Messier and his Catalogue

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Charles Messier and his Catalogue

Charles Messier 1730 - 1817

Astronomers talk a lot about ‘M’ number this and ‘M’ number that so what are these ‘M’ numbers?

The ‘M’ is short for Messier and refers to in an object from the Messier Catalogue of ‘fuzzy’ objects.

Charles Messier was a French comet hunter who spent much of his life searching for and studying comets.

While scanning the night sky, Messier kept finding ‘fuzzy’ objects that were not stars, looked like comets but did not appear to move like comets.

To avoid confusion Messier made a list of these ‘fuzzy’ objects so he could avoid them when he was searching for new comets.

Charles Messier and his Catalogue

Charles Messier 1730 - 1817

He was a comet hunter

He found objects that looked like comets

Some of these objects we not comets

He did not know what these objects were

So he listed these objects that he wanted to ignore

These turned out to be interesting objects

Originally he listed 44 objects in his Catalogue

The final issue of his Catalogue had 110 objects

With the advancement of telescope and our knowledge of Astronomy we now know what these objects are.

In fact these are the very interesting things that amateur astronomers search out when they start exploring the night sky.

Charles Messier's Catalogue

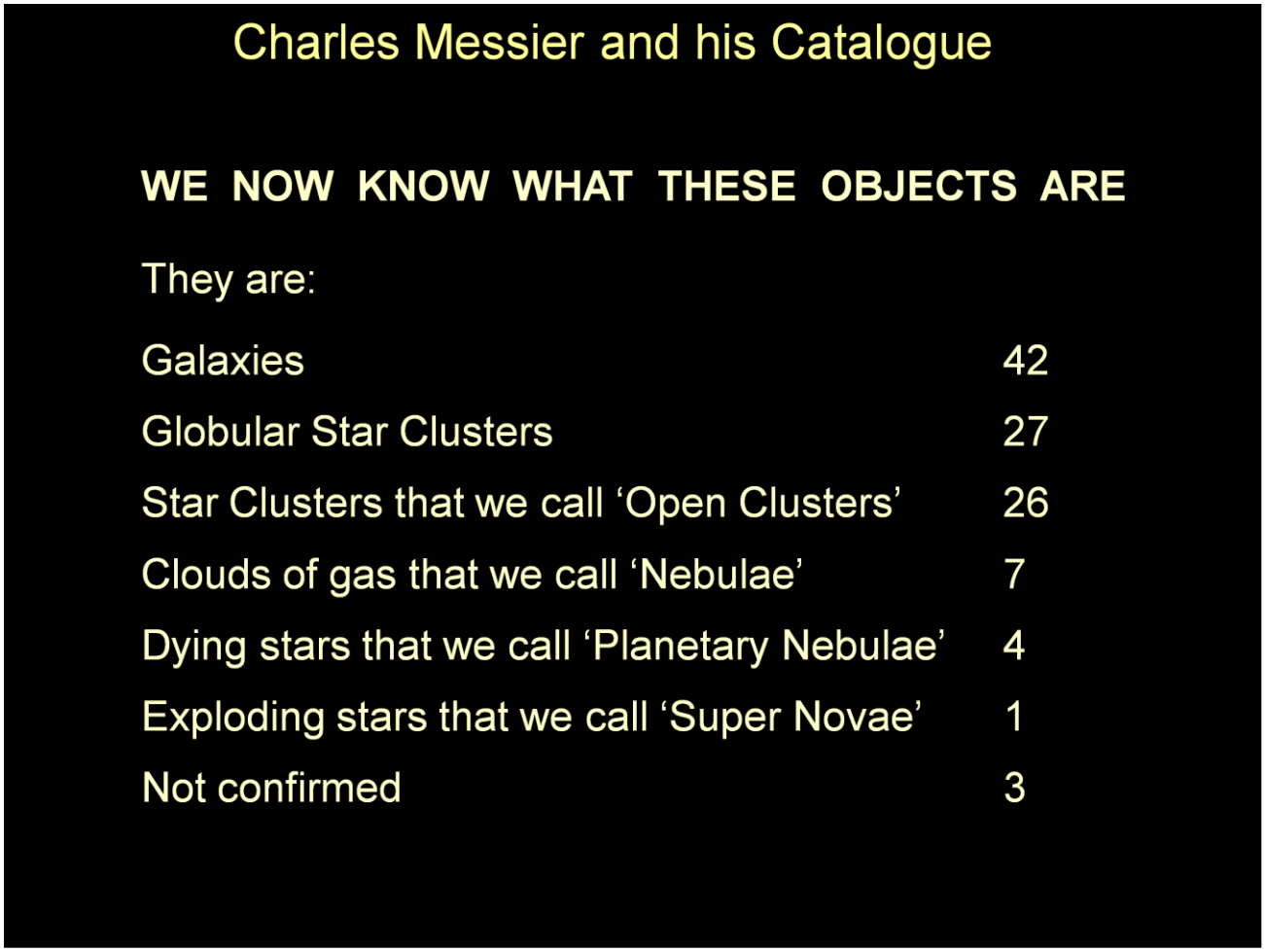
NUM	CONSTELLATION	OBJECT	NUM	CONSTELLATION	OBJECT	NUM	CONSTELLATION	OBJECT
M.01	Taurus	Supernova remnant	M.38	Auriga	Open cluster cruciform	M.75	Sagittarius	Globular cluster
M.02	Aquarius	Globular cluster	M.39	Cygnus	Open cluster	M.76	Perseus	Planetary
M.03	Canes Venatici	Globular cluster	M.40	Ursa Major	Double star	M.77	Cetus	Galaxy
M.04	Scorpio	Globular cluster	M.41	Canis Major	Open cluster naked eye	M.78	Orion	Nebula
M.05	Serpens	Globular	M.42	Orion	Nebula the Great nebula	M.79	Lepus	Globular cluster
M.06	Scorpio	Open cluster naked-eye	M.43	Orion	Nebula (part of M42)	M.80	Scorpio	Globular cluster
M.07	Scorpio	Open cluster	M.44	Cancer	Open cluster Praesepe.	M.81	Ursa major	Galaxy type Sb
M.08	Sagittarius	Lagoon Nebula	M.45	Taurus	Open cluster Pleiades	M.82	Ursa major	Galaxy irregular
M.09	Ophiuchus	Globular cluster	M.46	Puppis	Open cluster	M.83	Hydra	Galaxy type Sc
M.10	Ophiuchus	Globular cluster	M.47	Puppis	Open cluster naked-eye	M.84	Virgo	Galaxy type E1
M.11	Scutum	Open cluster Wild Duck	M.48	Hydra	Open cluster	M.85	Coma Berenices	Galaxy type Ep
M.12	Ophiuchus	Globular cluster	M.49	Virgo	Galaxy type E4	M.86	Virgo	Galaxy type E3
M.13	Hercules	Naked-eye Globular	M.50	Monoceros	Open cluster none	M.87	Virgo	Galaxy type Eo
M.14	Ophiuchus	Globular cluster	M.51	Canes Benatici	Spiral galaxy Whirlpool	M.88	Coma Berenices	Galaxy type Sb
M.15	Pegasus	Globular cluster	M.52	Cassiopeia	Open cluster	M.89	Virgo	Galaxy type So
M.16	Serpens	Nebula + cluster	M.53	Coma Berenices	Globular cluster	M.90	Virgo	Galaxy type Sc
M.17	Sagittarius	Nebula Omega	M.54	Sagittarius	Globular cluster	M.91	Coma Berenices	Galaxy
M.18	Sagittarius	Open cluster	M.55	Sagittarius	Globular cluster	M.92	Hercules	Globular cluster
M.19	Ophiuchus	Globular cluster	M.56	Lyra	Globular cluster	M.93	Puppis	Open cluster
M.20	Sagittarius	Nebula Triffid Nebula	M.57	Lyra	Planetary Ring Nebula	M.94	Canes Venatici	Spiral Galaxy
M.21	Sagittarius	Open cluster	M.58	Virgo	Galaxy type Sb	M.95	Leo	Galaxy type SBb
M.22	Sagittarius	Globular cluster	M.59	Virgo	Galaxy type E3	M.96	Leo	Galaxy type Sa
M.23	Sagittarius	Open cluster	M.60	Virgo	Galaxy type E1	M.97	Ursa major	Owl Nebula
M.24	Sagittarius	Open cluster	M.61	Virgo	Galaxy type Sc	M.98	Coma Berenices	Galaxy type Sb
M.25	Sagittarius	Open cluster	M.62	Ophiuchus	Globular cluster	M.99	Coma Berenices	Galaxy type Sc
M.26	Scutum	Open cluster	M.63	Canes Venatici	Spiral galaxy	M.100	Coma Berenices	Galaxy
M.27	Vulpecula	Planetary Dumb-Bell	M.64	Coma Berenices	Galaxy Black-Eye	M.101	Ursa Major	Spiral galaxy
M.28	Sagittarius	Globular cluster	M.65	Leo	Galaxy type Sa	M.102	Possibly Galaxies	NGC 5866
M.29	Cygnus	Open cluster	M.66	Leo	Galaxy type Sb	M.103	Cassiopeia	Star cluster
M.30	Capricornus	Globular cluster	M.67	Cancer	Open cluster	M.104	Virgo	Galaxy
M.31	Andromeda	Great Spiral Galaxy	M.68	Hydra	Globular cluster	M.105	Leo	Galaxy
M.32	Andromeda	Galaxy M31 companion	M.69	Sagittarius	Globular cluster	M.106	Canes Venatici	Galaxy
M.33	Triangulum	Galaxy type Sc..	M.70	Sagittarius	Globular cluster	M.107	Ophiuchus	Star cluster
M.34	Perseus	Open cluster	M.71	Sagitta	Open cluster	M.108	Ursa Major	Galaxy
M.35	Gemini	Open cluster naked eye	M.72	Aquarius	Globular cluster	M.109	Ursa Major	Galaxy
M.36	Auriga	Open cluster	M 73	Aquarius	Asterism of stars	M.110	Andromeda	Galaxy
M.37	Auriga	Open cluster	M.74	Pisces	Galaxy			

Messier's first catalogue [of these mysterious fuzzy objects] was published in 1774 and listed 45 objects.

There are now many other catalogues of deep sky objects such as the New General Catalogue (NGC Numbers) with thousands of objects listed.

However the 110 Messier objects are still the things most amateur astronomers start off looking for.

The good thing about these Messier objects is that new astronomers can search them out with their telescopes and see them with their own eyes from their own garden.



We now know that these objects, that we so annoying to Charles Messier, are Deep Space Objects (also called Deep Sky Objects).

They are objects that reside beyond the furthest reaches of our Solar System and out to the most distant parts of the Universe.

42 Galaxies

27 Globular Clusters

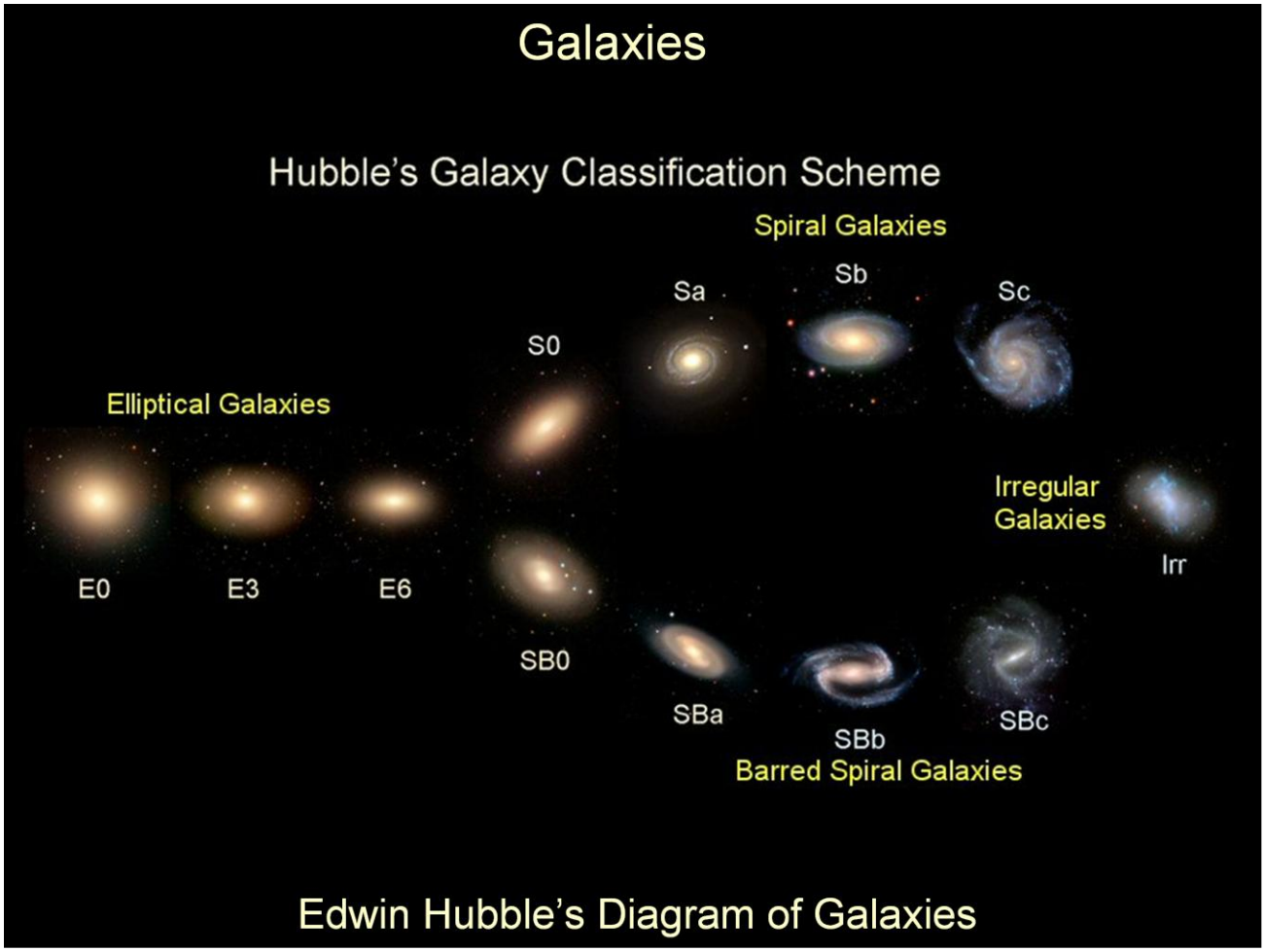
26 Open Clusters

7 Defused Nebulae

4 Planetary Nebulae

1 Super Nova Remnant

3 Not confirmed as real objects



Galaxies are huge conglomerations containing billions of stars. All stars that we know about are located or were formed within galaxies.

Some stars could be found outside galaxies but they are likely to have been ejected from a galaxy.

All the stars we see in our night sky are in our own galaxy that we call 'The Milky Way'.

There are many different types of galaxy but they are divided into four main classes based on their apparent shape.

The shapes are grouped as Elliptical, Spiral, Barred Spiral and Irregular (no regular shape).

Spiral and Barred Spiral galaxies are further divided into three subdivisions a, b and c depending on how tightly the arms are wound.

They are therefore referred to as Sa, Sb and Sc or SBa, SBb and SBc.

Elliptical galaxies have seven subdivisions ranging from E0 for those that appear spherical to E6 for those that are rather cigar shaped.

Galaxies

Our place in the Milky Way Galaxy

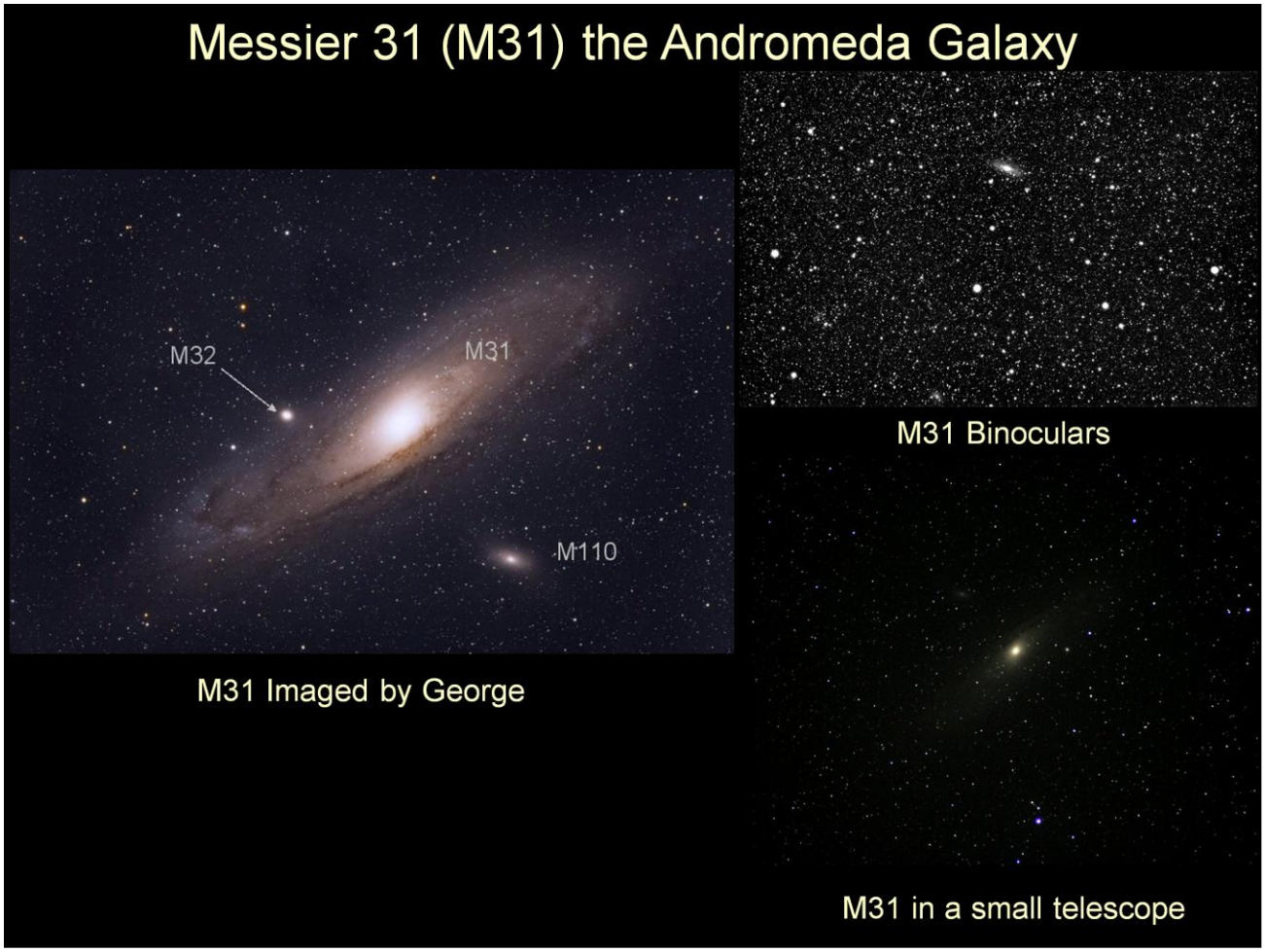
Our Galaxy is a Giant Barred Spiral Galaxy containing about 200 to 300 billion stars.

We call our Galaxy the Milky Way because to ancient astronomers it looked like milk that had been spilt across the sky.

The Milky Way is about 100,000 light years across its flat rotating disc.

It has about 100 Globular Clusters orbiting in irregular paths and forming a sort of halo around it.

The Milky Way has two small Irregular Satellite Galaxies associated to it.



Spiral galaxies are usually large and have a bright central ball of stars with curved arms spreading out from the ball to form a flat rotating disc.

Some of the brighter Messier galaxies are M31 in Andromeda and M65, M66, M95 and M96 in Leo.

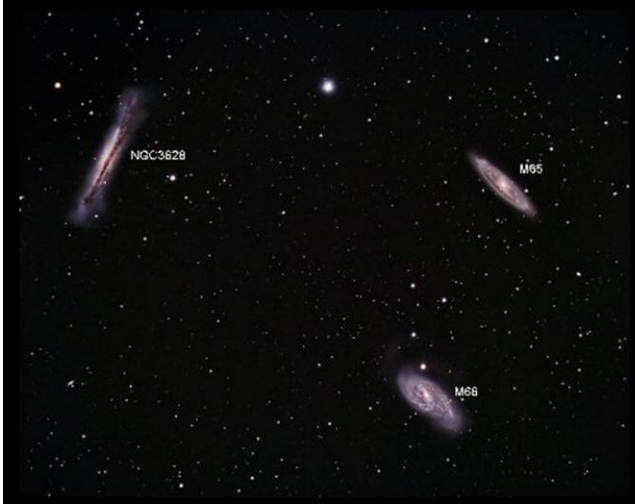
M110 is a small spiral and M32 is a rare Dwarf Elliptical, both are gravitationally associated with M31. See the images above.

Some Elliptical galaxies are the largest of all galaxies and the Irregular galaxies tend to be the smallest with the very smallest being called Dwarf Galaxies.

M31 can be just about seen with the naked eye which makes it the most distant visible object at 2.4 million light years away.

It can be easily seen using binoculars but a telescope is required to see the bright central bulge and the tilted disc.

Messier Galaxies in Leo



M65 and M66 with NGC3628

M95 and M96

M31 is the closest and brightest spiral galaxy and can just about be seen as a small smudge of light with the naked eye in a clear dark sky.

It can be seen as a small cigar shaped patch of fuzzy light using a good pair of binoculars.

However a telescope is needed to see it well and the bigger the telescope used the better it will appear.

All the other galaxies do require a telescope and a dark sky to see. There are four Messier galaxies in Leo these are: M65, M66, M95 and M96.

These can be seen using a 100mm refractor or a 130mm reflecting telescope but will need a clear dark sky.

One of the loveliest galaxies to see is M51 in Canes Venatici and located just off the end of the ‘handle’ of Ursa Major (the Plough). This is two galaxies that have had a close encounter.

Messier Globular Clusters

These are tight balls of 10,000 to 1,000,000 stars

Globular Clusters are satellites of Spiral Galaxies

They form a halo around Spiral Galaxies

Our Galaxy is thought to have about 100

They are thought to be cores of small galaxies

They have their outer stars pulled off

The are comprised of very old stars

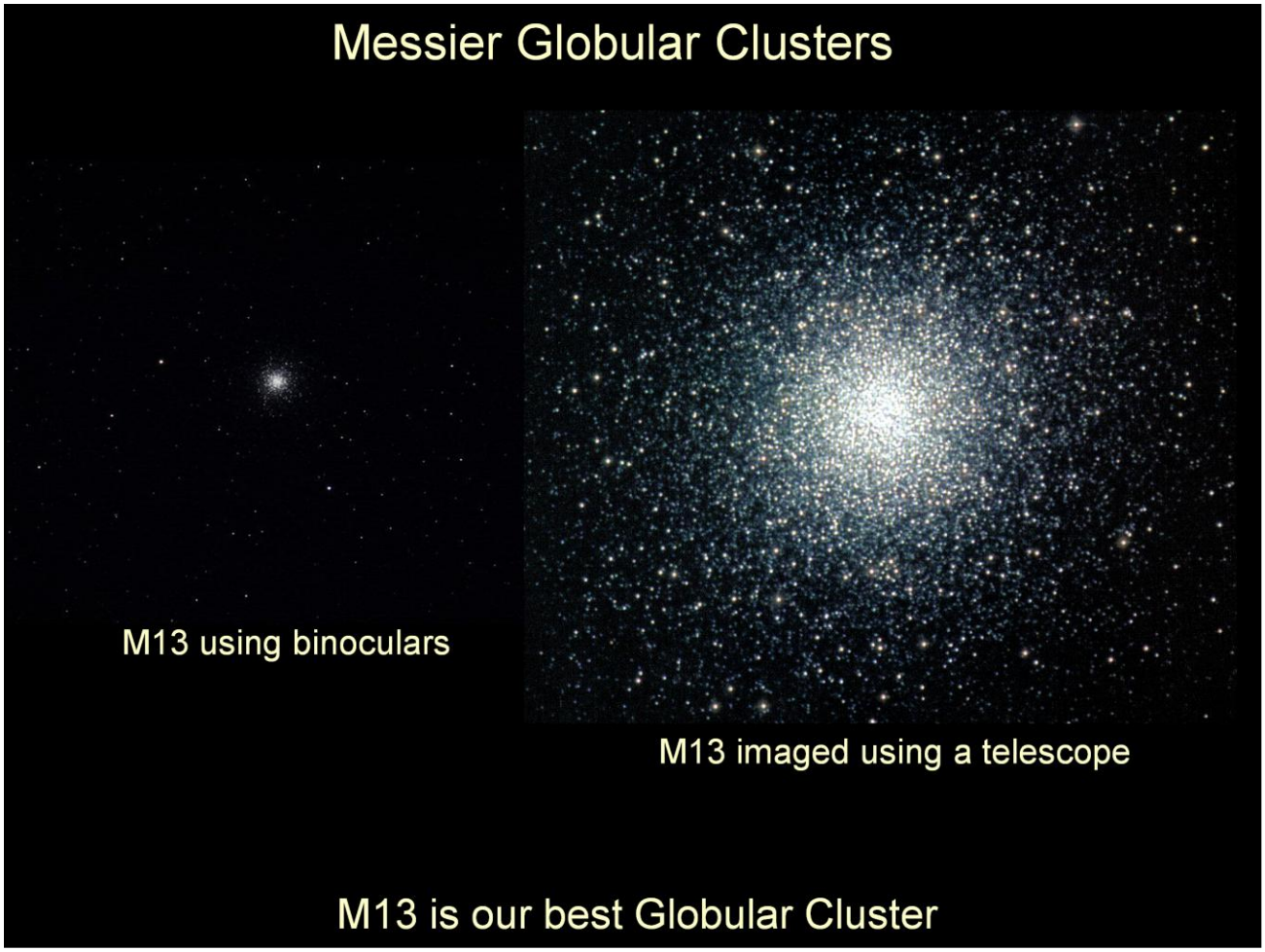
Globular Clusters are spherical clusters of stars that appear as a tight spherical ball of between about ten thousand and a million stars.

These clusters are found in spiral galaxies but are not situated in the main disc of the spiral arms.

They form a halo above and below the main disc of the galaxy orbiting around the central nucleus and even pass through the spiral arms.

The Globular Clusters orbit the central bulge randomly and often pass through the spiral arms.

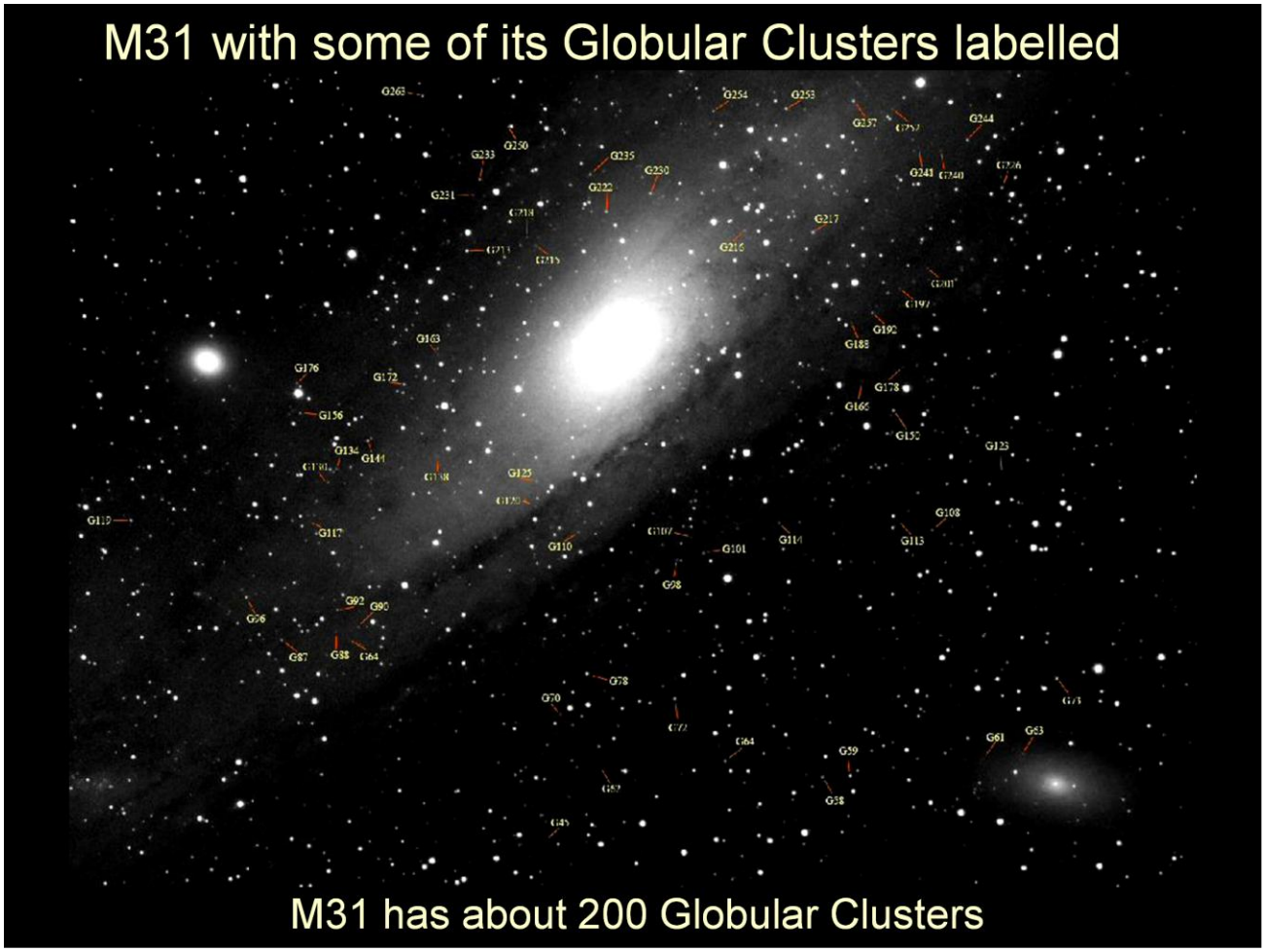
Collisions of individual stars are extremely rare as the spaces between stars, even in the centre of globular clusters, are vast.



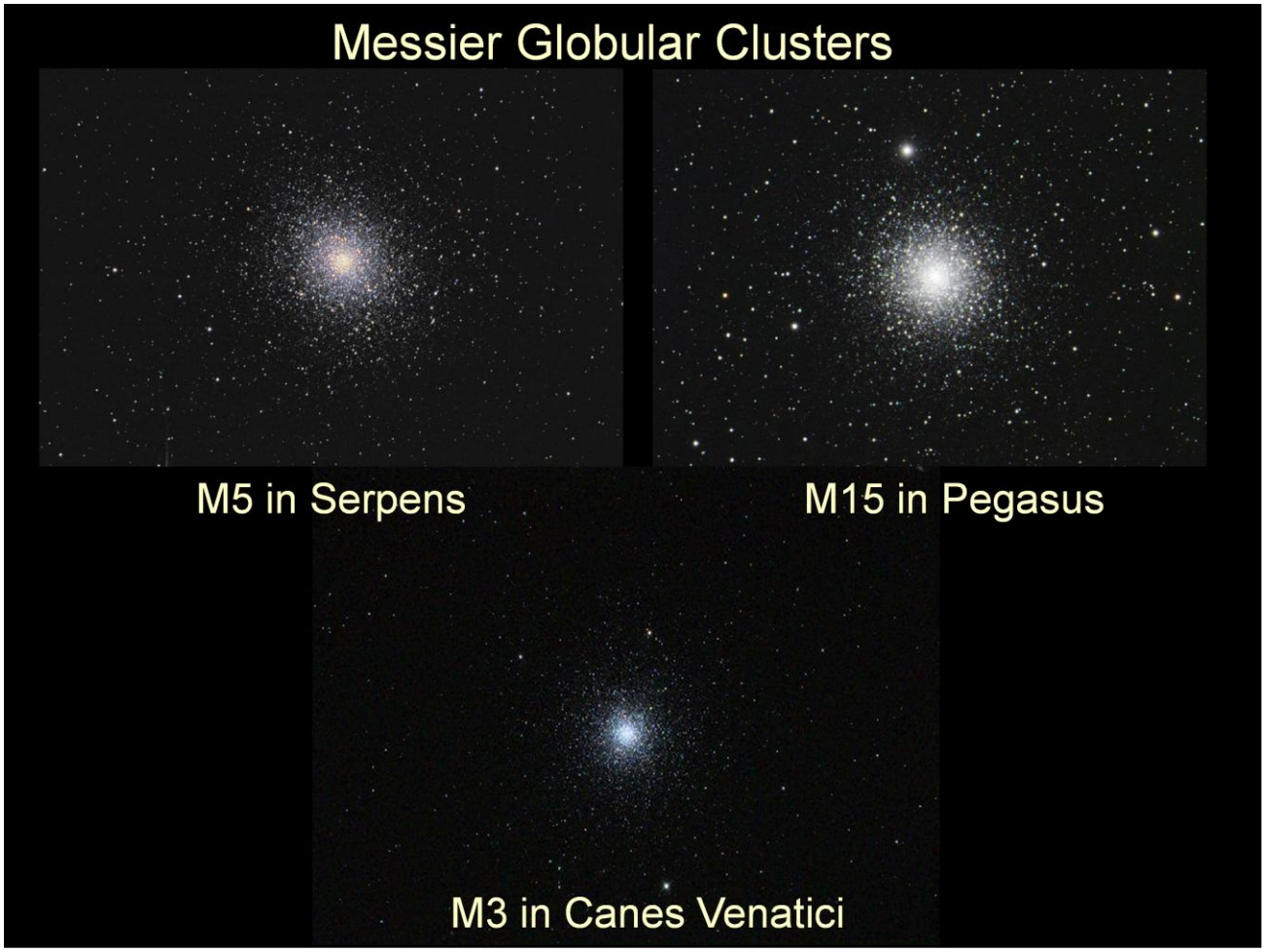
Globular clusters are comprised of very old stars with some appearing to be even older than the galaxy they are found in.

Globular Clusters are thought to be the dense cores of small galaxies that have ventured too close to Giant Spiral Galaxies like our own Milky Way.

Our Galaxy has about 100 Globular Clusters and our closest Giant Spiral Galaxy M31 has about 200.



This image of part of M31 above shows 64 of its estimated 200 Globular Clusters that have been identified and labelled.



All Giant Spiral Galaxies have smaller satellite galaxies associated with them and are gravitationally controlled by the much larger spiral.

Satellite galaxies M32 and M110 are shown on the picture of M31 on the previous image.

These smaller galaxies have orbits that may take them closer to the giant spiral where the strong gravity can pull off the outer stars that are more weakly controlled by the smaller galaxy.

Eventually only the dense cores of these small galaxies are all that is left.

Their orbits random around the giant galaxy and may even take them through the disc and spiral arms.

All Giant Spiral Galaxies have smaller satellite galaxies associated with them and are gravitationally controlled by the much larger spiral.

Our Galaxy has two large Irregular Satellite Galaxies called the Small Magellanic Cloud and the Large Magellanic Cloud.

They are named after the explorer Ferdinand Magellan who recorded seeing them on his circumnavigation of the world in 1519–1522.

They can be seen easily from the southern Hemisphere (south of the equator) but cannot be seen from the northern hemisphere.

Messier Open Clusters

Open Clusters are groups of 30 to 1000 stars

They form in the arms of Spiral Galaxies

They are the birth place of all stars

Our Galaxy is thought to have 1000s

We can see Open Clusters in stages of development

Our Sun was created in an Open Cluster

They are beautiful to see

The main disc of Spiral Galaxies are full of Hydrogen gas with about 11% of Helium gas and dust deposited by exploding stars - we call this gas a 'Nebula'.

Open Star Clusters are groups of between a few tens to a few thousand stars that have formed together from a collapsing cloud of gas and dust in a Nebula.

When stars form in a nebula they start their life as very active stars with a powerful wind of radiation blasting out into the surrounding space.

This 'Solar Wind' eventually pushes the remaining gas and dust away to reveal a cluster of new stars.

As millions of years pass the stars gradually move further apart until the cluster is dispersed.

M45 'The Pleiades' (Seven Sisters) in Taurus is one of our closest and most beautiful open clusters.

Messier 45 (the Seven Sisters)

The Pleiades' (Seven Sisters) in Taurus
Can be seen with the 'naked' eye

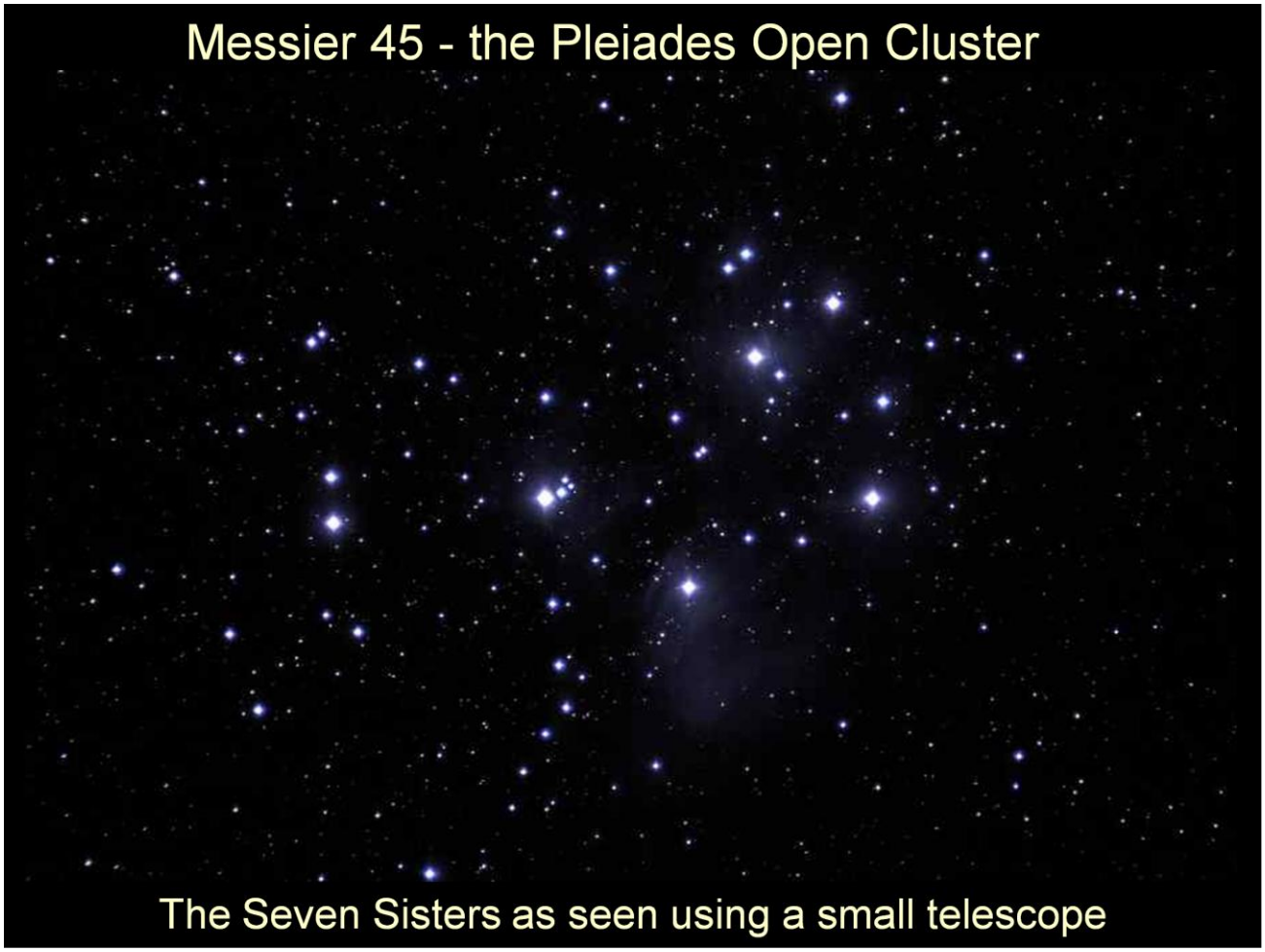
M45 'The Pleiades' (Seven Sisters) in Taurus is one of our closest and most beautiful open clusters.

Messier 45 (M45) is the brightest and most impressive of the many Open Clusters that are included Charles Messier's Catalogue.

Anyone with reasonably good eyesight will be able to count the six brightest stars in M45 on a clear dark night.

Initially the cluster may look like a small fuzzy cloud but with a deeper study the individual stars can be seen.

The image above (from Richard Fleet) shows M45 at the top centre of the image. The Hyades is to the left of M45 and Orion is further to the lower left.



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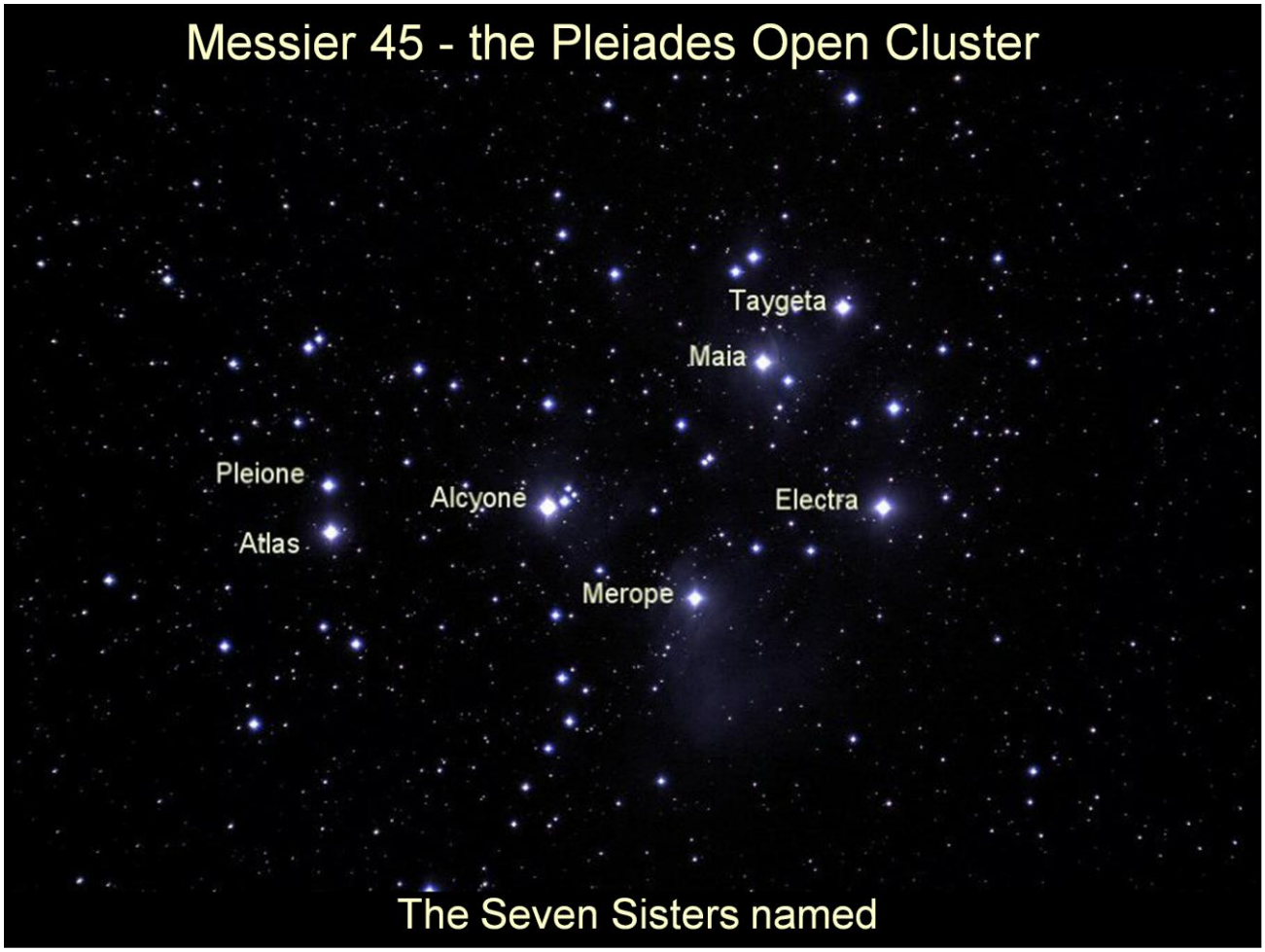
We can see the brightest stars (with good eyesight including Pleione the most difficult) that are called the Seven Sisters.



The stars of M45 are young (about 100 million years old). The brightest stars are large and up to ten times the mass of our Sun and about 100,000 times brighter.

When photographed they appear to be surrounded by a halo of light.

It was originally thought to be some of the gas from the nebula from which the stars formed.

We now know it is just a cloud of inter stellar gas that cluster is passing through and is being illuminated by the stars.

The brightest stars in the cluster are also spinning very fast.

However the stars that we call the Seven Sisters are in fact five of the sisters and their Father (Atlas) and Mother (Pleione).

The missing sisters are called Celaeno and Asterope (also called Sterope).

Messier 45 (M45) the Seven Sisters

Alcyone	Eta Tauri (25 Tauri)	B7IIIe	2.86
Atlas (Father)	27 Tauri	B8III	3.62
Electra	17 Tauri	B6IIIe	3.70
Maia	20 Tauri	B7III	3.86
Merope	23 Tauri	B6IVev	4.17
Taygeta	19 Tauri	B6V	4.29
Pleione (Mother)	BU Tauri (28 Tauri)	B8IVpe	5.09
Celaeno	16 Tauri	B7IV	5.44
Sterope (Asterope)	21 Tauri, 22 Tauri	B8Ve, B9V	5.64, 6.41

The chart above shows the nine brightest stars in the M45 cluster in order of their brightness from the top (the magnitude is shown in the right column lowest magnitude number denotes the brightest). So Alcyone is the brightest.

The Seven Sisters names are: Alcyone, Electra, Maia, Merope, Taygeta, Celaeno and Asterope (also called Sterope).

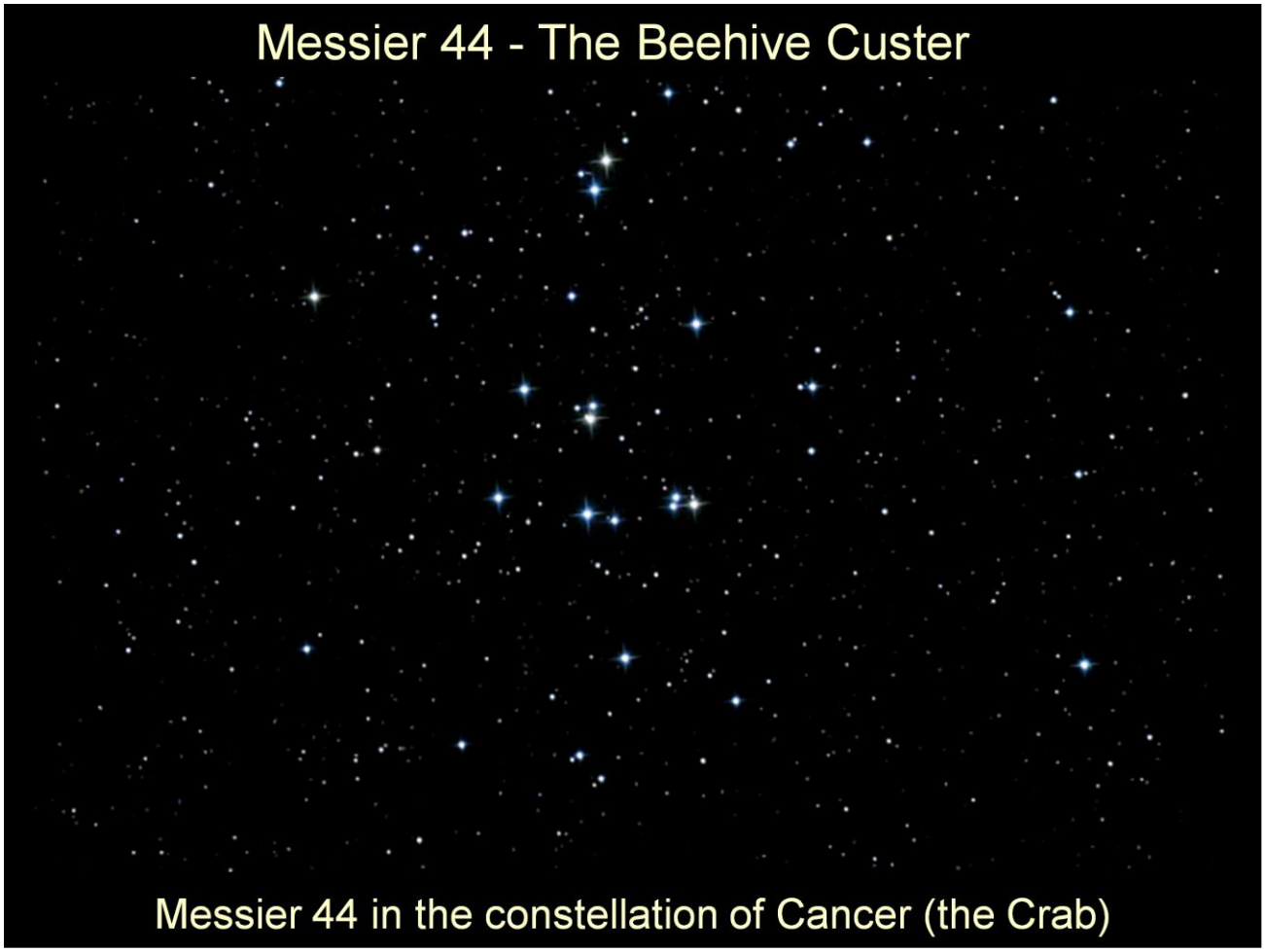
It can be seen that Atlas and Pleione (shown in red) are actually the sisters' Father Atlas (the Titan who holds the World in his shoulders) and their Mother Pleione.

The two fainter stars Celaeno and Asterope (also called Sterope) (are shown orange) and are the real 6th and 7th sisters. Asterope is actually a binary (double) star.

The true sisters (white and orange) and their Mother and Father are labelled (red) on the image above.

The Seven Sisters names are: Alcyone, Electra, Maia, Merope, Taygeta, Celaeno and Asterope (also called Sterope).

Atlas and Pleione are their Father and Mother and are shown in red.



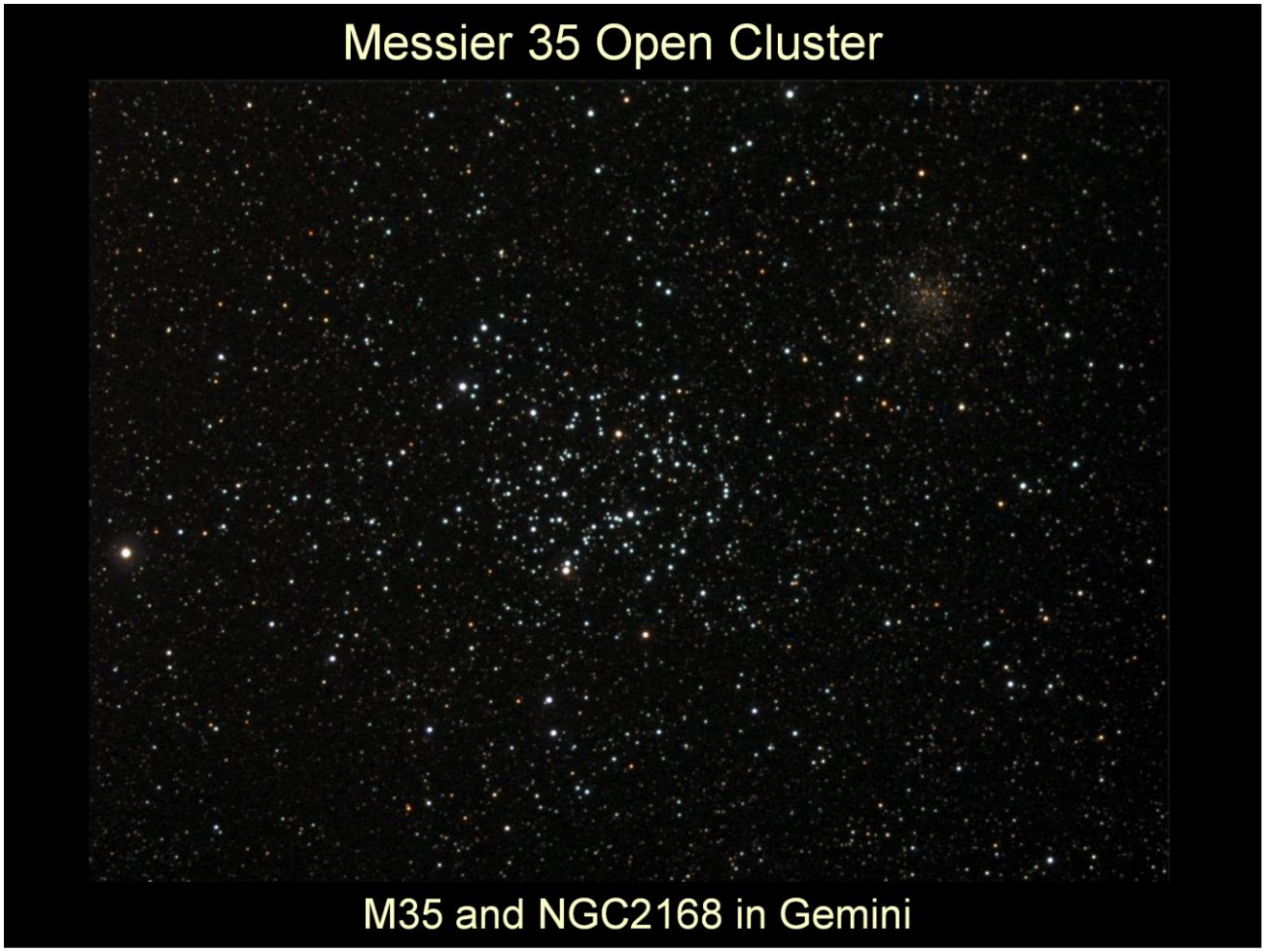
Another naked eye open cluster is M44 in Cancer and is also beautiful to see.

It can be seen in a dark sky on a clear night but the stars are not so bright as those in M45 and more spread out.

Binoculars will show the cluster at its best with more than forty stars visible.

M44 is called the Beehive Cluster because four or five of the brightest stars can appear to look like an old straw beehive.

The rest of the cluster is said to look like bees flying around the beehive.



M35 is the best of the four Open Clusters in Gemini and Auriga.

M35 looks beautiful using a telescope and has what appears to be a string of stars running through it.

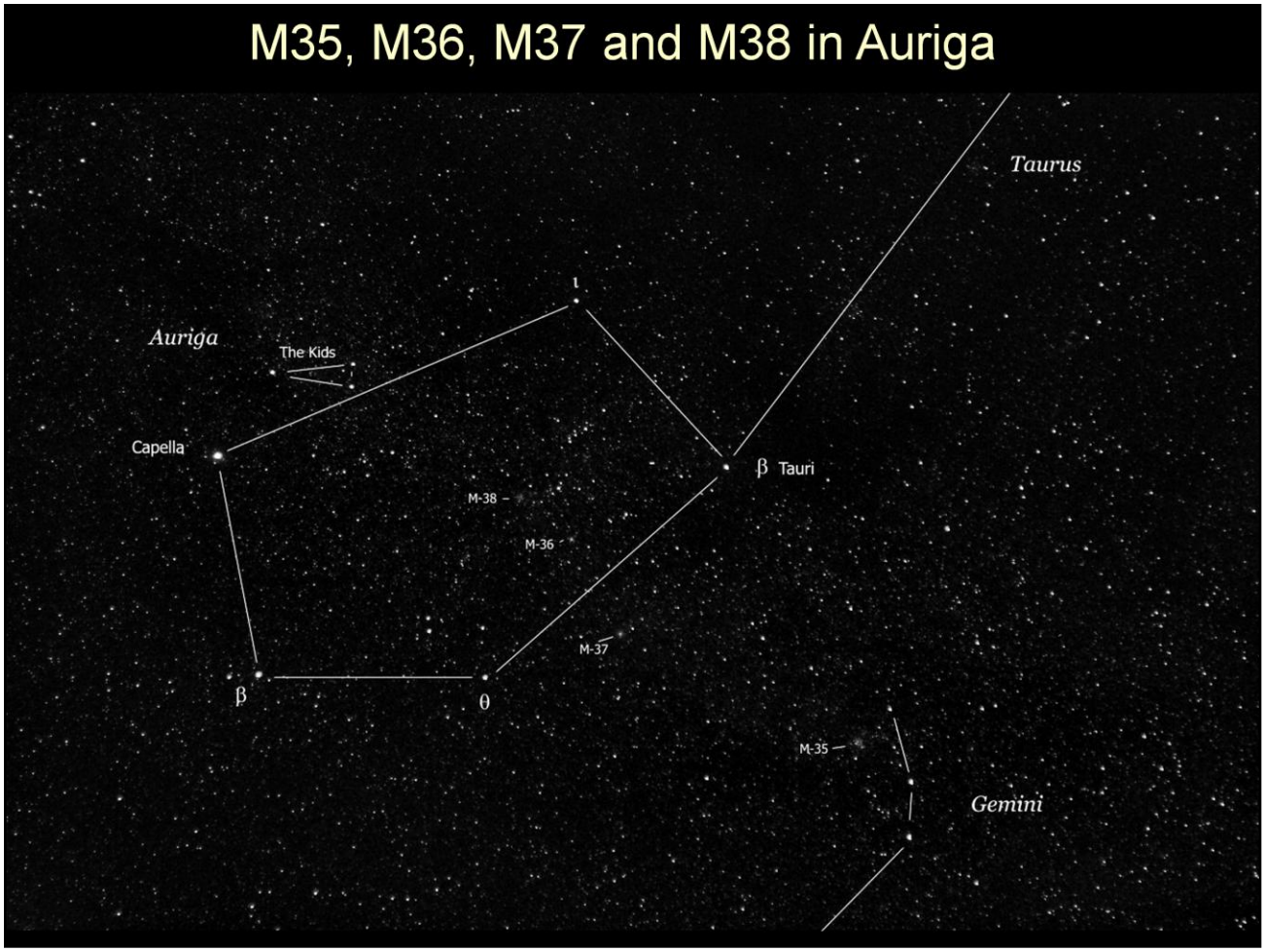
All the stars in the cluster are related but the string of stars is just a ‘line of sight’ effect.

There is another open cluster to the upper right of M35 but it appears much smaller and fainter.

This is called NGC2168 and was too faint to be seen by Charles Messier in the 1700’s.

It is much further away than M35 and therefore appears smaller. It is listed in the New General Catalogue of Deep Sky objects.

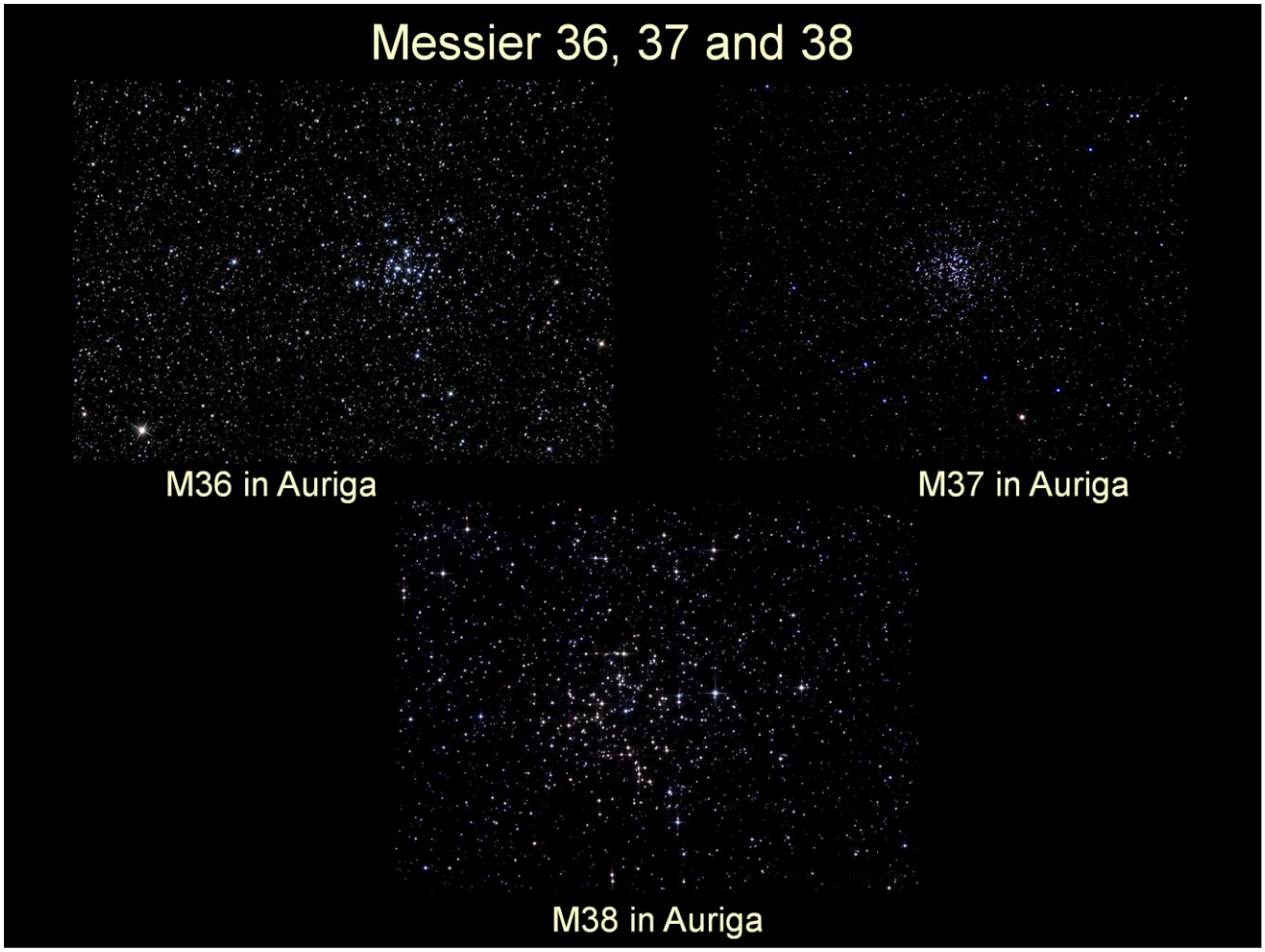
There are many more Open Clusters listed in the New General Catalogue (NGC)



The image above has been labelled to show the positions of Open Clusters.

M35 is in the constellation of Gemini the three other clusters in the neighbouring constellation of Auriga.

M37, M36 and M38 in Auriga appear to form a line of Open Clusters with M35.



There are three other Open Clusters in Auriga that appear to be in a line with M35.

The three open clusters in the constellation of Auriga are M36, M37 and M38.

A larger pair of binoculars will enable them to be seen but a telescope is required to see them as individual stars.

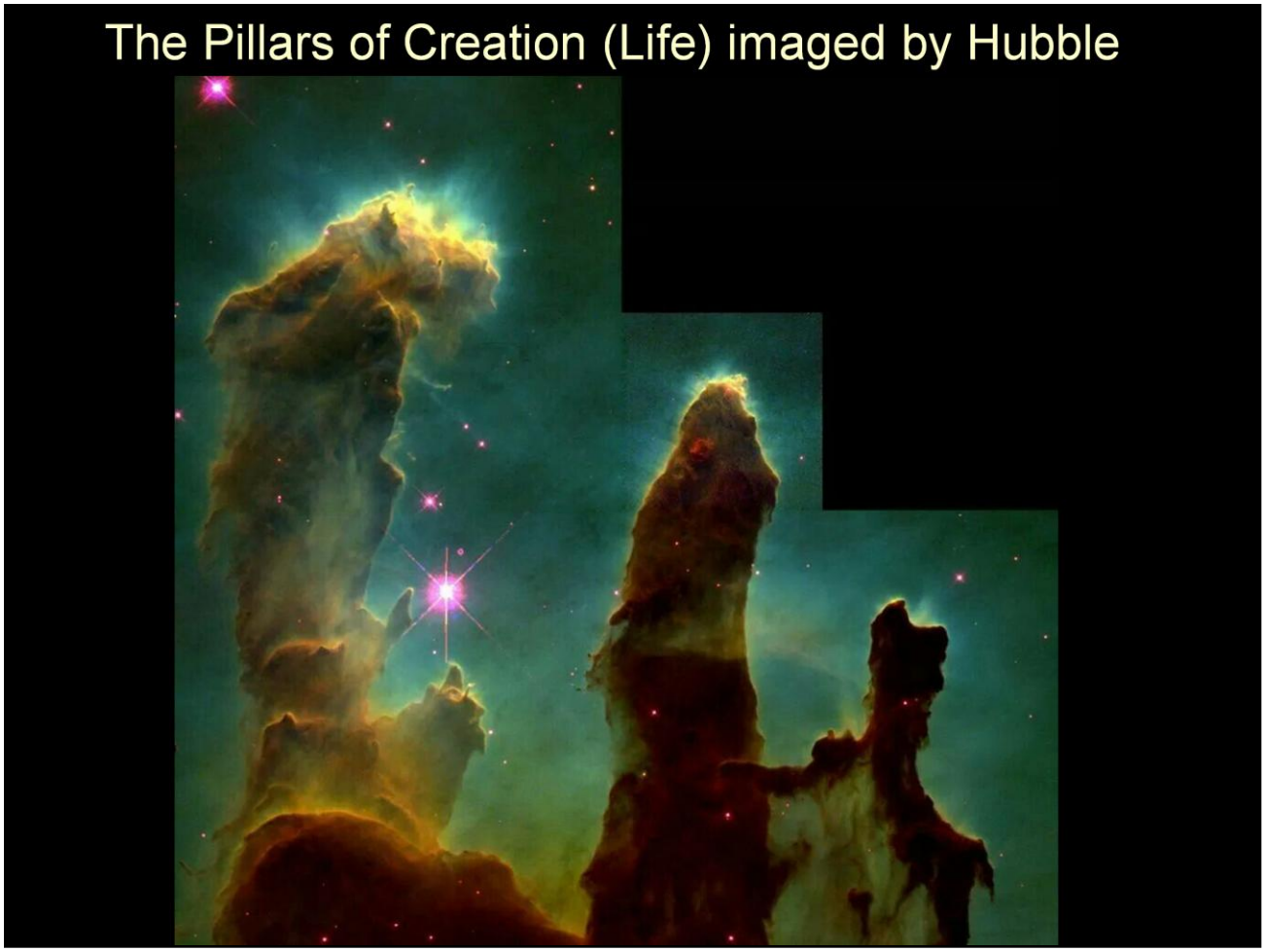
Nebulae (plural, the singular is Nebula) are huge clouds of gas and dust mainly found in the arms of spiral galaxies.

Most of the gas in these clouds is Hydrogen from in the Big Bang but there are often traces of other elements.

There are two main types of nebula these are called Reflection Nebulae and Emission Nebulae.

As the names suggest they either reflect light from neighbouring stars or emit light from the gas within them.

The image above shows M16 the Eagle Nebula with the ‘Pillars of Life’ star forming ‘pillar shaped’ clouds in the Nebula.



When stars form in a nebula they start their life as very active stars with a powerful wind of radiation blasting out into the surrounding space.

The pillars of gas shown above formed as giant stars off the top of the image blasted away the thinner areas and left the denser pillars.

Stars can be seen forming within the pillars of gas above and illuminating the gas around them.

The ‘Solar Wind’ created by these new stars eventually pushes the remaining gas and dust surrounding them away to reveal a cluster of new stars.

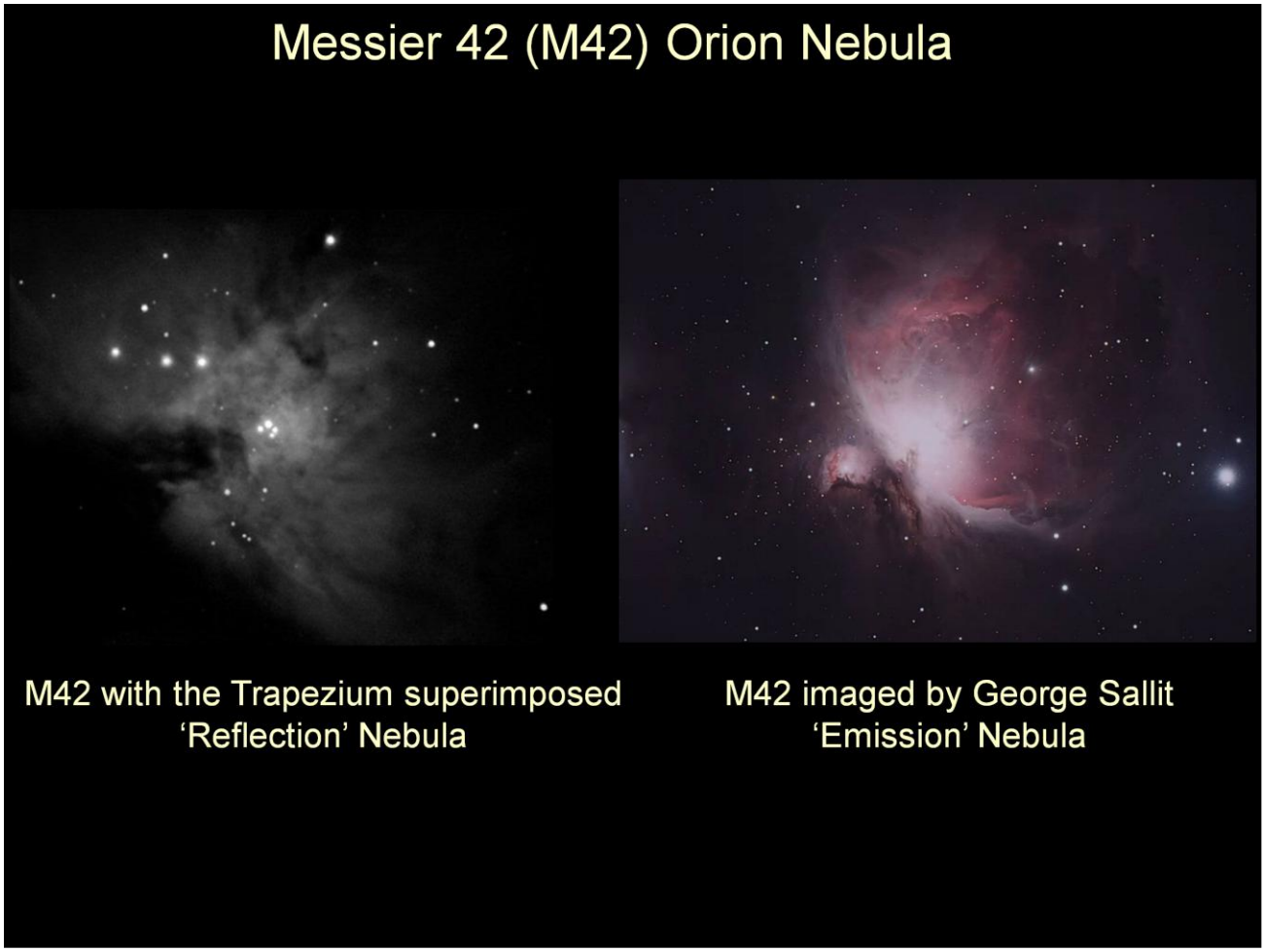
As millions of years pass the stars gradually move further apart until the cluster is dispersed.

M45 ‘The Pleiades’ (Seven Sisters) in Taurus is one of our closest and most beautiful open clusters.

This image shows the binocular view of the lower half of the constellation of Orion (below the belt) with M42 in Orion's sword.

The constellation of Orion is located in the direction that we are looking away from the centre of our Galaxy 'the Milky Way'.

The Nebula can just about be seen with the naked eye on a very clear night but is easy to find using binoculars.



The constellation of Orion is located in the direction that we are looking away from the centre of our Galaxy 'the Milky Way'.

In the left picture of M42 above, light from the stars is being reflected off the nebulosity around the stars.

M42 is just a small part of the Nebula that that pervades the whole area around the constellation of Orion and is illuminated by light from stars forming within area of M42.

The bottom left image shows the four bright stars of the Trapezium that illuminate the nebula.

Photons of mainly ultraviolet radiation from the stars of the Trapezium are absorbed by the Hydrogen atoms of the nebula which are re-emitted as the red light shown in the image on the right.

The Horse Head Nebula part of Orion Nebula

The Horse Head is a small feature in M42. It is a part of the nebula that is silhouetted against the glowing Hydrogen gas in the nebula.

Light is also emitted by the gas in the cloud when it has been hit by the radiation from the four large powerful and very active stars called the Trapezium.

Photons of the ultraviolet radiation from the stars of the Trapezium are absorbed by the Hydrogen atoms of the nebula.

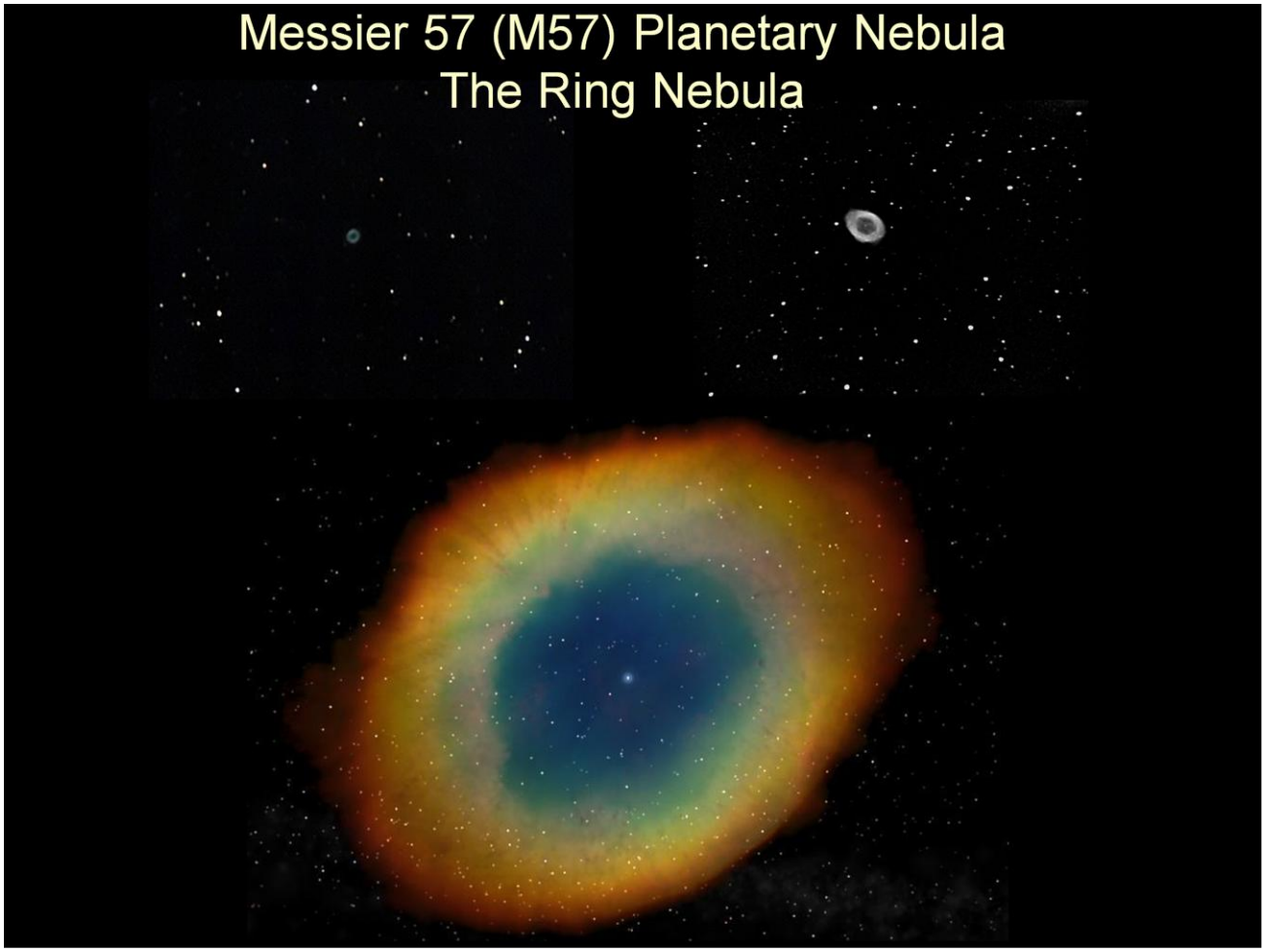
To absorb this additional energy an electron jumps from its normal orbit around the nucleus to a higher orbit.

The atom will become unstable so the electron will quickly jump back to its original orbit.

To enable this to happen, the atom must release the excess energy it has absorbed from the photon.

It does this by radiating a flash of light as photons. Light is always emitted at the same wavelength (colour) from an atom of a particular element.

For example Hydrogen always emits a red light photon as can be seen in the image above.



A Planetary Nebula is the remains of a star of about the same size as our Sun and nothing to do with planets at all.

After about ten billion years the Hydrogen that has powered the star would have run out.

The outer parts of the star then became inflated like a giant balloon.

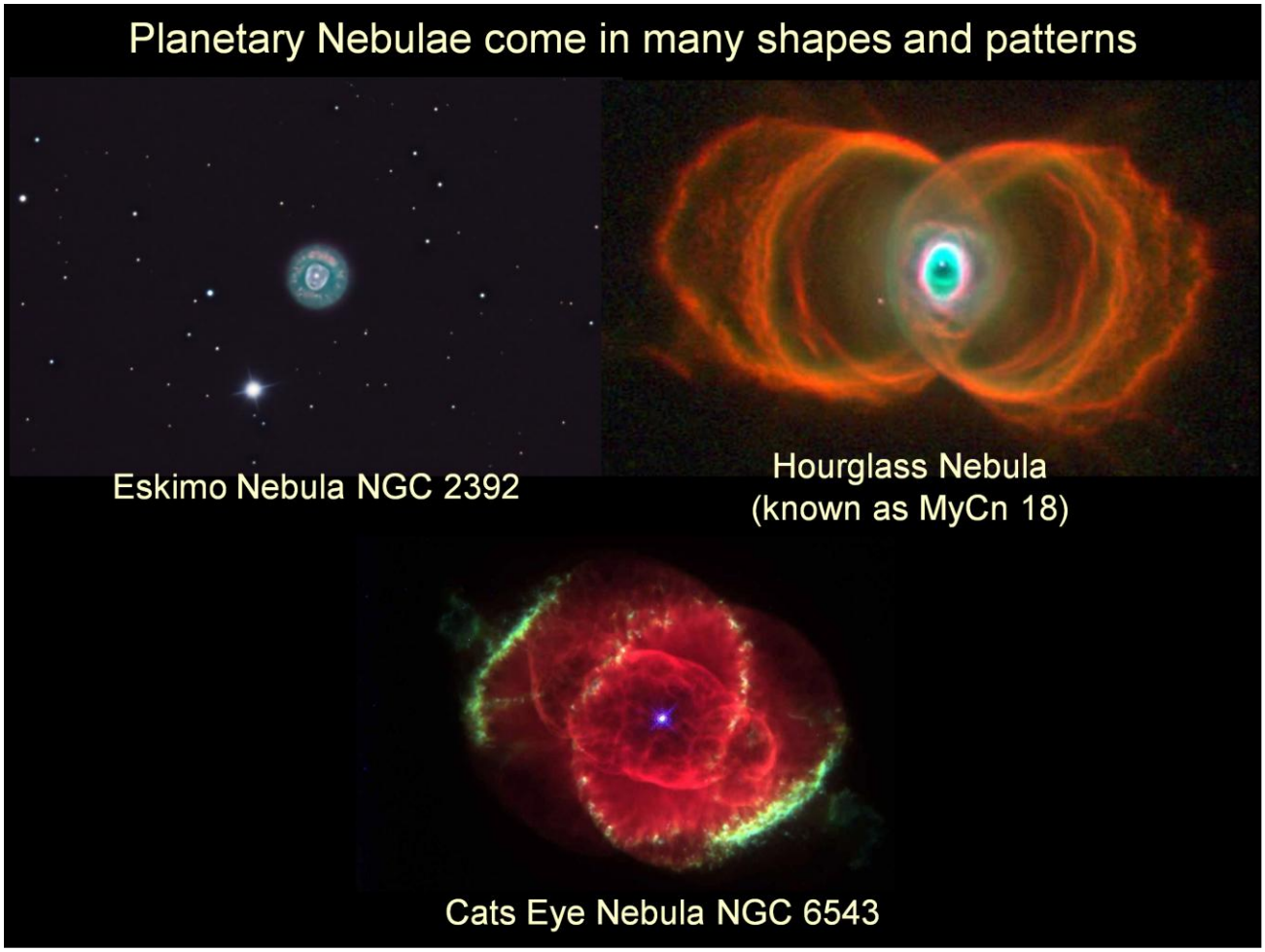
Eventually the outer parts of the star drifted off into space to form a huge bubble of gas.

As we look through the bubble we see more material through the edge so it appears more like a ring.

The Ring Nebula M57 in Lyra is the most famous. Top left using a small telescope, top right imaged using a larger telescope and bottom imaged by the Hubble Space Telescope.

The White Dwarf star that is the remains of the original star can be seen in the centre of M57 in the Hubble image.

The interesting thing about Planetary Nebulae is we can see what will happen to our star the Sun as it reaches the end of it ‘life’.



Many of these Planetary Nebulae have intricate and very beautiful structure that can be seen in astro-images produced by amateur astronomers using fairly modest equipment.

There are only four Planetary Nebulae listed in Charles Messier's Catalogue (M27, M57, M76 and M97) but there are a good number of Planetary Nebulae listed in the New General Catalogue (NGC).

The Cat's Eye Nebula NGC6543 is also a good example.

Two Planetary Nebulae are easy to see

Messier 27

M57 the Ring Nebula

Most Planetary Nebulae are faint and difficult to see using a small telescope or even a larger amateur astronomer's larger telescopes.

However M27 and M57 are possible to see in most telescopes.

Even though they may look small and faint it is still well worth searching them out to see them with your own eye using your own telescope from your own garden.

Two Planetary Nebulae are not so easy to see

Messier 76 the Little Dumbbell

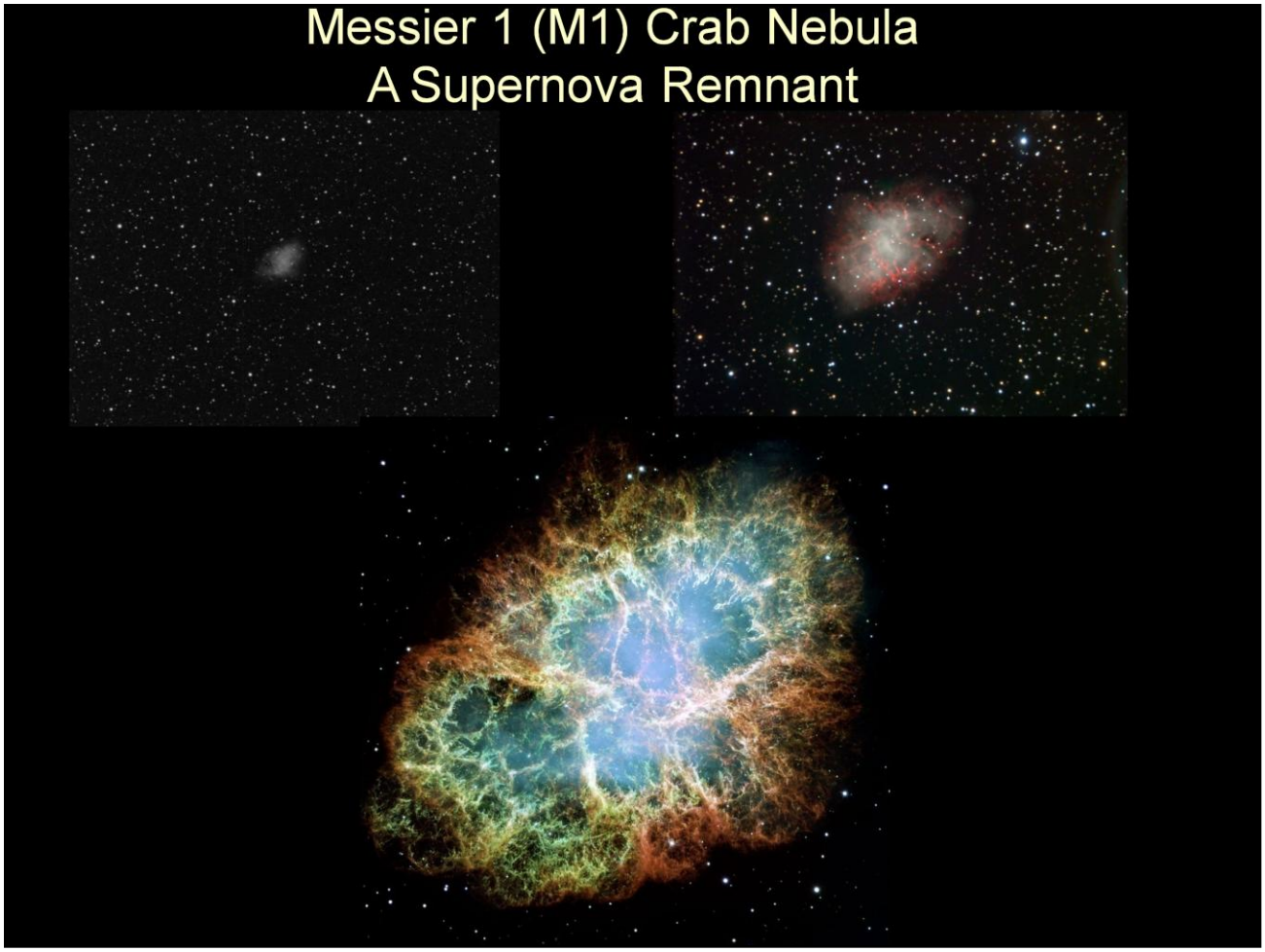
M97 the Owl Nebula

The other two Messier Planetary Nebulae are faint and difficult to see using a small telescope or even a larger amateur astronomer's larger telescopes.

However M76 (the Little Dumbbell) and M97 (the Owl Nebula) are possible to see in larger telescopes.

Even though they may look small and faint it is still well worth searching them out to see them with your own eye using your own telescope from your own garden.

The colour can only be seen in deep images.



One particular type of dying star called a Super Nova produces a different fuzzy patch.

This is created when a giant star about five or more times the mass of our Sun reaches the end of its existence.

The star becomes very unstable until it eventually explodes and completely destroys itself.

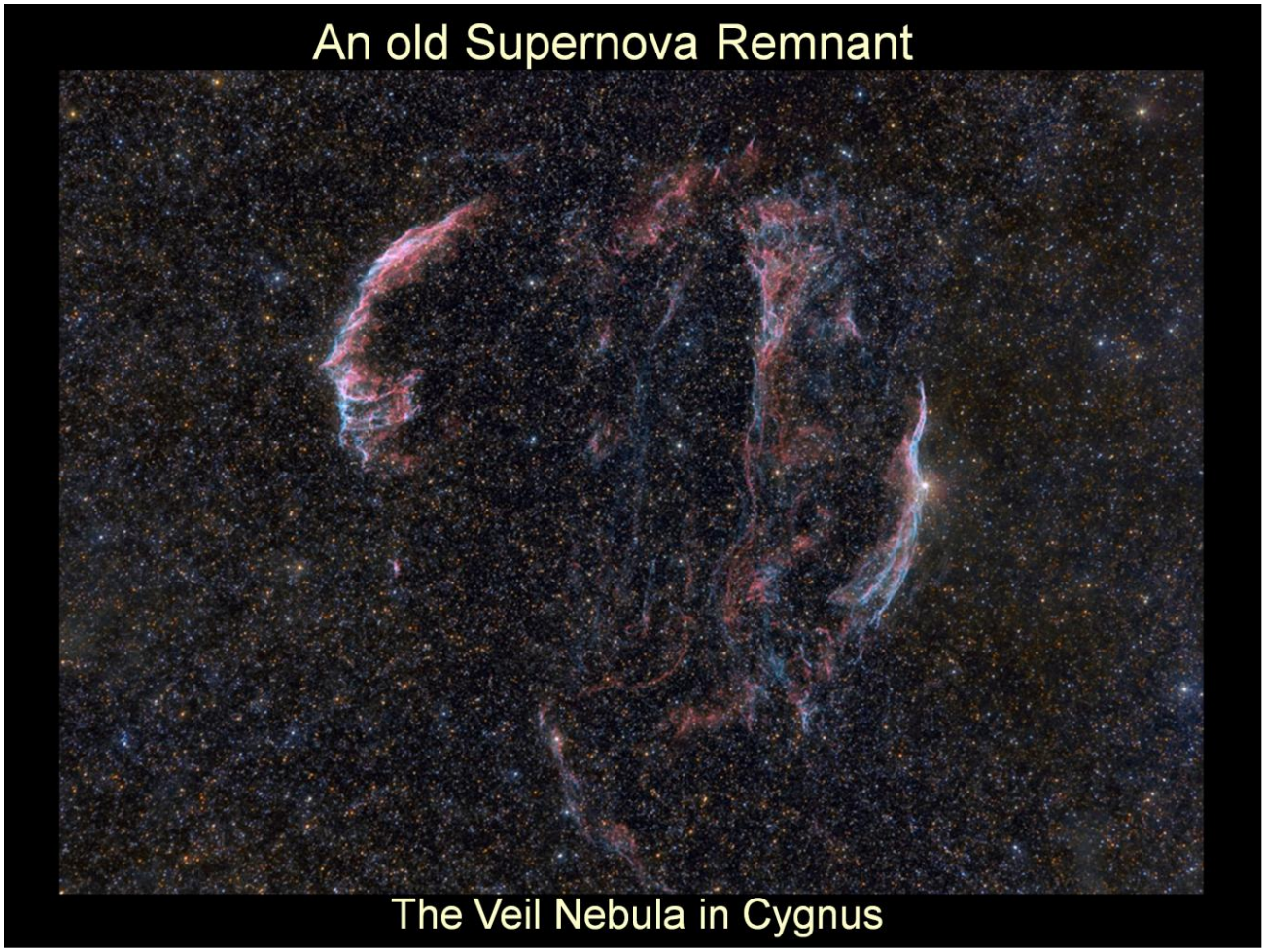
The super nova remnant known as the Crab Nebula, in Taurus, is the first entry in Messier's Catalogue and is therefore designated as Messier 1 (M1).

The Crab Nebula Supernova exploded about 7000 years ago but its light took about 6000 years to reach Earth.

A new star (Nova) was seen in the sky in the year 1054 and was recorded by Chinese astronomers.

It was bright enough to be seen in the bright daytime sky.

It is still possible to see M1 using a larger pair of binoculars or a smaller telescope but it does require a clear dark sky away from light pollution.



With the passage of time over the course of many thousands of years the expansion of the gas and dust blasted into space by the explosion dissipates.

The filaments that can be seen in M1 will become long faint wisps spread across vast distances of space.

The Veil Nebula in the constellation of Cygnus is one such ancient super nova remnant and not included by Messier.

It is very faint so it needs a large telescope to see its filaments and is best seen in photographic images that bring out the detail.

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