Earth, its large size, and its active galactic nucleus (which harbors a 70 million solar mass supermassive black hole) Messier 81 is a popular galaxy to study in professional astronomy research. The galaxy's large size and relatively low apparent magnitude also make it a popular target for amateur astronomy observations.

Messier 81 was first discovered by Johann Elert Bode in 1774. Consequently, the galaxy is sometimes referred to as "Bode's Galaxy". In 1779, Pierre Méchain and Charles Messier reidentified Bode's object, which was subsequently listed in the Messier Catalog.

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# M82 Cigar Galaxy

Object Type: Galaxy  
Distance: 12 MLY  
Image : 130 minutes exp.  
Scope: 10" Newtonian

## Information

Messier 82 is a starburst galaxy about 12 million light-years away in the constellation Ursa Major. The starburst galaxy is five times as bright as the whole Milky Way and one hundred times as bright as our galaxy's center.

Throughout the galaxy's center, young stars are being born 10 times faster than they are inside our entire Milky Way Galaxy.

Forming a striking pair in small telescopes with nearby spiral M81, M82 is being physically affected by its larger neighbor. Tidal forces caused by gravity have deformed this galaxy, a process that started about 100 million years ago. This interaction has caused star formation to increase 10 fold compared to "normal" galaxies. Ignoring any difference in their respective distances from us, the centers of M81 and M82 are visually separated by about 130,000 light-years.

SN 2014J, a type Ia supernova, was discovered in M82 on January 21, 2014, by a group of students and staff at the University of London Observatory. It brightened to roughly tenth magnitude and was the closest type Ia supernova observed in more than 40 years.

The James Webb Space Telescope observed the core of M82 with its Near-Infrared Camera in 2024 and with its Mid-Infrared Instrument in 2025. The data resolve millions of individual stars in the starburst region and trace the structure of the galactic wind being driven out of it.

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# M83 Southern Pinwheel Galaxy

Object Type: Galaxy  
Distance: 15 MLY  
Image : 40 minutes exp.  
Scope: 10" Newtonian

## Information

Messier 83 (also known as the Southern Pinwheel Galaxy, is an intermediate spiral galaxy approximately 15 million light-years away in the constellation Hydra. It is one of the closest and brightest barred spiral galaxies in the sky.

Pierre Mechain discovered M83 in 1752 at the Cape of Good Hope. Charles Messier added it to his catalog of nebulous objects (now known as the Messier Catalog) in March 1781.

On 16 June 2008 NASA's Galaxy Evolution Explorer project reported finding large numbers of new stars in the outer reaches of the galaxy. It had hitherto been thought that these areas lacked the materials necessary for star formation.

In 2025 astronomers reported that Webb's Mid-Infrared Instrument had detected highly ionized neon emission near the center of M83. The finding is evidence for an active galactic nucleus, and therefore a supermassive black hole, that had been sought for decades but remained hidden behind dust.

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# M84

Object Type: Galaxy  
Distance: 60 MLY  
Image : 115 Minutes  
Scope: 9.25" SCT

## Information

Messier 84 is a lenticular galaxy in the constellation Virgo. M84 is situated in the heavily populated inner core of the Virgo Cluster of galaxies.

Radio observations and Hubble Space Telescope images of M84 have revealed two jets of matter shooting out from the galaxy's center as well as a disk of rapidly rotating gas and stars indicating the presence of a 1.5 billion solar mass supermassive black hole.

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# M85

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Object Type: Galaxy  
Distance: 60 MLY  
Image : 20 minutes exposure  
Scope: C-14 SCT

## Information

Messier 85 (also known as M85 or NGC 4382 or PGC 40515 or ISD 0135852) is a lenticular galaxy (type S0) in the Coma Berenices constellation. It is 60 million light years away, making it the 94th most distant Messier object, and it 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 as of 2004[citation needed].

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

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



# M86

Object Type: Galaxy  
Distance: 52 MLY  
Image : 115 Minutes  
Scope: 9.25" SCT

## Information

Messier 86 is a lenticular galaxy in the constellation Virgo. It was discovered by Charles Messier in 1781. M86 lies in the heart of the Virgo Cluster of galaxies and forms a most conspicuous group with another giant, Lenticular Galaxy M84.

It displays the highest blue shift of all Messier objects, as it is approaching the Milky Way at 244 km/s. This is thought to be due to its falling towards the center of the Virgo cluster, which brings it closer to the Milky Way.



# M87 Virgo A

Object Type: Galaxy  
Distance: 53.5 MLY  
Image : 12 Minutes  
Scope: 10" Newtonian

## Information

Messier 87 (also known as M87, Virgo A or NGC 4486) is a supergiant elliptical galaxy. It was discovered in 1781 by the French astronomer Charles Messier, who cataloged it as a nebulous feature. The second brightest galaxy within the northern Virgo Cluster, it is located about 16.4 million parsecs (53.5 million light-years) from Earth. Unlike a disk-shaped spiral galaxy, Messier 87 has no distinctive dust lanes and it has an almost featureless, ellipsoidal shape that diminishes in luminosity with distance from the center. At the core is a supermassive black hole, which forms the primary component of an active galactic nucleus. This object is a strong source of multiwavelength radiation, particularly radio waves. A jet of energetic plasma originates at the core and extends outward at least 1,500 parsecs (5,000 light-years).

The stars in this galaxy form about one sixth of Messier 87's mass. They have a nearly spherically symmetric distribution, while the density of stars decreases with increasing distance from the core. The galactic envelope extends out to a radius of about 150 kpc (490 kly), where it has been truncated—possibly by an encounter with another galaxy. Between the stars is a diffuse interstellar medium of gas that has been chemically enriched by elements emitted from evolved stars. Any dust formed within the galaxy is destroyed within 46 million years by the X-ray emission from the core, although optical filaments of dust have been observed. Orbiting the galaxy is an abnormally large population of about 12,000 globular clusters, compared to 150-200 globular clusters orbiting the Milky Way.

As one of the most massive giant elliptical galaxies near Earth and one of the brightest radio sources in the sky, Messier 87 is a popular target for both amateur astronomy observations and professional astronomy study.

On April 10, 2019, the Event Horizon Telescope collaboration published the first direct image of the shadow of a black hole, that of M87's central black hole of about 6.5 billion solar masses. A version in polarized light, showing the magnetic field structure at the edge of the shadow, followed in March 2021.

Observations with the Global mm-VLBI Array, ALMA and the Greenland Telescope, published in 2023, produced the first image showing both the ring of material falling toward M87's black hole and the base of the relativistic jet it launches. The ring measured in these data is about 64 microarcseconds across.

Event Horizon Telescope images from 2017, 2018 and 2021, published in 2025, show that the polarization pattern around M87's black hole reversed direction between observing campaigns. The magnetic fields near the event horizon are therefore not static, and the observations also detected faint emission at the base of the jet.

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# M88

Object Type: Galaxy  
Distance: 63 MLY  
Image : 75 Minutes  
Scope: 14" SCT

## Information

Messier 88 (also known as M88 or NGC 4501) is a spiral galaxy about 63 million light-years away in the constellation Coma Berenices. It was discovered by Charles Messier in 1781.

This galaxy is one of the fifteen Messier objects that belong to the nearby Virgo Cluster of galaxies. This galaxy may be on a highly elliptical orbit that is carrying it toward the cluster center, which is occupied by the giant elliptical galaxy M87.

The supermassive black hole at the core of this galaxy has 107.9 solar masses, or about 80 million times the mass of the Sun.

In 1999, supernova 1999cl was discovered in this galaxy.

# M89

Object Type: Galaxy  
Distance: 50 MLY  
Image : 14 Minutes  
Scope: 10" Newtonian

## Information

Messier 89 (M89 for short, also known as NGC 4552) is an elliptical galaxy in the constellation Virgo. It was discovered by Charles Messier on March 18, 1781. M89 is a member of the Virgo Cluster of galaxies.

Current observations indicate that M89 may be nearly perfectly spherical in shape. This is unusual, since all other known elliptic galaxies are relatively elongated ellipsoids. However, it is possible that the galaxy is oriented in such a way that it appears spherical to an observer on Earth but is in fact elliptical.

The galaxy also features a surrounding structure of gas and dust extending up to 150,000 light-years from the galaxy and jets of heated particles that extend 100,000 light-years outwards. This indicates that it may have once been an active quasar or radio galaxy.

M89 also has a large population of globular clusters. A 2006 survey estimates that there are  $2,000 \pm 700$  globulars within  $25'$  of M89, compared to the estimated 150-200 thought to surround the Milky Way.

# M90

Object Type: Galaxy  
Distance: 60 MLY  
Image : 55 minutes  
Scope: 10" Newtonian

## Information

Messier 90 (also known as M90 and NGC 4569) is a spiral galaxy about 60 million light-years away in the constellation Virgo. It was discovered by Charles Messier in 1781. Messier 90 is a member of the Virgo Cluster. The galaxy is located approximately  $1^\circ.5$  away from the subgroup centered on Messier 87. Star formation in Messier 90 appears truncated.

Consequently, the galaxy's spiral arms appear to be smooth and featureless, rather than knotted like galaxies with extended star formation. However, the center of Messier 90 appears to be a site of significant star formation activity. Multiple supernovae in the nucleus have produced 'superwinds' that are blowing the galaxy's interstellar medium outward into the intracluster medium. The spectrum of Messier 90 is blueshifted, which indicates that it is moving towards the Earth.

Messier 90 has PIE satellite galaxy (IC 3583) which is an irregular galaxy.

# M91

Object Type: Galaxy  
Distance: 63 MLY  
Image : 85 minutes  
Scope: 10" Newtonian

## Information

Messier 91 (also known as NGC 4548 or M91) is a barred spiral galaxy located in the Coma Berenices constellation and is part of the Virgo Cluster of galaxies. M91 is about 63 million light-years away from the earth. It was the last of a group of eight nebulae discovered by Charles Messier in 1781. Originally M91 was a missing Messier object in the catalog as the result a bookkeeping mistake by Messier. It was not until 1969 that amateur astronomer William C. Williams realized that M91 was NGC 4548, which was documented by William Herschel in 1784.

Messier 91 was discovered on the night of March 18, 1781, Charles Messier described it as Nebula without stars, fainter than M90. Messier mistakenly logged its position from Messier 58, where in fact it should have been Messier 89. William Herschel observed the same galaxy on April 8, 1784. Williams solved the missing Messier object by measuring its right ascension and declination relative to those of the nearby galaxy M89 (there are no suitable reference stars in the vicinity). Williams applied the observed differences of M91 with M58, a 9th-magnitude galaxy which Messier recorded in 1778. The calculation reproduces the Messier position to 0.1' in right ascension and 1' in declination.

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# M92

Object Type: Globular Cluster  
Distance: 26,000 LY  
Image : 15 minutes exp.  
Scope: 10 Inch Newtonian

## Information

Messier 92 (also known as M92 or NGC 6341) is a globular cluster in the constellation Hercules. It was discovered by Johann Elert Bode in 1777 and independently rediscovered by Charles Messier on March 18, 1781. M92 is at a distance of about 26,000 light-years away from Earth. M92 is one of the brighter globular clusters in the northern hemisphere, but it is often overlooked by amateur astronomers because of its proximity to the even more spectacular Messier 13. It is visible to the naked eye under very good conditions.

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# M93

Object Type: Open Cluster  
Distance: 3,600 LY  
Image : 50 minutes exp.  
Scope: 80mm APO

## Information

Messier 93 (also known as M 93 or NGC 2447) is an open cluster in the constellation Puppis. It was discovered by Charles Messier in 1781.

M93 is at a distance of about 3,600 light years from Earth and has a spatial radius of some 10 to 12 light years. Its age is estimated at some 100 million years.

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# M94

Object Type: Galaxy  
Distance: 17 MLY  
Image : 80 minutes exp.  
Scope: C-9.25" SCT

## Information

Messier 94 is a spiral galaxy in the constellation Canes Venatici. It was discovered by Pierre Méchain in 1781, and cataloged by Charles Messier two days later. Although some references describe M94 as a barred spiral galaxy, the "bar" structure appears to be more oval-shaped. The galaxy is also notable in that it has two ring structures. M94 contains both an inner ring with a diameter of 70" and an outer ring with a diameter of 600". These rings appear to form at resonance locations within the disk of the galaxy. The inner ring is the site of strong star formation activity and is sometimes referred to as a starburst ring. This star formation is fueled by gas that is dynamically driven into the ring by the inner oval-shaped bar-like structure. There are several possible external events that could have led to the origin of M94's outer disk including the accretion of a satellite galaxy or the gravitational interaction with a nearby star system. However, further research found problems with each of these scenarios. Therefore, the report concludes that the inner disk of M94 is an oval distortion which led to the creation of this galaxy's peripheral disk. In 2008 a study was published that appeared to show that M94 had very little or no dark matter present. The study analyzed the rotation curves of the galaxy's stars and the density of hydrogen gas and found that ordinary luminous matter appeared to account for all of the galaxy's mass. This result was unusual and somewhat controversial, as current models don't indicate how a galaxy could form without a dark matter halo or how a galaxy could lose its dark matter. Other explanations for galactic rotation curves, such as MOND, also have difficulty explaining this galaxy.

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# M95

Object Type: Galaxy  
Distance: 33 MLY  
Image : 90 minutes exp.  
Scope: C-9.25"

## Information

Messier 95 (also known as M95 or NGC 3351) is a barred spiral galaxy about 33 million light-years away in the constellation Leo. It was discovered by Pierre Méchain in 1781, and cataloged by Charles Messier four days later.

The center of the galaxy contains a ring-shaped circumnuclear star-forming region with a diameter of approximately 2000 ly (600 pc).

M95 is one of several galaxies within the M96 Group, a group of galaxies in the constellation Leo. The group also includes the Messier objects M96 and M105.

# M96

Object Type: Galaxy  
Distance: 35 MLY  
Image : 90 minutes exp.  
Scope: 80mm APO

## Information

Messier 96 (also known as NGC 3368) is an intermediate spiral galaxy about 35 million light-years away in the constellation Leo. It was discovered by Pierre Méchain in 1781.

M96 is the brightest galaxy within the M96 Group, a group of galaxies in the constellation Leo also includes the Messier objects M95 and M105, as well as at least nine other galaxies. The M96 galaxy has asymmetric arms and a displaced core, probably caused by the gravitational pull by the other nearby galaxies.

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# M97 Owl Nebula

Object Type: Planetary Nebula  
Distance: 2,600 LY  
Image : 50 minutes exp.  
Scope: C-9.25"

## Information

The Owl Nebula (also known as Messier Object 97 or NGC 3587) is a planetary nebula in the constellation Ursa Major. It was discovered by Pierre Méchain in 1781.

M97 is regarded as one of the more complex of the planetaries. The 16th magnitude central star has about 0.7 solar mass and the nebula itself about 0.15 solar mass. The nebula formed roughly 6,000 years ago.

The nebula gets its name due to the appearance of owl-like "eyes" when viewed through a large (>200 mm) telescope under dark sky conditions with the aid of a so-called "nebula filter." The "eyes" are also easily visible through photographs taken of the nebula.

# M98

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Object Type: Galaxy  
Distance: 44 MLY  
Image : 20 minutes exp.  
Scope: 10" Newtonian

## Information

Messier 98 (also known as M98 or NGC 4192) is an intermediate spiral galaxy about 44 million light-years away in the constellation Coma Berenices. It was discovered by Pierre Méchain on 15 March 1781 along with M99 and M100 and was cataloged as a Messier object on 13 April 1781. Messier 98 has a blue shift and is approaching us at about 140 km per second.



# M99

Object Type: Galaxy  
Distance: 55 MLY  
Image : 120 minutes exp.  
Scope: C-9.25"

## Information

Messier 99 is an unbarred spiral galaxy approximately 50 million light-years away in the constellation Coma Berenices.

The galaxy has a normal looking arm and an extended arm that is less tightly wound. A bridge of neutral hydrogen gas links NGC 4254 with VIRGOHI21. The gravity from the dark galaxy VIRGOHI21 appears to have distorted M99 and drawn out the gas bridge, as the two galaxy-sized objects have a close encounter, before they go their separate ways. It is expected that the drawn out arm will relax to match the normal arm once the encounter is over. Three supernovae have been observed in this galaxy.

Messier 99 was discovered by Pierre Méchain on March 17, 1781 along . The discovery was then reported to Charles Messier, who included the object in the Messier Catalog, which was the first astronomical catalog of star clusters, nebulae, and galaxies.

Messier 99 was one of the first galaxies in which a spiral pattern was first seen.

# M100

Object Type: Galaxy  
Distance: 55 MLY  
Image : 70 minutes exp.  
Scope: C-9.25"

## Information

Messier 100 is an example of a grand design spiral galaxy located within the southern part of constellation Coma Berenices. It is one of the brightest galaxies in the Virgo cluster, approximately 55 million light-years distant from Earth and has a diameter of 160,000 light years. It was discovered by Pierre Méchain in March 15, 1781 and was subsequently entered in Messier's catalog of nebulae and star clusters after Charles Messier made observations of his own on April 13, 1781. The galaxy was one of the first spirals discovered, and was listed as 1 of 14 spiral nebulae by Lord William Parsons of Rosse in 1850. A satellite galaxy named NGC 4323 is present within M100.

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# M101 Pinwheel Galaxy

Object Type: Galaxy  
Distance: 23 MLY  
Image : 80 minutes exp.  
Scope: AP 5"

## Information

The Pinwheel Galaxy is a face-on spiral galaxy about 23 million light-years away in the constellation Ursa Major. It was discovered by Pierre Méchain on March 27, 1781, and he subsequently communicated his discovery to Charles Messier who verified its position and added it to the Messier Catalog as one of the final entries. M101 is a relatively large galaxy compared to the Milky Way. With a diameter of 170,000 light-years it is nearly twice the size of the Milky Way. It has a disk mass on the order of 100 billion solar masses, along with a small bulge of about 3 billion solar masses. Another remarkable property of this galaxy is its huge and extremely bright H II regions, of which a total of about 3,000 can be seen on photographs. H II regions usually accompany the enormous clouds of high density molecular hydrogen gas contracting under their own gravitational force where stars form. H II regions are ionized by large numbers of extremely bright and hot young stars. On photographs M101 can be seen to be asymmetrical on one side. It is thought that in the recent past (speaking in galactic terms) M101 underwent a near collision with another galaxy and the associated gravitational tidal forces caused the asymmetry. In addition, this encounter also amplified the density waves in the spiral arms of M101. The amplification of these waves leads to the compression of the interstellar hydrogen gas, which then triggers strong star formation activity.

SN 2023ixf, a type II supernova, was discovered in M101 on May 19, 2023, by the Japanese amateur astronomer Koichi Itagaki. It reached about eleventh magnitude and is the closest core-collapse supernova observed in more than a decade, which allowed its red supergiant progenitor to be identified in archival images.

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# M102

Object Type: Galaxy  
Distance: 44 MLY  
Image : 33 minutes exp.  
Scope: C-9.25"

## Information

Messier 102 is a galaxy listed in the Messier Catalog that has not been identified unambiguously. Its original discoverer Pierre Méchain later claimed that it was a duplicate observation of Messier 101, but there are historical and observational reasons to believe that it would actually be NGC 5866, although other galaxies have been suggested as possible identities.

Since the publication of the Messier Catalog, a number of galaxies have been identified by different historians, professional astronomers, and amateur astronomers as corresponding to M102.

Messier 101 (also known as the Pinwheel Galaxy or NGC 5457) is a face-on spiral galaxy in the constellation Ursa Major. In a letter written in 1783 to J. Bernoulli, Pierre Méchain (who had shared information about his discoveries with Messier) claimed that M102 was actually an accidental duplication of M101 in the catalog. This letter was later published twice: First in original French in the Memoirs of the Berlin Academy for 1782, and second in German translation and somewhat rearranged by Johann Elert Bode in the Berliner Astronomisches Jahrbuch for 1786.



# M103

Object Type: Open Cluster  
Distance: 10,000 LY  
Image : 55 minutes exp.  
Scope: C-9.25"

## Information

Messier 103 (also known as M103, or NGC 581) is an open cluster in the constellation Cassiopeia. It was discovered by Pierre Méchain in 1781. M103 is about 25 million years old and at a distance of about 10,000 light-years from Earth. M103 is also the last Messier object to be cataloged by Charles Messier himself. M103 is one of the more remote open clusters in Messier's catalog, at about 8,000 light years or slightly more; the Sky Catalogue 2000.0 gives 8,500 (quoted also e.g. by Kenneth Glyn Jones and Robert Garfinkle), Pennington 9,000 and Kepple's and Sanner's Night Sky Observer's Handbook 9,200 light years - the uncertainty mainly due to the less wellknown amount of obstruction for this cluster which lies well within the band of the Milky Way.

This cluster is quite easy to find from Delta or 37 Cassiopeiae (named Ruchbah), Situated nearby are a number of other open clusters, including Trumpler 1, NGC 654, NGC 659 and NGC 663. The latter is sometimes mentioned as a candidate to be confused with M103.



# M104 Sombrero Galaxy

Object Type: Galaxy  
Distance: 30 MLY  
Image : 37 minutes exp.  
Scope: 10" Newtonian

## Information

The Sombrero Galaxy is an unbarred spiral galaxy in the constellation Virgo. It has a bright nucleus, an unusually large central bulge, and a prominent dust lane in its inclined disk. The dark dust lane and the bulge give this galaxy the appearance of a sombrero. The Sombrero Galaxy was discovered in March of 1767 by Pierre Méchain, who described the object in a May 1767 letter to J. Bernoulli that was later published in the Berliner Astronomisches Jahrbuch. Charles Messier made a hand-written note about this and five other objects (now collectively recognized as M104 - M109) to his personal list of objects now known as the Messier Catalog, but it was not "officially" included until 1921. The redshift for the Sombrero Galaxy itself was calculated to be 1100 km/s.

In the 1990s, a research group led by John Kormendy demonstrated that a supermassive black hole is present within the Sombrero Galaxy. Using spectroscopy data from both the CFHT and the Hubble Space Telescope, the group showed that the speed of rotation of the stars within the center of the galaxy could not be maintained unless a mass 1 billion times the mass of the Sun, is present in the center.

The James Webb Space Telescope imaged M104 with its Mid-Infrared Instrument in 2024. In the mid-infrared the bright core seen at visible wavelengths largely disappears, and the galaxy's outer ring resolves into clumpy structure.

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# M105

Object Type: Galaxy  
Distance: 30 MLY  
Image : 90 minutes exp.  
Scope: C-9.25"

## Information

Messier 105 (also known as M105 and NGC 3379) is an elliptical galaxy in the constellation Leo. Messier 105 is known to have a supermassive black hole.

Messier 105 was discovered by Pierre Méchain on 24 March 1781, just a few days after he discovered the nearby galaxies Messier 95 and Messier 96. This galaxy is one of several that were not originally included in the original Messier Catalog compiled by Charles Messier. Messier 105 was included in the catalog only when Helen S. Hogg found a letter by Méchain describing Messier 105 and when the object described by Méchain was identified as a galaxy previously named NGC 3379.

Messier 105 is one of several galaxies within the M96 Group, a group of galaxies in the constellation Leo. The group also includes the Messier objects M95 and M96.

In this image, M105 is the furthest right.

# M106

Object Type: Galaxy  
Distance: 25 MLY  
Image : 120 minutes exp.  
Scope: C-9.25"

## Information

Messier 106 (also known as NGC 4258) is a spiral galaxy in the constellation Canes Venatici. It was discovered by Pierre Méchain in 1781. M106 is at a distance of about 22 to 25 million light-years away from Earth. It is also a Seyfert II galaxy, which means that due to x-rays and unusual emission lines detected, it is suspected that part of the galaxy is falling into a supermassive black hole in the center. NGC 4217 is a possible companion galaxy of Messier 106.

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# M107

Object Type: Globular Cluster  
Distance: 20,900 LY  
Image : 70 minutes exp.  
Scope: C-9.25"

## Information

Globular Cluster M107 (also known as Messier Object 107 or NGC 6171) is a very loose globular cluster in the constellation Ophiuchus. It was discovered by Pierre Méchain in April 1782 and independently by William Herschel in 1793. It wasn't until 1947 that Helen Sawyer Hogg added it and three other objects discovered by Méchain to the list of Messier objects.

M107 is close to the galactic plane at a distance of about 20,900 light-years from Earth. There are 25 known variable stars in this cluster.

# M108

Object Type: Galaxy  
Distance: 45 MLY  
Image : 110 minutes exp.  
Scope: C-9.25"

## Information

Messier 108 is a barred spiral galaxy in the constellation Ursa Major. It was discovered by Pierre Méchain in 1781 or 1782. This galaxy is an isolated member of the Ursa Major Cluster cluster of galaxies in the Virgo supercluster.

This galaxy has an estimated mass of 125 billion times the mass of the Sun and includes about  $290 \pm 80$  globular clusters. Examination of the distribution of neutral hydrogen in this galaxy shows shells of expanding gas extending for several kiloparsecs, known as H1 supershells. These may be driven by bursts of star formation activity, resulting in supernovae explosions. Alternatively they may result from an in fall of gas from outside the galaxy or by radio jets. The supermassive black hole at the core has an estimated mass equal to 24 million times the mass of the Sun.

# M109

Object Type: Galaxy  
Distance: 60 MLY  
Image : 120 minutes exp.  
Scope: C-9.25"

## Information

Messier 109 is a barred spiral galaxy approximately 60 million light-years away in the constellation Ursa Major. M109 can be seen southeast of the star Phecda. Messier 109 was discovered by Pierre Méchain in 1781. In 1783 Charles Messier cataloged it as his 109th object.

M109 has three satellite galaxies (UGC 6923, UGC 6940 and UGC 6969) and possibly might have more. Detailed hydrogen line observations have been obtained from M109 and its satellites. M109's H I distribution is regular with a low level radial extension outside the stellar disc, while at exactly the region of the bar, there is a central H I hole in the gas distribution. Possibly the gas has been transported inwards by the bar because of the emptiness of the hole no large accretion events can have happened in the recent past.





# M110

Object Type: Galaxy  
Distance: 2.65 MLY  
Image : 960 minutes exp.  
Scope: 80mm APO

## Information

M110 (seen in this image right below the Andromeda Galaxy) Messier 110 (also known as M110 and NGC 205) is a dwarf elliptical galaxy that is a satellite of the Andromeda Galaxy. M110 contains some dust and hints of recent star formation, which is unusual for dwarf elliptical galaxies in general.

Although Charles Messier never included the galaxy in his famous list, it was depicted by him, together with M32, on a drawing of the Andromeda galaxy; a label on the drawing indicates that Messier first observed NGC 205 on August 10, 1773. The galaxy was independently discovered by Caroline Herschel on August 27, 1783; her brother William Herschel described her discovery in 1785. The suggestion to assign the galaxy a Messier number was made by Kenneth Glyn Jones in 1967.

In 1999, Johnson and Modjaz discovered a nova in M110.

Unlike M32, NGC205 does not show evidence for a supermassive black hole at its center.

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## CHARLES MESSIER

Charles Messier (26 June 1730 – 12 April 1817) was a French astronomer most notable for publishing an astronomical catalog consisting of deep sky objects such as nebulae and star clusters that came to be known as the 103 "Messier objects". The purpose of the catalog was to help astronomical observers, in particular comet hunters such as himself, distinguish between permanent and transient objects in the sky.

Messier was born in Badonviller in the Lorraine region of France, being the tenth of twelve children of Françoise B. Grandblaise and Nicolas Messier, a Court usher. Six of his brothers and sisters died while young and in 1741, his father died. Charles' interest in astronomy was stimulated by the appearance of the spectacular, great six-tailed comet in 1744 and by an annular solar eclipse visible from his hometown on 25 July 1748.

In 1751 he entered the employ of Joseph Nicolas Delisle, the astronomer of the French Navy, who instructed him to keep careful records of his observations. Messier's first documented observation was that of the Mercury transit of 6 May 1753.

In 1764, he was made a fellow of the Royal Society, in 1769, he was elected a foreign member of the Royal Swedish Academy of Sciences, and on 30 June 1770, he was elected to the French Academy of Sciences.

The first version of Messier's catalog contained 45 objects and was published in 1774 in the journal of the French Academy of Sciences in Paris. The final version of the catalog was published in 1781, in *Connaissance des Temps* for 1784. The final list of Messier objects had grown to 103.

On several different occasions between 1921 and 1966, astronomers and historians discovered evidence of another seven deep-sky objects that were observed either by Messier or his friend and assistant, Pierre Mechain, shortly after the final version was published. These seven objects, M104 through M110, are accepted by astronomers as "official" Messier objects.

The Messier catalog comprises nearly all the most spectacular examples of the five types of deep sky object -- diffuse nebulae, planetary nebulae, open clusters, globular clusters and galaxies -- visible from European latitudes. Because these objects could be observed with the relatively small-aperture refracting telescope (approximately 102 mm, or four inches) used by Messier to study the sky, they are among the brightest and most attractive deep sky objects observable from earth, and are among the most popular targets for visual study and photography available to modern amateur astronomers using larger aperture equipment. Furthermore, almost all of the Messier objects are among the closest to our planet in their respective classes, which makes them heavily studied with professional class instruments that today can resolve very small and visually spectacular details in them. Professional astronomers still often refer to these structures by their Messier designation.

The crater Messier on the Moon and the asteroid 7359 Messier were named in his honor.

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## CHANAN GREENBERG

Anyone who has attended a star party has heard the name Charles Messier, and many have viewed the night-sky jewels this 18th-century French astronomer cataloged in his catalog of comet-like objects. As I gradually moved from a 6-inch Newtonian telescope to a 12-inch scope, easily resolving stars in globular clusters, I was in awe of what Messier achieved with equipment so limited by today's standards. His note that the globular cluster M13 is a beautiful nebula containing no stars makes for a good story at star parties, but all joking aside, his work documented some of the favorite and most-viewed objects in amateur astronomy. As I delved deeper into astrophotography, that appreciation grew even stronger when I looked at Messier's own illustrations of the Orion Nebula and the Andromeda Galaxy. Messier objects are wonderful astrophotography targets, so I decided it would be nice to one day view and image all 110 objects in his catalog. In theory this could be done within twelve months, but life, work, and those damn clouds prolonged the experience. After imaging each object, I would spend time reading about it online, and that is when I had the idea for a single interactive source of information on every Messier object. The Messier Catalog Greenberg Companion was born. Putting this interactive PowerPoint together is my way of paying homage to Messier, and to all the great astronomers who, long before high-quality optics, tracking mounts, auto-guiding, computers, and CCD chips, did remarkable work through great effort and skill that we still benefit from today. Because this project has spanned more than four years, the image quality is not always consistent. It often reflects different stages in my own astrophotography learning curve, and occasionally the effects of poor conditions. In time I may revisit some of these objects and try to produce better images. This file may be distributed freely for educational purposes. The Messier Catalog Greenberg Companion includes: An interactive table of all 110 objects. Clicking any image links to that object's dedicated page. 110 object pages, each with its image and information I gathered online about the object. Full English translations of all of Messier's original entries. A brief biography of Charles Messier. If you find any errors or have suggestions, please feel free to contact me through the contact page on my website: [www.greenhawkbobservatory.com](http://www.greenhawkbobservatory.com)

Dedication I dedicate this work to my wife **Ayelet** and my children **Ronnie** and **Adam**, for their love, patience, and support; in loving memory of my parents, **Yasha** and **Hilary Greenberg**, who gave me life and guided me in how to live it; in memory of my grandfather **Emmanuel Fagin**, for making my childhood so special and for largely sowing the seed that has driven my interest in astronomy; and in memory of my father-in-law **Moti Aharoni**, with whom I spent many hours conversing about the wonders of the universe.

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CHARLES  
MESSIER

## Charles Messier's Personal Copy of his 1781 "Catalog of Nebulae and Star Clusters"

### CATALOGUE of Nebulae and Clusters of Stars *Observed at Paris by M. Messier. At the Observatory of the Marine. Hotel de Cluny. Rue de Mathurins.*

M. Messier has observed with the utmost care, the Nebulae and star clusters which one can detect over the horizon of Paris; he has determined their Right Ascension and Declination and given their diameters, together with circumstantial details for each one: a work which was missing in astronomy.

He also gives details to the searches he has made for those other nebulae which other astronomers have discovered but which he has looked for without success.

The catalog of nebulae and star clusters of M. Messier was included in the volume of the Academy of Sciences for the year 1771, page 435. He reported at the end of his *Memoir*, a drawing outlined with the greatest care, of the fine nebula in the sword of Orion with the stars it contains. This drawing will be of help to recognize it again, provided that it is not subject to change with time. If one compares the present drawing with those of Ms. Huygens, Picard, de Mairan and Le Gentil, one is astonished to find such a change in it that, considering its shape alone, one would have difficulty to recognise it as the same nebula. M. Le Gentil's drawing can be seen in the volume of the Academy for 1759, page 470, plate XXI.

To the catalog printed by M. Messier, which we give here, we have also reported a large number of nebulae and star clusters which he has discovered since the printing of his *Memoir*, and which he communicated to us.

With the positions of the nebulae, M. Messier reports the numbers which are the same on the following pages, where the details of each of the observed nebulae are given.

# Messier Catalog Object 1-6

1. 5h 20m 02s (80d 00' 33") +21d 45' 27"

(September 12, 1758) `Nebula above the southern horn of Taurus, it doesn't contain any star; it is a whitish light, elongated in the shape of a flame of a candle, discovered while observing the comet of 1758. See the chart of that comet, Mem. Acad. of the year 1759, page 188; observed by Dr. Bevis in about 1731. It is reported on the English Celestial Atlas.'

2. 21h 21m 08s (320d 17' 00") -1d 47' 00"

(September 11, 1760) `Nebula without star in the head of Aquarius, its center is brilliant, & the light surrounding it is round; it resembles the beautiful nebula which is situated between the head & the bow of Sagittarius [M22], it is seen very well with a telescope of 2 feet [FL], placed below the parallel [same Dec] of Alpha Aquarii. M. Messier has reported this nebula on the chart of the path of the comet observed in 1759. Mem. Acad. of the year 1760, page 464. M. Maraldi has seen this nebula in 1746 while observing the comet which appeared that year. (Diam. 4')  
[Handwritten note:] `No. 53 of the Berlin tables'

3. 13h 31m 25s (202d 51' 19") +29d 32' 57"

(May 3, 1764) `Nebula discovered between Bootes and one of the hunting dogs of Hevelius [Canes Venatici], it doesn't contain any star, its center is brilliant, and its glow is gradually fading away, it is round; in a good [dark] sky, one can see it in a telescope of 1-foot [FL]: It is reported on the chart of the comet observed in 1779. Memoirs of the Academy of the same year. Reviewed on March 29, 1781, always very beautiful. (Diam. 3')  
[Handwritten remark:] `Reviewed on January 9, 1790.'

4. 16h 09m 08s (242d 16' 56") -25d 55' 40"

(May 8, 1764) `Cluster of very small [faint] stars; with an inferior telescope, it appears more like a nebula; this cluster is situated near Antares and below its parallel. Observed by M. de la Caille & reported in his catalog. Reviewed Jan 30 & Mar 22, 1781. (Diam 2.5)'

5. 15h 06m 36s (226d 39' 04") +2d 57' 16"

(May 23, 1764) `A fine nebula discovered between Libra & Serpens, near that star in Serpens, of 6th magnitude, which is the 5th according to Flamsteed's catalog [5 Ser]: It doesn't contain any star; it is round, & one sees it very well in a fine [clear dark] sky with an ordinary telescope of 1-foot [FL]. M. Messier has reported it in the chart of the comet of 1763. Mem. Acad for the year 1774, page 40. Reviewed on Sep. 5, 1780, January 30 & March 22, 1781. (Diam. 3')'

6. 17h 24m 42s (261d 10' 39") -32d 10' 34"

(May 23, 1764) `A cluster of small stars between the bow of Sagittarius & the tail of Scorpius. To the naked eye, this cluster seems to form a nebula without stars; but even with the smallest instrument one employs for investigating one sees a cluster of small [faint] stars. (Diam. 15')  
[Handwritten remark:] Lacaille has it.



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# Messier Catalog Object 7-12

7. 17h 38m 02s (264d 30' 24") -34d 40' 34"

(May 23, 1764) `A star cluster, more considerable than the preceding [M6]; to the naked eye, this cluster looks like a nebulosity; it is little distant from the preceding, placed between the bow of Sagittarius & the tail of Scorpius. (Diam. 30)'  
[Handwritten remark:] Lacaille has it.

8. 17h 49m 58s (267d 29' 30") -24d 21' 10"

(May 23, 1764) `A cluster which appears like a nebula in an ordinary telescope of 3 feet [FL] but with an excellent instrument, one perceives nothing but a large number of small stars; near this star cluster is a fairly bright star, surrounded by a very faint glow: this is 9 Sagittarii, of 7th mag, according to Flamsteed: this cluster appears in elongated shape, extended NE-SW, between the arc of Sagittarius & the foot of Ophiuchus. (Diam. 30)'  
[Handwritten remark:] Lacaille has it.

9. 17h 05m 22s (256d 20' 36") -18d 13' 26"

(May 28, 1764) `Nebula, without star, in the right leg of Ophiuchus; it is round & its light is faint. Reviewed on March 22, 1781. (Diam. 3)'

10. 16h 44m 48s (251d 12' 06") -3d 42' 18"

(May 29, 1764) `Nebula, without stars, in the belt of Ophiuchus; near the 30th star of that constellation, of sixth magnitude, according to Flamsteed [30 Oph]. This nebula is beautiful & round; one can only see it with difficulty in an ordinary telescope of 3-feet [FL]. M. Messier has reported on the 2nd chart of the track of the comet of 1769. Mem. Acad. for the year 1775, plate IX. Reviewed on March 6, 1781.' (Diam. 4)'  
[manuscript note:] `Reviewed on March 10, 1790, in the morning, Night-glass of Rebour.'

11. 18h 30m 23s (279d 35' 43") -6d 31' 01"

(May 30, 1764) `Cluster of a great number of small stars, near the star K of Antinous [ Sct], which one can see only in a good instrument; with an ordinary telescope of 3 feet [FL] it resembles a comet: This cluster is mingled with a faint glow; in this cluster there is a star of 8th magnitude. Seen by Kirch in 1681. Phil. Trans. No. 347, p. 390. It is reported on the English Great Atlas.' (diam. 4')

12. 16h 34m 53s (248d 43' 10") -2d 30' 28"

(May 30, 1764) `Nebula discovered in the Serpent, between the arm and the left side of Ophiuchus: this nebula contains no star, it is round & its light is faint; near this nebula there is a star of 9th magnitude. M. Messier reported it on the 2nd chart of the comet observed in 1769. Mem. Acad. 1775, pl. IX. Reviewed on March 6, 1781. (diam. 3)'  
[Handwritten remark in Messier's copy:] Reviewed on March 10, 1790.



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# Messier Catalog Object 20-26

20. 17h 48m 16s (267d 04' 05") -22d 59' 10"

(June 5, 1764) `Cluster of stars, a little above the Ecliptic, between the bow of Sagittarius & the right foot of Ophiuchus. Reviewed on March 22, 1781.' [see also description of M21]

21. 17h 50m 07s (267d 31' 35") -22d 31' 25"

(June 5, 1764) `Star cluster, near the preceding [M20]: The nearest neighboring known star to these two clusters is 11 Sagittarii, 7 mag, according to Flamsteed. The stars of both these clusters are of 8-9 magnitude, enveloped in nebulosity.'

22. 18h 21m 55s (275d 28' 39") -24d 06' 11"

(June 5, 1764) `Nebula, below the ecliptic, between the head and the bow of Sagittarius, near a star of 7th magnitude, 25 Sagittarii, according to Flamsteed, this nebula is round, it doesn't contain any star, & one can see it very well in an ordinary telescope of 3.5-foot [FL]; the star Lambda Sagittarii served for determination [of its position]. Abraham Ihle, a German, discovered it in 1665, while observing Saturn. M. Le Gentil observed it in 1747, & he made an engraving of it. Memoirs of the Academy, year 1759, page 470. Reviewed on March 22, 1781; it is reported in the English Atlas.' (diam. 6')

23. 17h 42m 51s (265d 42' 50") -18d 45' 55"

(June 20, 1764) `A star cluster, between the end of the bow of Sagittarius & the right foot of Ophiuchus, very near to 65 Ophiuchi, according to Flamsteed. The stars of this cluster are very close to one another. Its position was determined from Mu Sagittarii.' (diam. 15')

24. 18h 01m 44s (270d 26' 00") -18d 26' 00"

(June 20, 1764) `Cluster on the parallel of the preceding [M23] & near the end of the bow of Sagittarius, in the Milky Way: a large nebulosity in which there are many stars of different magnitudes: the light which is spread throughout this cluster is divided into several parts; it is the center of this cluster which has been determined [position].' (diam. 1d 30')

25. 18h 17m 40s (274d 25' 00") -19d 05' 00"

(June 20, 1764) `A cluster of small stars in the neighborhood of the two previous clusters [M23 and M24], between the head & the end of the bow of Sagittarius: the nearest known star to this cluster is 21 Sagittarii, 6th magnitude, according to Flamsteed. The stars of this cluster are seen with difficulty with an ordinary telescope of 3.5-foot [FL]; no nebulosity can be seen. Its position has been determined from Mu Sagittarii.' (diam. 10')

26. 18h 32m 22s (278d 05' 25") -9d 38' 14"

(June 20, 1764) `A cluster near Eta and Omicron in Antinous [now Alpha and Delta Scuti], between which there is another one of more brightness: with a telescope of 3.5-foot [FL] one cannot distinguish them, one needs to employ a good instrument. This cluster contains no nebulosity.' (diam. 2')



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# Messier Catalog Object 27-32

27. 19h 49m 27s (297d 21' 41") +22d 04' 00"

(July 12, 1764) `Nebula without star, discovered in Vulpecula, between the two forepaws, & very near the star 14 of that constellation, of 5th magnitude according to Flamsteed; one can see it well with an ordinary telescope of 3.5-foot [FL]; it appears of oval shape, & it contains no star. M. Messier has reported its position on the chart of the Comet of 1779, which was engraved for the volume of the Academy of the same year.

Reviewed on January 31, 1781.' (diam. 4')

28. 18h 09m 58s (272d 29' 30") -24d 57' 11"

(July 27, 1764) `Nebula discovered in the upper part of the bow of Sagittarius at about one degree from the star Lambda & little distant from the beautiful nebula which is between the head and the bow [M22]. It contains no star; it is round, it can only be seen difficultly with an ordinary telescope of 3.5-foot [FL]. Its position has been determined from Lambda Sagittarii. Reviewed on March 20, 1781.' (diam. 2')

29. 20h 15m 38s (303d 54' 29") +37d 11' 57"

(July 29, 1764) `A cluster of 7 or 8 very small stars, which are below Gamma Cygni, which one sees with an ordinary telescope of 3.5-foot [FL] in the form of a nebula. Its position determined from Gamma Cygni. Reported on chart of the Comet of 1779.'

30. 21h 27m 05s (321d 46' 18") -24d 19' 04"

(August 3, 1764) `Nebula discovered below the tail of Capricorn, very near to the star 41 of that constellation, of 6th magnitude, according to Flamsteed. One sees it with difficulty with an ordinary telescope of 3.5-foot [FL]. It is round & contains no star; its position determined from Zeta Capricorni, M. Messier reported it on chart of the Comet of 1759. Mem. Acad. 1760, pl. II.' (diam. 2')

31. 0h 29m 46s (7d 26' 32") +39d 09' 32"

(August 3, 1764) `The beautiful nebula of the belt of Andromeda, shaped like a spindle; M. Messier has investigated it with different instruments, & he didn't recognise a star: it resembles two cones or pyramids of light, opposed at their bases, the axes of which are in direction NW-SE; the two points of light or the apices are about 40 arc minutes apart; the common base of the pyramids is about 15'. This nebula was discovered by Simon Marius, & consequently observed by different astronomers. M. le Gentil has given a drawing in the Memoirs of the Academy for 1759, page 453. It is reported on the English Atlas.' (diam. 40')

(Flammarion reports that Messier added a note in his personal copy of the catalog by hand: `I have employed different instruments, especially an excellent Gregorian telescope of 30 feet FL, the large mirror 6 inches in diameter, magnification 104x. The center of this nebula appears fairly clear in this instrument without any stars appearing. The light gradually diminishes until it becomes extinguished. The former measurements were made with a Newtonian telescope of 4.5 feet FL, provided with a silk thread micrometer. Diameter 40'. August 3, 1764.')

32. 0h 29m 50s (7d 27' 32") +38d 45' 34"

(August 3, 1764) `Small nebula without stars, below & at some minutes [separation] from that of the belt of Andromeda [M31]; this small nebula is round, its light fainter than that of the belt. M. le Gentil has discovered it on October 29, 1749. M. Messier saw it, for the first time, in 1757, & he has not found any change.' (diam. 2')



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# Messier Catalog Object 33-39

33. 1h 40m 37s (20d 09' 17") +29d 32' 25"

(August 25, 1764) `Nebula discovered between the head of the Northern Fish [of Pisces] & the great Triangle, a bit distant from a star of 6th magnitude: The nebula is of a whitish light of almost even density [of brightness], however a little brighter along two-third of its diameter, & contains no star. One sees it with difficulty with an ordinary telescope of 1-foot [FL]. Its position was determined from Alpha Trianguli. Reviewed on September 27, 1780.' (diam. 15')

34. 2h 27m 27s (36d 51' 37") +41d 39' 32"

(August 25, 1764) `Cluster of small stars, between the head of Medusa (Algol) & the left foot of Andromeda, a little below the parallel of Gamma [Andromedae]: with an ordinary telescope of 3 foot [FL] one can distinguish the stars. Its position has been determined from Beta [Persei], the head of Medusa.' (diam. 15')

35. 5h 54m 41s (88d 40' 09") +24d 33' 30"

(August 30, 1764) `Cluster of very small stars, near the left foot of Castor, at a little distance from the stars Mu & Eta of that constellation [Gemini]. M. Messier has reported its position on the chart of the comet of 1770, Mem. Acad. 1771, pl. VII. Reported in the English Atlas.' (diam. 20')

36. 5h 20m 47s (80d 11' 42") +34d 08' 06"

(September 2, 1764) `Cluster of stars in Auriga, near the star Phi: with an ordinary telescope of 3.5 foot [FL] one has pain to distinguish the stars, the cluster contains no nebulosity. Its position determined from Phi [Aurigae].' (diam. 9')

37. 5h 37m 01s (84d 15' 12") +32d 11' 51"

(September 2, 1764) `Cluster of small stars, little remote from the preceding [M36], above the parallel of chi Aurigae; the stars are smaller, more close together and enclosing some nebulosity; with an ordinary telescope of 3.5 feet [FL], one has pain to see the stars: this cluster is reported on the Chart of the second Comet of 1771, Mem. Acad. 1777.' (diam. 9')

[Handwritten remark in Messier's copy:] Reviewed on the 6th of March, 1781.

38. 5h 12m 41s (78d 10' 12") +36d 11' 51"

(September 25, 1764) `Cluster of small stars in Auriga, near the star Sigma, little distant from the two preceding clusters [M36 and M37]; this one is of square shape & contains no nebulosity, if one takes care to examine it with a good telescope. Its extension is about 15' of arc.' (diam. 15')

39. 21h 23m 49s (320d 57' 10") +47d 25' 00"

(October 24, 1764) `Cluster of stars near the tail of the Swan; one can see them with an ordinary telescope of 3.5 feet [FL].' (diam. 1d 00')

[actually, it seems that Hevelius has observed another nearby binary, 74 Ursae Majoris, of mag 5]



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# Messier Catalog Object 40-46

40. 12h 11m 02s (182d 45' 30") +59d 23' 50"

(October 24, 1764) [1771] `The same night on October 24-25, [1764] I searched for the nebula above the tail of the Great Bear, which is indicated in the book Figure of the Stars, second edition. Its position in 1660 was right ascension 183d 32' 41", declination 60d 20' 33". By means of this position, I found two stars very near each other and of equal brightness, about 9th magnitude, placed at the beginning of the tail of the Great Bear. One can hardly distinguish them in an ordinary (nonachromatic) refractor of 6 feet [FL]. Their position is 182 deg 45' 30", +59 deg 23' 50". We presume that Hevelius mistook these two stars for a nebula.'

[1780 and 1781] `Two stars very close together & very small, placed at the root of the tail of the Great Bear: One has difficulty to distinguish them with an ordinary telescope of 6 feet [FL]. While searching for the nebula above the back of Ursa Major, reported in the book Figures des Astres, and which is supposed to be for 1660 at 183d 32' 41" right ascension, & 60d 20' 33" northern declination, which Messier couldn't see, he has observed these two stars.'

[actually, it seems that Hevelius has observed another nearby binary, 74 Ursae Majoris, of mag 5]

41. 6h 35m 53s (98d 58' 12") -20d 33' 00"

(January 16, 1765) `Cluster of stars below Sirius, near Rho Canis Majoris; this cluster appears nebulous in an ordinary telescope of one foot [FL]; it is nothing more than a cluster of small stars.'

42. 5h 23m 59s (80d 59' 40") -5d 34' 06"

(March 4, 1769) `Position of the beautiful nebula in the sword of Orion, around the star Theta which it contains [together] with three other smaller stars which one cannot see but with good instruments. Messier has entered into the great details in this great nebula; he has created a drawing, made with the greatest care, which one can see in the Memoirs of the Academy for 1771, plate VIII. It was Huygens who discovered it in 1656: it has been observed since by many astronomers. Reported in the English Atlas.'

43. 5h 24m 12s (81d 03' 00") -5d 26' 37"

(March 4, 1769) `Position of the little star surrounded by nebulosity & which is below the nebula of the sword of Orion. M. Messier has included it in the drawing of the Great [Nebula].'

44. 8h 07m 22s (126d 50' 30") +20d 31' 38"

(March 4, 1769) `Cluster of stars known by the name of the nebula in Cancer. The position given is that of the star C.'

45. 3h 33m 48s (53d 27' 04") +23d 22' 41"

(March 4, 1769) `A cluster of stars, known by the name of the Pleiades. The position reported is that of the star Alcyone.'

46. 7h 31m 11s (112d 47' 43") -14d 19' 07"

(February 19, 1771) `A cluster of very small stars, between the head of the Great Dog and the two hind feet of the Unicorn, [its position] determined by comparing this cluster with the star 2 Navis, of 6th-magnitude, according to Flamsteed; one cannot see these stars but with a good refractor; the cluster contains a bit of nebulosity.'



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# Messier Catalog Object 47-51

47. 7h 44m 16s (116d 03' 58") -14d 50' 08"

(February 19, 1771) `Cluster of stars, little distant from the preceding; the stars are greater [brighter]; the middle of the cluster was compared with the same star, 2 Navis. The cluster contains no nebulosity.'

(At the position recorded by Messier, which also found its way into John Herschel's GC as GC 1594 and, consequently, into Dreyer's NGC as NGC 2478, no cluster is found, so that this object was missed, until Oswald Thomas identified it correctly but perhaps by chance in 1934 as Herschel's cluster H VIII.38 (NGC 2422), and T.F. Morris, in 1959, realised that Messier had done a simple sign error in RA difference when reducing the positional data.)

48. 8h 02m 24s (120d 36' 00") -1d 16' 42"

(February 19, 1771) `Cluster of very small [faint] stars, without nebulosity; this cluster is at a short distance from the three stars that form the beginning of the Unicorn's tail.'

(As for M47, Messier did a reduction error, this time giving a position exactly 5 degrees north of the object, so that M48 was missing until T.F. Morris identified it in 1959 (with Herschel's H VI.22, NGC 2548).)

49. 12h 17m 48s (184d 26' 58") +9d 16' 09"

(February 19, 1771) `Nebula discovered near the star Rho Virginis. One cannot see it without difficulty with an ordinary telescope of 3.5-feet [FL]. The Comet of 1779 was compared by M. Messier with this nebula on April 22 and 23: The comet and the nebula had the same light. M. Messier has reported this nebula on the chart of the route of the comet, which appeared in the volume of the Academy of the same year 1779. Reviewed on April 10, 1781.'

50. 6h 51m 50s (102d 57' 28") -7d 57' 42"

(April 5, 1772) `Cluster of small stars, more or less brilliant, above the right loins of the Unicorn, above the star Theta of the ear of Canis Major, & near a star of 7th magnitude. It was while observing the Comet of 1772 that M. Messier observed this cluster. He has reported it on the chart of that comet, on which its trace has been drawn. Mem. Acad. 1772.'

51. 13h 20m 23s (200d 05' 48") +48d 24' 24"

(January 11, 1774) `Very faint nebula, without stars, near the eye of the Northern Greyhound [hunting dog], below the star Eta of 2nd magnitude of the tail of Ursa Major: M. Messier discovered this nebula on October 13, 1773, while he was watching the comet visible at that time. One cannot see this nebula without difficulties with an ordinary telescope of 3.5 foot [FL]: Near it is a star of 8th magnitude. M. Messier reported its position on the Chart of the Comet observed in 1773 & 1774. Memoirs of the Academy 1774, plate III. It is double, each has a bright center, which are separated 4'35". The two "atmospheres" touch each other, the one is even fainter than the other. Reobserved several times.'

[Handwritten note in Messier's personal copy of the 1780 version of the catalog:] M. Méchain has seen that nebula on March 21, 1781 .. [included is a sketch of the two "nebulae" and a star]

(The first, dominant component is NGC 5194 or M51A, or simply M51, while the second, fainter one, discovered by Méchain, is NGC 5195 or M51B).



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# Messier Catalog Object 52-58

52. 23h 14m 38s (348d 39' 27") +60d 22' 12"

(September 7, 1774) `Cluster of very small [faint] stars, mingled with nebulosity, which can be seen only with an achromatic telescope. It was when he observed the Comet which appeared in this year that M. Messier saw this cluster, which was close to the comet on the 7th of September 1774; it is below the star d Cassiopeiae: that star was used to determine [the position of] both the cluster of stars & the comet.'

53. 13h 02m 02s (195d 30' 26") +19d 22' 44"

(February 26, 1777) `Nebula without stars discovered below & near Coma Berenices, a little distant from the star 42 in that constellation, according to Flamsteed. This nebula is round and conspicuous. The Comet of 1779 was compared directly with this nebula, & M. Messier has reported it on the chart of that comet, which will be included in the volume of the Academy for 1779. Reviewed on April 13, 1781: It resembles the nebula which is below Lepus (M79).'

54. 18h 40m 52s (280d 12' 55") -30d 44' 01"

(July 24, 1778) `Very faint nebula, discovered in Sagittarius; its center is brilliant & it contains no star, seen with an achromatic telescope of 3.5 feet [FL]. Its position has been determined from Zeta Sagittarii, of 3rd magnitude.'

55. 19h 26m 02s (291d 30' 25") -31d 26' 27"

(July 24, 1778) `A nebula which is a whitish spot, of about 6' extension, its light is even and does not appear to contain any star. Its position has been determined from zeta Sagittarii, with the use of an intermediate star of 7th magnitude. This nebula has been discovered by M. l'Abbe de LaCaille, see Mem. Acad. 1755, p. 194 [Glyn Jones has erroneously 1775]. M. Messier has looked for it in vain on July 29, 1764, as reported in his memoir.'

56. 19h 08m 00s (287d 00' 01") +29d 48' 14"

(January 23, 1779) `Nebula without stars, having little light; M. Messier discovered it on the same day as he found the comet of 1779, January 19. On the 23rd, he determined its position by comparing it with the star 2 Cygni, according to Flamsteed: it is near the Milky Way; and close to it is a star of 10th magnitude. M. Messier reported it on the chart of the comet of 1779.'

57. 18h 45m 21s (281d 20' 08") +32d 46' 03"

(January 31, 1779) `A cluster of light between Gamma & Beta Lyrae, discovered when looking for the Comet of 1779, which has passed it very close: it seems that this patch of light, which is round, must be composed of very small stars: with the best telescopes it is impossible to distinguish them; there stays only a suspicion that they are there. M. Messier reported this patch of light on the Chart of the Comet of 1779. M. Darquier, at Toulouse, discovered it when observing the same comet, and he reports: "Nebula between gamma and beta Lyrae; it is very dull, but perfectly outlined; it is as large as Jupiter & resembles a planet which is fading".'

[was it this description which gave rise to the term, "Planetary Nebula" ?]

58. 12h 26m 30s (186d 37' 23") +13d 02' 42"

(April 15, 1779) `Very faint nebula discovered in Virgo, almost on the same parallel as epsilon [Virginis], 3rd mag. The slightest light for illuminating the micrometer wires makes it disappear. M. Messier reported it on the chart of the Comet of 1779, which is located in the volume of the Academy for the same year.'



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# Messier Catalog Object 59-67

59. 12h 30m 47s (187d 41' 38") +12d 52' 36"

(April 15, 1779) `Nebula in Virgo & in the neighborhood of the preceding [M58], on the parallel of epsilon [Virginis], which has served for its [position] determination: it is of the same light as the above, equally faint. M. Messier reported it on the Chart of the Comet of 1779.'

60. 12h 32m 28s (188d 06' 53") +12d 46' 02"

(April 15, 1779) `Nebula in Virgo, a little more distinct than the two preceding [M58 and M59], on the same parallel as epsilon [Virginis], which has served for its [position] determination. M. Messier reported it on the Chart of the Comet of 1779. He discovered these three nebulae while observing this Comet which passed very close to them. The latter passed so near on April 13 & 14 that the one & the other were both in the same field [of view] of the refractor, and he could not see it; it was not until the 15th, while looking for the Comet, that he perceived the nebula. These three nebulae don't appear to contain any star.'

61. 12h 10m 44s (182d 41' 05") +5d 42' 05"

(May 11, 1779) `Nebula, very faint & difficult to perceive. M. Messier mistook this nebula for the Comet of 1779, on the 5th, 6th & 11th of May; on the 11th he recognized that this was not the Comet, but a nebula which was located on its path & in the same point [place] of the sky.'

62. 16h 47m 14s (251d 48' 24") -29d 45' 30"

(June 4, 1779) `Very beautiful nebula, discovered in Scorpio, it resembles a little Comet, the center is brilliant & surrounded by a faint glow. Its position [was] determined, by comparing it with the star Tau of Scorpius. M. Messier had already seen this nebula on June 7, 1771, without having determined the position where it is close to. Reviewed on March 22, 1781.'

63. 13h 04m 22s (196d 05' 30") +43d 12' 37"

(June 14, 1779) `Nebula discovered by M. Méchain in Canes Venatici. M. Messier searched for it; it is faint, it has nearly the same light as the nebula reported under no. 59 [M59]: it contains no star, & the slightest illumination of the micrometer wires makes it disappear: it is close to a star of 8th magnitude, which precedes the nebula on the hour wire. M. Messier has reported its position on the Chart of the path of the Comet of 1779.'

64. 12h 45m 51s (191d 27' 38") +22d 52' 31"

(March 1, 1780) `Nebula discovered in Coma Berenices, which is about half as apparent as that which is below the hair [M53]. M. Messier has reported its position on the Chart of the Comet of 1779. Reviewed on March 17, 1781.'

65. 11h 07m 24s (166d 50' 54") +14d 16' 08"

(March 1, 1780) `Nebula discovered in Leo: It is very faint and contains no star.'

66. 11h 08m 47s (167d 11' 39") +14d 12' 21"

(March 1, 1780) `Nebula discovered in Leo; its light is very faint & it is very close to the preceding [M65]: They both appear in the same field [of view] in the refractor. The comet of 1773 & 1774 has passed between these two nebulae on November 1 to 2, 1773. M. Messier didn't see them at that time, no doubt, because of the light of the comet.'

67. 8h 36m 28s (129d 06' 57") +12d 36' 38"

(April 6, 1780) `Cluster of small stars with nebulosity, below the southern claw of Cancer. The position determined from the star Alpha [Cancr].'



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# Messier Catalog Object 68-73

68. 12h 27m 38s (186d 54' 33") -25d 30' 20"

(April 9, 1780) `Nebula without stars below Corvus & Hydra; it is very faint, very difficult to see with the refractors; near it is star of sixth magnitude.'

ADDITION to the Catalog of Nebulae & clusters of Stars by M. Messier, inserted in the Connoiss. des Temps for 1783, pag. 225 & following. This Catalog, we have also reported in this [volume], pages 227-254 ...

69. 18h 16m 47s (274d 11' 46") -32d 31' 45"

(August 31, 1780) `Nebula without star, in Sagittarius, below his left arm & near the arc; near it is a star of 9th magnitude; its light is very faint, one can only see it under good weather, & the least light employed to illuminate the micrometer wires makes it disappear: its position has been determined from Epsilon Sagittarii: this nebula has been observed by M. de La Caille, & reported in his Catalog; it resembles the nucleus of a small Comet.' (diam 2')

70. 18h 28m 53s (277d 13' 16") -32d 31' 07"

(August 31, 1780) `Nebula without star, near the preceding [M69], & on the same parallel: near it is a star of the ninth magnitude & four small telescopic stars, almost on the same straight line, very close to one another, & [they] are situated above the nebula, as seen in a reversing telescope; the [position of the] nebula was determined from the same star Epsilon Sagittarii.' (diam 2')

71. 19h 43m 57s (295d 59' 06") +18d 13' 00"

Méchain: (296d 00' 04") +18d 14' 21"

(October 4, 1780) `Nebula discovered by M. Méchain on June 28, 1780, between the stars Gamma and Delta Sagittae. On October 4 following, M. Messier looked for it: its light is very faint & it contains no star; the least light makes it disappear. It is situated about 4 degrees below [south of] that which M. Messier discovered in Vulpecula. See No. 27. He reported it on the Chart of the Comet of 1779.' (diam 3 1/5')

72. 20h 41m 23s (310d 20' 49") -13d 20' 51"

Méchain: (310d 21' 10") -13d 21' 24"

(October 4, 1780) `Nebula seen by M. Méchain in the night of August 29-30, 1780, above the neck of Capricorn. M. Messier looked for it on the 4th and 5th October following: the light is as faint as for the preceding [M71]; near it is a small telescopic star: the position was determined from the star Nu Aquarii, of fifth magnitude.' (diam 2')

73. 20h 46m 52s (311d 43' 04") -13d 28' 40"

(October 4 & 5, 1780) `Cluster of three or four small stars, which resembles a nebula at first sight, containing a little nebulosity: this cluster is situated on the same parallel as the preceding nebula [M72]: its position was determined from the same star Nu Aquarii.'



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# Messier Catalog Object 74-78

74. 1h 24m 57s (21d 14' 09") +14d 39' 35"

Méchain: (21d 17' 00") +14d 36' 00"

(October 18, 1780) `Nebula without stars, near the star Eta Piscium, seen by M. Méchain at the end of September 1780, & he reports: "This nebula doesn't contain any stars; it is fairly large, very obscure, and extremely difficult to observe; one can recognize it out with more certainty in fine, frosty conditions". M. Messier looked for it & found it, as M. Méchain describes it: it has been compared directly with the star Eta Piscium.'

75. 19h 53m 10s (298d 17' 24") -22d 32' 23"

Méchain: (298d 17' 30") -22d 32' 00"

(October 18, 1780) `Nebula without star, between Sagittarius & the head of Capricorn; seen by M. Méchain on August 27 & 28, 1780. M. Messier looked for it on the following October 5, & on October 18, compared it [i.e., its position] with the star 4 Capricorni, of sixth magnitude, according to Flamsteed: it seemed to M. Messier to be composed of nothing but very small stars, containing nebulosity: M. Méchain reported it as a nebula without stars. M. Messier saw it on October 5; but the Moon being above the horizon, & it was not until the 18th of the same month that he was able to judge about its form & determine its position.'

76. 1h 28m 43s (22d 10' 47") +50d 28' 48"

Méchain: (22d 10' 26") +50d 28' 12"

(October 21, 1780) `Nebula at the right foot of Andromeda, seen by M. Méchain on September 5, 1780, & he reports: "This nebula contains no star; it is small and faint". On the following October 21, M. Messier looked for it with his achromatic telescope, & it seemed to him that it was composed of nothing but small stars, containing nebulosity, & that the least light employed to illuminate the micrometer wires causes it disappear: its position was determined from the star Phi Andromedae, of fourth magnitude.' (diam. 2')

77. 2h 31m 30s (37d 52' 33") -0d 57' 43"

Méchain: (37d 52' 58") -0d 57' 44"

(December 17, 1780) `Cluster of small stars, which contains some nebulosity, in Cetus & on the parallel of the star Delta, reported of the third magnitude, & which M. Messier estimated to be hardly of the fifth. M. Méchain saw this cluster on October 29, 1780 in the form of a nebula.'

78. 5h 35m 34s (83d 53' 35") -0d 01' 23"

Méchain: (83d 53' 02") -0d 00' 31"

(December 17, 1780) `Cluster of stars, with much nebulosity in Orion & on the same parallel as the star Delta in the belt, which has served to determine its position; the cluster follows [is east of] the star on the hour wire at 3d 41', & the cluster is above [north of] the star by 27'7". M. Méchain had seen this cluster at the beginning of 1780, & reported: "On the left side of Orion [Glyn Jones has, erroneously, the right]; 2 to 3 minutes in diameter, one can see two fairly bright nuclei, surrounded by nebulosity".' (diam. 3')



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# Messier Catalog Object 79-85

79. 5h 15m 16s (78d 49' 02") -24d 42' 57"

Méchain: (78d 47' 10") -24d 44' 46"

(December 17, 1780) `Nebula without star, situated below Lepus, & on the same parallel as a star of sixth magnitude: seen by M. Méchain on October 26, 1780. M. Messier looked for it on the following December 17: this nebula is beautiful; the center brilliant, the nebulosity a little diffuse; its position was determined from the star Epsilon Leporis, of fourth magnitude.'

80. 16h 04m 00s (240d 59' 48") -22d 25' 13"

Méchain: (241d 00' 26") -22d 27' 58"

(January 4, 1781) `Nebula without star, in Scorpius, between the stars g. [now Rho Ophiuchi] and Delta, compared to g to determine its position: this nebula is round, the center brilliant, & it resembles the nucleus of a small Comet, surrounded with nebulosity. M. Méchain saw it on January 27, 1781.' (diam. 2')

81. 9h 37m 51s (144d 27' 44") +70d 07' 24"

Méchain: (144d 27' 00") +70d 04' 00"

(February 9, 1781) `A nebula near the ear of the great Bear [Ursa Major], on the parallel of the star d, of fourth or fifth magnitude: its position was determined from that star. This nebula is a little oval, the center clear, & one can see it well in an ordinary telescope of 3.5 feet [FL]. It was discovered by M. Bode at Berlin on December 31, 1774, & by M. Méchain, in the month August 1779.'

82. 9h 37m 57s (144d 29' 22") +70d 44' 27"

Méchain: (144d 28' 13") +70d 43' 05"

(February 9, 1781) `Nebula without star, near the preceding [M81]; both are appearing in the same field of the telescope, this one is less distinct than the preceding; its light faint & [it is] elongated: at its extremity is a telescopic star. Seen at Berlin, by M. Bode, on December 31, 1774, & by M. Méchain in the month August 1779.'

83. 13h 24m 33s (201d 08' 13") -28d 42' 27"

(February 17, 1781) `Nebula without star, near the head of Centaurus: it appears as a faint & even glow, but it is difficult to see in the telescope, as the least light to illuminate the micrometer wires makes it disappear. One is only able with the greatest concentration to see it at all: it forms a triangle with two stars estimated of sixth & seventh magnitude: [its position was] determined from the stars i, k and h in the head of Centaurus: M. de la Caille has already determined this nebula. See the end of this Catalog.'

84. 12h 14m 01s (183d 30' 21") +14d 07' 01"

(March 18, 1781) `Nebula without star, in Virgo; the center it is a bit brilliant, surrounded with a slight nebulosity: its brightness & its appearance resemble that of those in this Catalog, No.s 59 & 60.'

85. 12h 14m 21s (183d 35' 21") +19d 24' 26"

Méchain: (183d 35' 45") +19d 23' 00"

(March 18, 1781) `Nebula without star, above & near to the ear of the Virgin [Virgo], between the two stars in Coma Berenices, No.s 11 & 14 of the Catalog of Flamsteed: this nebula is very faint. M. Méchain had determined its position on March 4, 1781.'



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# Messier Catalog Object 86-93

86. 12h 15m 05s (183d 46' 21") +14d 09' 52"

(March 18, 1781) `Nebula without star, in Virgo, on the parallel & very near to the nebula above, No. 84: their appearances are the same, & both appear together in the same field of the telescope.'

87. 12h 19m 48s (184d 57' 06") +13d 38' 01"

(March 18, 1781) `Nebula without star, in Virgo, below & very near a star of eighth magnitude, the star having the same Right Ascension as the nebula, & its Declination was 13d 42' 21" north. This nebula appears at the same luminosity as the two nebulae Nos. 84 and 86.'

88. 12h 21m 03s (185d 15' 49") +15d 37' 51"

(March 18, 1781) `Nebula without star, in Virgo, between two small stars & one star of the sixth magnitude, which appear at the same time as the nebula in the field of the telescope. Its luminosity is one of the faintest, & [it] resembles the one reported in Virgo, No. 58.'

89. 12h 24m 38s (186d 09' 36") +13d 46' 49"

(March 18, 1781) `Nebula without star, in Virgo, a little of distance from & on the same parallel as the nebula reported above, No. 87. Its light was extremely faint & pale, & and it is not without difficulty that one can distinguish it.'

90. 12h 25m 48s (186d 27' 00") +14d 22' 50"

(March 18, 1781) `Nebula without star, in Virgo: its light is as faint as the preceding, No. 89.'

91. 12h 26m 28s (186d 37m 00s) +14d 57' 06"

(March 18, 1781) `Nebula without star, in Virgo, above the preceding No. 90: its light is still fainter than that of the above.'

(At the position Messier has given, no object is present which he could have seen, thus M91 was missing until 1969, when William C. Williams discovered that Messier had probably measured its position from M89, while he thought he used M58, and plotted it wrong.)

(Following the entry for M91 in the Connoissance des Temps for 1784, Messier added the note below:)

`Note. The constellation of Virgo, & especially the northern Wing is one of the constellations which encloses the most Nebulae: this Catalog contains thirteen which have been determined: viz. Nos. 49, 58, 59, 60, 61, 84, 85, 86, 87, 88, 89, 90, & 91. All these nebulae appear to be without stars: one can see them only in a very good sky, & near their meridian passage. Most of these nebulae have been pointed to me by M. Méchain.'

92. 17h 10m 32s (257d 38' 03") +43d 21' 59"

(March 18, 1781) `Nebula, fine, distinct, & very bright, between the knee & the left leg of Hercules, it can be seen very well in a telescope of one foot [FL]. It contains no star; the center is clear & brilliant, surrounded by nebulosity & [it] resembles the nucleus of a large Comet: its brightness, its size, approach much that of the nebula which is in the girdle of Hercules. See No. 13 of this Catalog: its position has been determined, by direct comparison with the star Sigma Herculis, fourth magnitude: the nebula & the star are on the same parallel.' (diam. 5')

93. 7h 35m 14s (113d 48' 35") -23d 19' 45"

(March 20, 1781) `Cluster of small stars, without nebulosity, between the Greater Dog [Canis Major] and the prow of the ship [Puppis of Argo Navis].' (diam 8')



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# Messier Catalog Object 94-99

94. 12h 40m 43s (190d 10' 46") +42d 18' 43"

Méchain: (190d 09' 38") +42d 18' 50"

(March 24, 1781) `Nebula without star, above the Heart of Charles [alpha Canum Venaticorum], on the parallel of the star no. 8, of sixth magnitude of the Hunting Dogs [Canes Venatici], according to Flamsteed: In the center it is brilliant & the nebulosity [is] a bit diffuse. It resembles the nebula which is below Lepus, No. 79; but this one is more beautiful & brighter: M. Méchain has discovered this one on March 22, 1781.' (diam. 2.5')

95. 10h 32m 12s (158d 03' 05") +12d 50' 21"

Méchain: (158d 06' 23") +12d 49' 50"

(March 24, 1781) `Nebula without star, in the Lion [Leo], above star l (53 Leonis): its light is very faint.'

96. 10h 35m 05s (158d 46' 20") +12d 58' 09"

Méchain: (158d 48' 00") +12d 57' 33" (March 24, 1781) `Nebula without star, in the Lion [Leo], near the preceding [No. 95]: this one is less distinct, both are on the same parallel of Regulus: they resemble the two nebulae in the Virgin [Virgo], Nos. 84 and 86. M. Méchain saw them both on March 20, 1781.'

97. 11h 01m 15s (161d 18' 40") +56d 13' 30"

(actually, an erroneous "A" for "Australis", thus "Southern dec" appears in the printed version of the Catalog in the Connaissance des Temps, while not in Messier's preliminary, handwritten notes)

(March 24, 1781) `Nebula in the great Bear [Ursa Major], near Beta: It is difficult to see, reports M. Méchain, especially when one illuminates the micrometer wires: its light is faint, without a star. M. Méchain saw it the first time on Feb 16, 1781, & the position is that given by him. Near this nebula he has seen another one, [the position of] which has not yet been determined [M108], and also a third which is near Gamma of the Great Bear [M109 near Gamma Ursae Majoris].' (diam. 2')

(The two nebulae mentioned here have been entitled M108 and M109 by Owen Gingerich in 1953, see the additional Messier objects.)

98. 12h 03m 23s (180d 50' 49") +16d 08' 15"

(April 13, 1781) `Nebula without star, of an extremely faint light, above the northern wing of Virgo, on the parallel & near to the star no. 6, fifth magnitude, of Coma Berenices, according to Flamsteed. M. Méchain saw it on Mar 15, 1781.'

99. 12h 07m 41s (181d 55' 19") +15d 37' 12"

(April 13, 1781) `Nebula without star, of a very pale light, nevertheless a little clearer than the preceding [M98], situated on the northern wing of Virgo, & near the same star, no. 6, of Comae Berenices. The nebula is between two stars of seventh & of eighth magnitude. M. Méchain saw it on March 15, 1781.'



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# Messier Catalog Object 100-104

100. 12h 11m 57s (182d 59m 19s) +16d 59' 21"

(April 13, 1781) `Nebula without star, of the same light as the preceding [M99], situated in the ear of Virgo. Seen by M. Méchain on March 15, 1781. The three nebulae, nos. 98, 99 & 100, are very difficult to recognize, because of the faintness of their light: one can observe them only in good weather, & near their passage of the Meridian.'

By M. Méchain, which M. Messier has not yet seen.

101. 13h 43m 28s (208d 52' 42") +55d 24' 25"

(March 27, 1781) `Nebula without star, very obscure & pretty large, of 6 or 7 minutes [of arc] in diameter, between the left hand of Bootes & the tail of the great Bear [Ursa Major]. It is difficult to distinguish when one lits the [graticule] wires.' (diam. 7')

102.

(Méchain) `Nebula between the stars Omicron Bootis & Iota Draconis: it is very faint; near it is a star of the sixth magnitude.'

(Handwritten position added by Messier in his personal copy: 14h 40m, +56.)

103.

(Méchain) `Cluster of stars between Epsilon & Delta of the leg of Cassiopeia.'

(Handwritten position added by Messier in his personal copy: 1h 20m, +61.)

[104.] 12h 28m 39s (187d 9' 42") -10d 24' 49"

[Messier's handwritten note on bottom margin of p. 264, below M97] (May 11, 1781). `Very faint nebula, seen by M. Méchain on May 11, 1781.



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