

# HALLOWEEN ASTRONOMY

## Celestial Targets for your Binoculars and Telescopes!

Halloween needs more Galileos, Keplers and Sir Isaac Newtons knocking on doors and asking for sweets to remind us of the scientific discoveries that made our current understanding of the universe possible.

Without scientific breakthroughs, we would still be wondering why magnets work, puzzling how birds fly, and getting spooked by the eerie aurorae!

This Halloween, I've put together a list of Halloween-themed astronomical targets for you. You can discover more about the cosmos by exploring many Halloween-themed astronomical objects in the night sky. Let's go outside, look up, and learn what it is we're looking at.

Here's the list of targets that might be of interest to you. We're going to cover 13 of these in greater detail. Not all of these will be visible during Fall, so keep this list for later in the year:

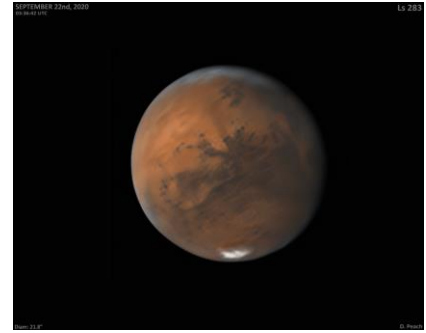


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| <input type="checkbox"/> Mars                           | <input type="checkbox"/> Blinking Nebula NGC 6826      |
| <input type="checkbox"/> Witch Head Nebula NGC 1909     | <input type="checkbox"/> Ghost of Mirach NGC 404       |
| <input type="checkbox"/> Ghost Head Nebula              | <input type="checkbox"/> Phantom Streak NGC 6741       |
| <input type="checkbox"/> Witch's Broom Nebula NGC 6960  | <input type="checkbox"/> Ghost of the Moon NGC 6781    |
| <input type="checkbox"/> Bat Nebula                     | <input type="checkbox"/> Barnard's E(vil) Nebula       |
| <input type="checkbox"/> Cat's Paw Nebula NGC 6334      | <input type="checkbox"/> Specter Nebula NGC 1999       |
| <input type="checkbox"/> Cat's Eye Nebula NGC 6543      | <input type="checkbox"/> Little Ghost Nebula           |
| <input type="checkbox"/> Owl Nebula M97                 | <input type="checkbox"/> The Spider and the Fly Nebula |
| <input type="checkbox"/> Owl Cluster NGC 457            | <input type="checkbox"/> Red Spider Nebula             |
| <input type="checkbox"/> Flaming Skull Nebula           | <input type="checkbox"/> Tarantula Nebula              |
| <input type="checkbox"/> Skull Nebula NGC 246           | <input type="checkbox"/> Dragon's Head Nebula          |
| <input type="checkbox"/> The Vampire Star               | <input type="checkbox"/> Horsehead Nebula              |
| <input type="checkbox"/> X-ray Skull in Perseus Cluster | <input type="checkbox"/> Ghost Nebula                  |

In this document, all images are courtesy of APOD and Stellarium unless otherwise indicated.  
Text written by Kent Wallace, Brian Cox and Aurora Lipper.

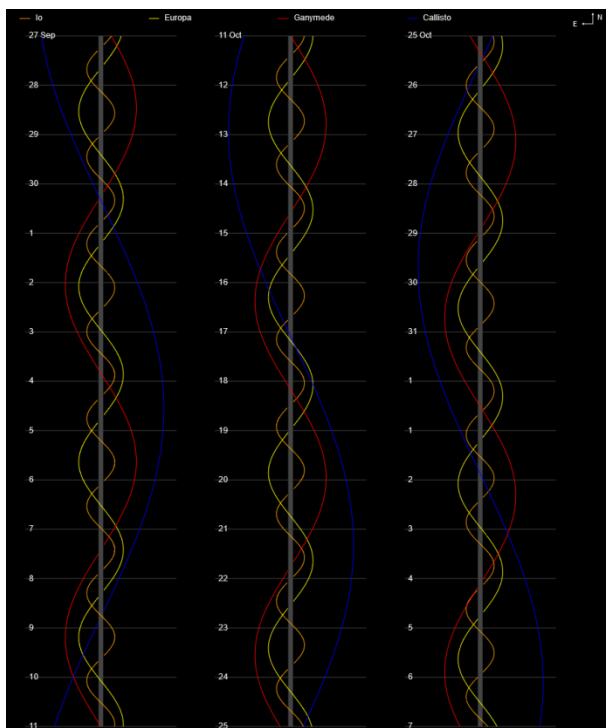
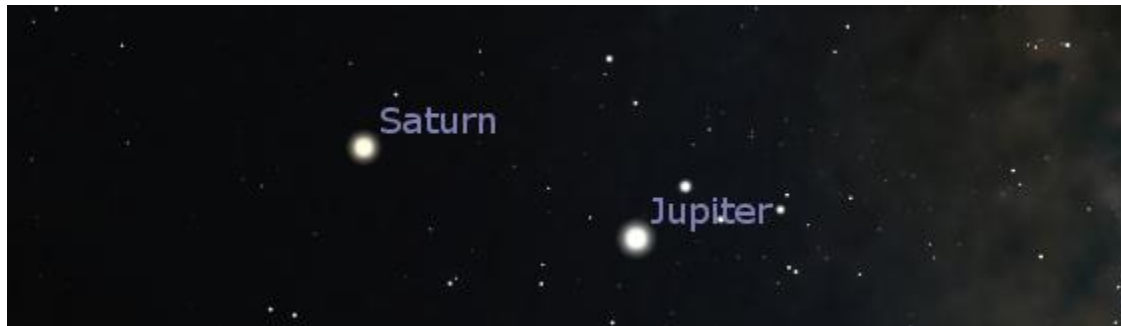
## Mars

On October 13, 2020, Mars comes to opposition in Earth's sky for the first time since July 27, 2018. In mid-October, our planet Earth will pass between the sun and Mars. Mars will be brighter at this year's opposition than it will be again until the year 2035. Oppositions of Mars happens about every 26 months (we gain a lap on Mars every 25 months), and this particular opposition is one that will be especially bright!



## Jupiter and Saturn

Jupiter is known as the "King of the Planets", and Saturn is known as the "Lord of the Rings". In 2020, both of these objects will be visible together. Jupiter and Saturn continue to be amazing to watch together in the Southern part of the sky.



With a pair of binoculars, you should be able to see the moons of Jupiter all lined up with a brighter center dot.

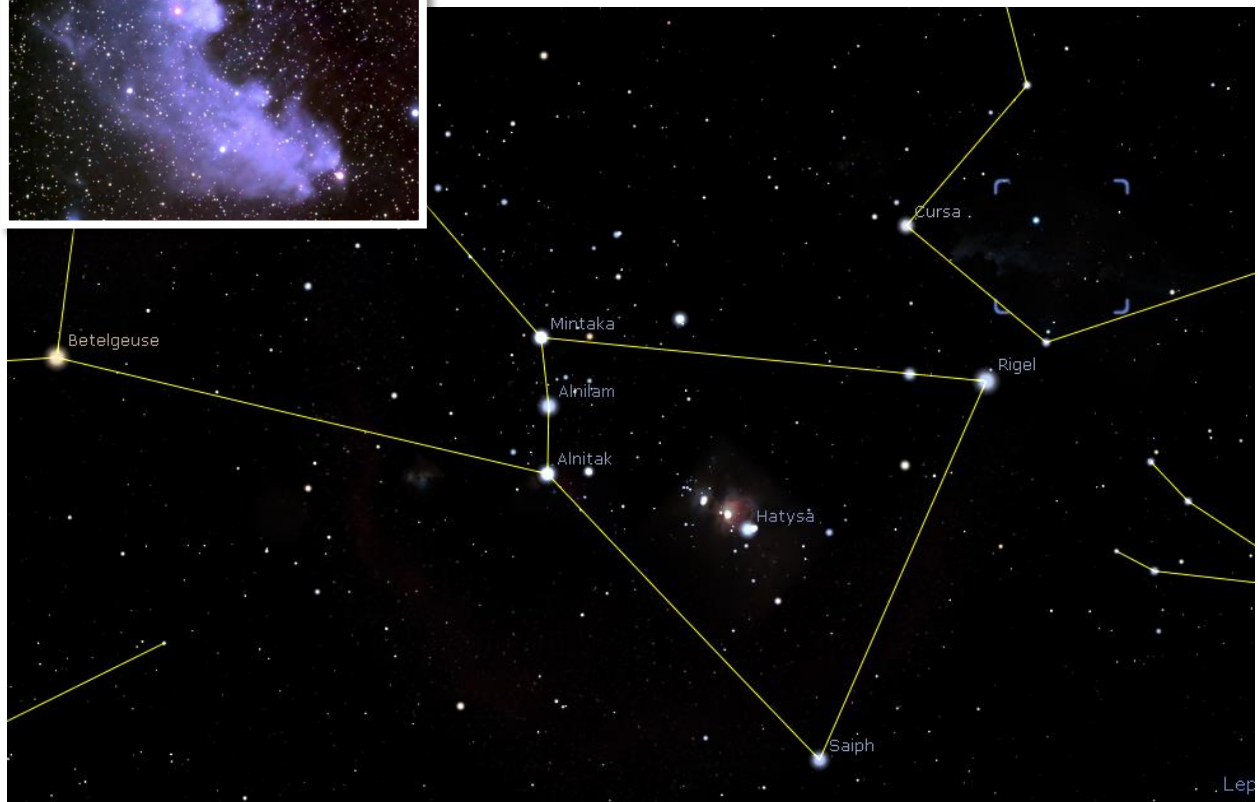
(Saturn's moons will be all over the place, except when the rings are viewed edge-on from Earth, which happens about every 15 years, and our next one is in 2025.)

Galileo Galilei was the first to see the moons of Jupiter with his telescope in 1610. You can use a chart (shown to the left) to help you figure out which moon is which.

This chart is available at [in-the-sky.org/jupiter.php](https://in-the-sky.org/jupiter.php)

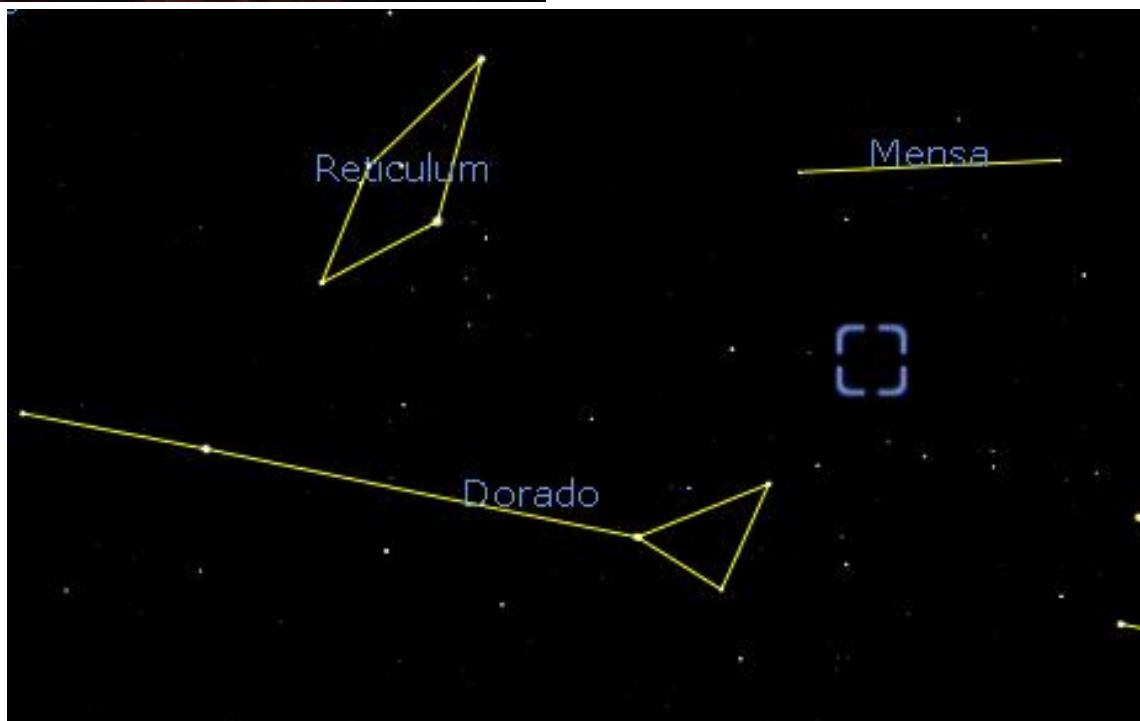
## Witch Head Nebula (NGC 1909, IC 2118)

Witch Head Nebula, NGC 1909/IC 2118, reflection nebula, in Eridanus (The River). This is a large faint reflection nebula about 2.4 degrees north-south and about 1.0 degree east-west. It is about 2.7 degrees west-northwest of Rigel which provides the light that it reflects. It can be seen in binoculars or a small telescope at low power under dark skies. William Herschel discovered this object on December 20, 1786 which is listed as NGC 1909. Unfortunately, Herschel had this object following Rigel instead of preceding it. This error led to NGC 1909 being thought not to exist. The Witch Head Nebula was independently discovered by Max Wolf using photography in 1909, leading to it being listed as IC 2118. This nebula is about 900 light years away. See the APOD for October 31, 2008 for a nice picture of the Witch Head Nebula and Rigel.



## Ghost Head Nebula (NGC 2080)

Ghost Head Nebula, NGC 2080, emission nebula in the Large Magellanic Cloud in the constellation of Dorado (Swordfish). It is about 163,00 light years away and 50 light years across. NGC 2080 was discovered by John Herschel on December 23, 1834. It can be seen in a 12" telescope as a bright nebula. See the APOD of October 31, 2010 for a nice Hubble image of this nebula.



## Witch's Broom Nebula (NGC 6960)

Witch's Broom Nebula, NGC 6960, part of the Veil Nebula supernova remnant in Cygnus. It is the western side of the Veil Nebula which goes right by the 4th magnitude naked eye star 52 Cygni. This nebula is about 1,400 light years away. It was discovered by William Herschel on September 7, 1784. See the APOD for April 18, 2018 for a nice image of the Witch's Broom Nebula.





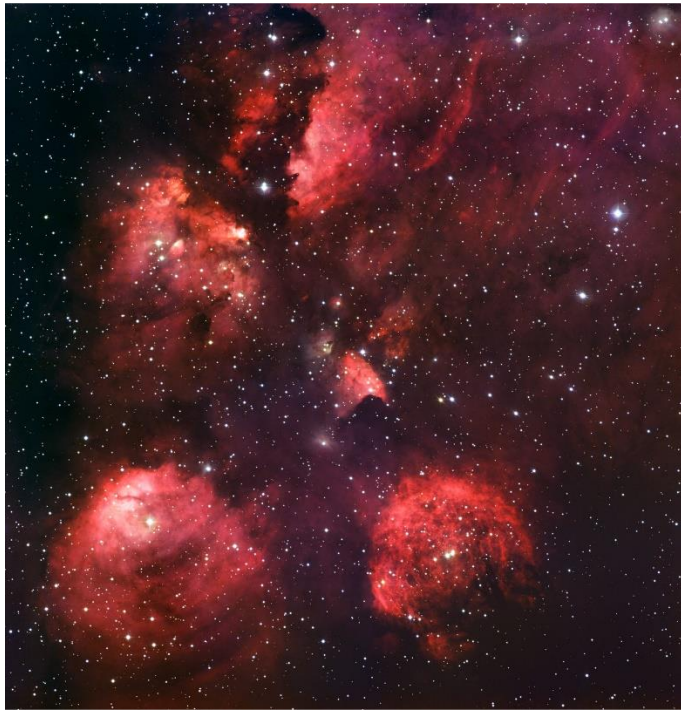
## Bat Nebula

Bat Nebula, piece of NGC 6995 which is on the eastern side of the Veil Nebula, a supernova remnant in Cygnus. It is about 1,400 light years away. This area of the nebula is a fantastic jumble of filaments in my 20" scope when using a 2" O-III screwed into the back of my 32mm eyepiece. NGC 6995 was discovered by John Herschel on September 7, 1825. See the APOD for November 25, 2019 for an image of the Bat Nebula.



## Cat's Paw Nebula (NGC 6334)

Cat's Paw Nebula, RCW 127 for the whole paw, NGC 6334 for the brightest toe, in Scorpius, a faint emission nebula, about 5,500 light years, magnitude 9.0, size 40' x 30'. NGC 6334 was discovered by John Herschel on June 7, 1837. From the stinger of the scorpion go 3 degrees west and 1 degree north to arrive at the Cat's Paw Nebula. An O-III or UHC filter may enhance this faint nebula. See the APOD for June 28, 2006 for a nice image of this object.



## Cat's Eye Nebula

Cat's Eye Nebula, NGC 6543, planetary nebula, magnitude 8.1, size 22"x 18", about 300 light years away, in Draco. Discovered by William Herschel on February 15, 1786. On August 29, 1864 William Huggins directed a telescope with a spectroscope to NGC 6543 and saw a single bright line, denoting a luminous gas. This was the first proof that some nebulae were gaseous instead of being composed of extremely faint stars which would have given a continuous spectrum. NGC 6543 has a faint surrounding halo about 300" across. A bright piece of this halo was thought to be a galaxy and listed as IC 4677. See the APOD for May 28, 2016 for a spooky image.





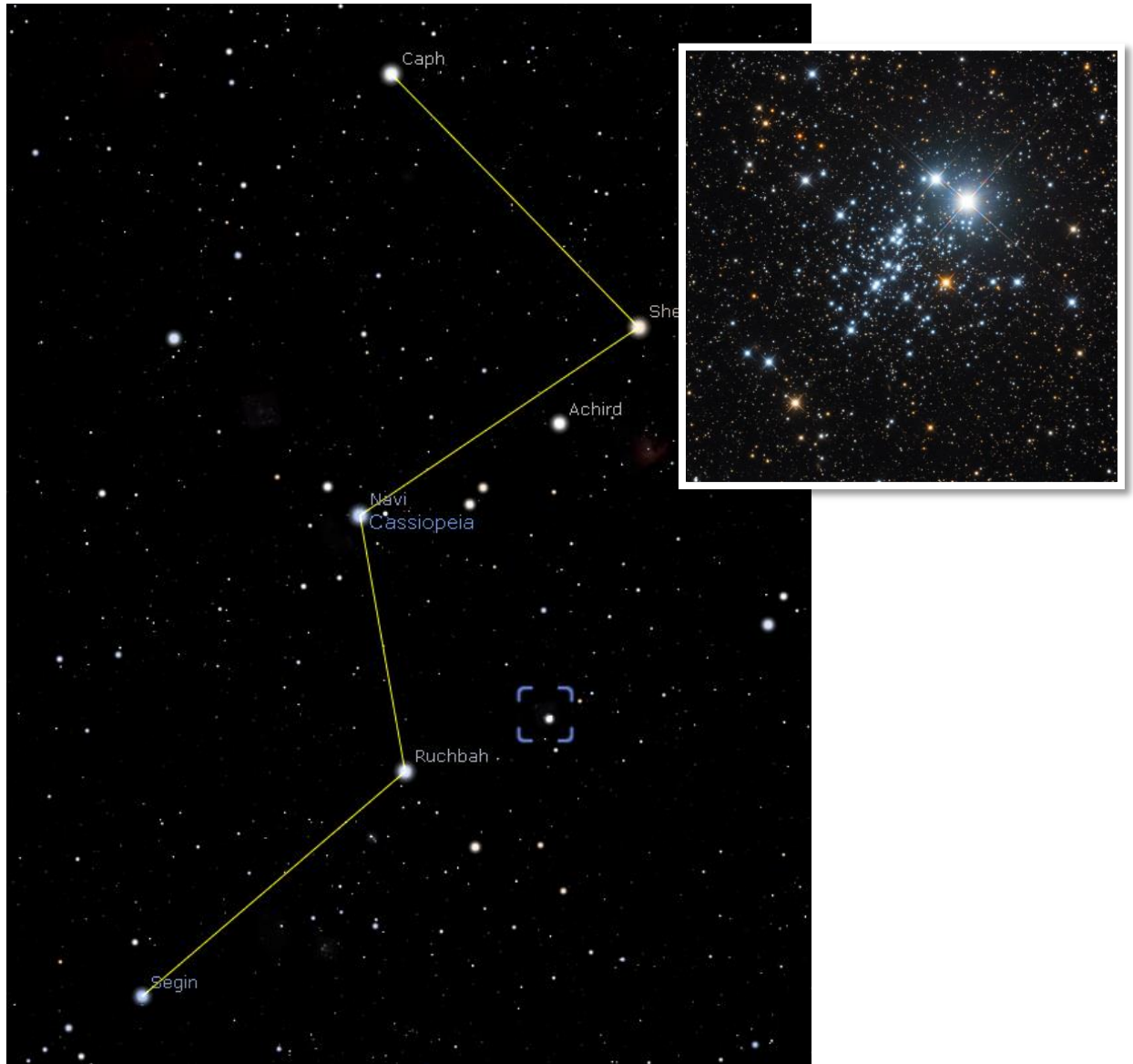
## Owl Nebula

Owl Nebula, M 97, NGC 3587, planetary nebula, magnitude 9.8, central star magnitude 14.0, size 210", in Ursa Major (The Great Bear), about 4,100 light years away. Discovered by Piere Mechain on March 24, 1781. There are two dark patches on Messier 97 which Lord Rosse likened to the eyes of an owl, thus the nickname. See the APOD for May 15, 2009.



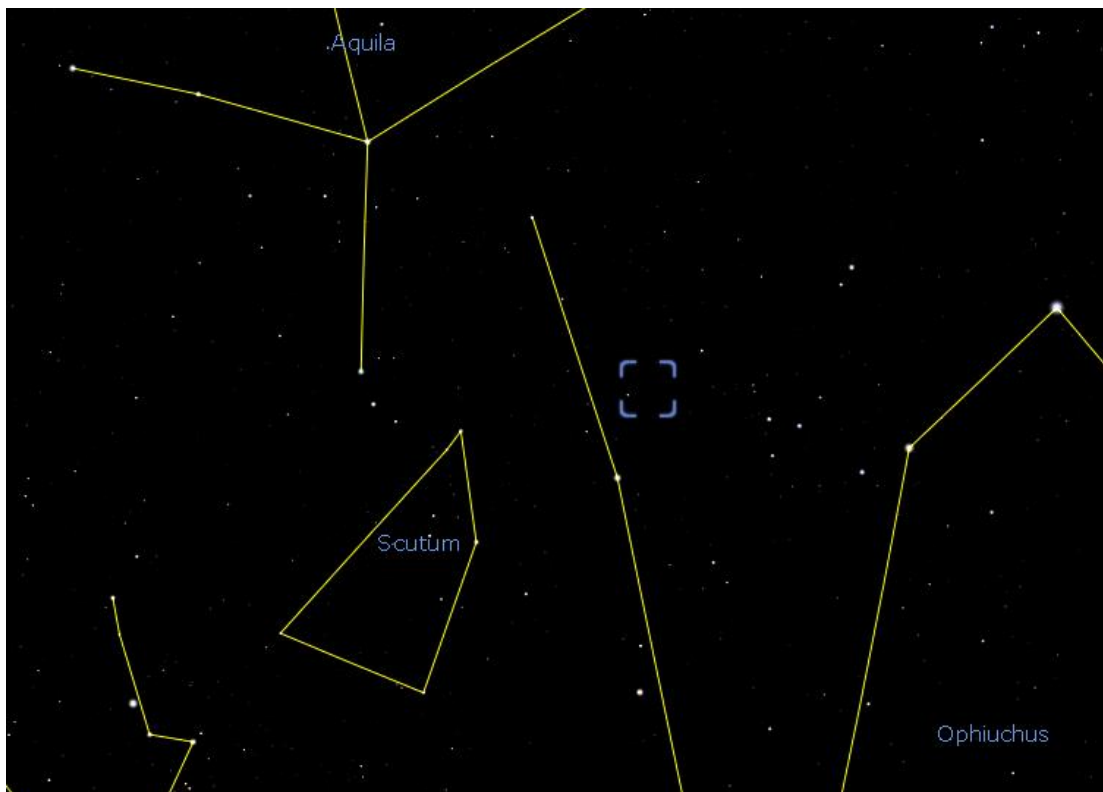
## Owl Cluster (NGC 457)

Owl Cluster, NGC 457, open cluster in Cassiopeia, magnitude 6.4, about 7,900 light years away, size 13'. Discovered by William Herschel on October 18, 1787. The nickname "Owl Cluster" was coined by David J. Eicher, current editor of Astronomy Magazine.



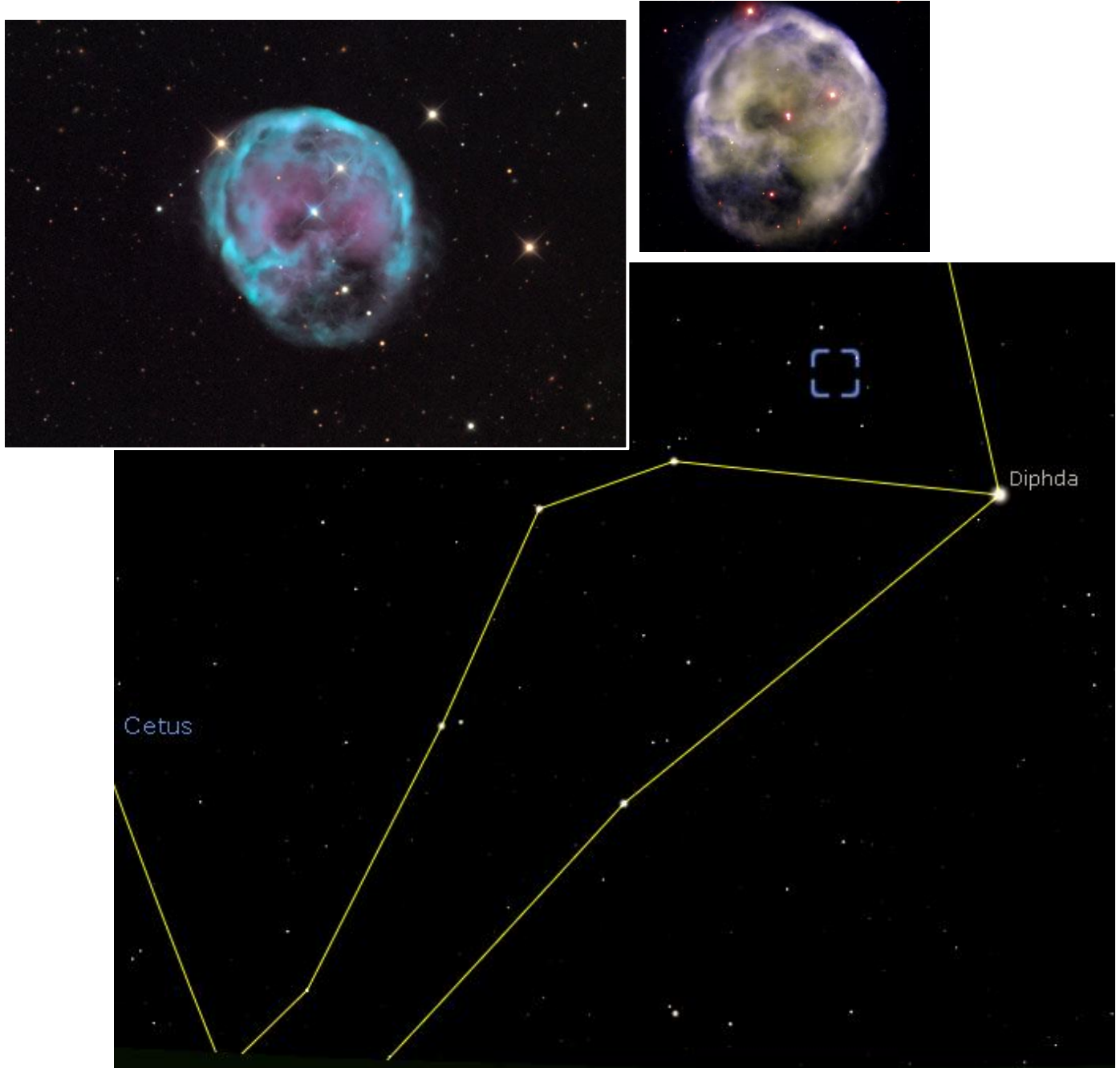
## Flaming Skull Nebula

Flaming Skull Nebula, Sh 2-68, planetary nebula, magnitude 13.1, size 375" x 302", in Serpens Cauda (snake's tail or eastern part). This object is 52' northwest of 59 serpentis.



## Skull Nebula

Skull Nebula, NGC 246, planetary nebula, magnitude 10.4, central star magnitude 12.0, size 240" x 210", about 1,500 light years away in Cetus. NGC 246 appears as a large somewhat round nebula with several stars embedded within it. William Herschel discovered NGC 246 on November 27, 1785. The Skull Nebula forms an equilateral triangle with Phi One (17) and Phi Two (19) Ceti, with NGC 246 being to the south of these two stars. It is about 6 degrees to the north of Beta Ceti. It has a good response to an O-III filter. See the APOD for for a good image of the Skull Nebula.



## The Vampire's Star

The Vampire's Star, R Leporis. It is a long period variable carbon star changing from a magnitude of 5.5 to 11.7 and back in about 432 days. R leporis is located 1,360 light years away in the constellation of Lepus (The Rabbit). It was discovered by John Russel Hind in October of 1845, who reported that it appeared like a drop of blood on a black field. This object is better known as Hind's Crimson Star. See the APOD for October 31, 2018 for a nice image of The Vampire's Star.

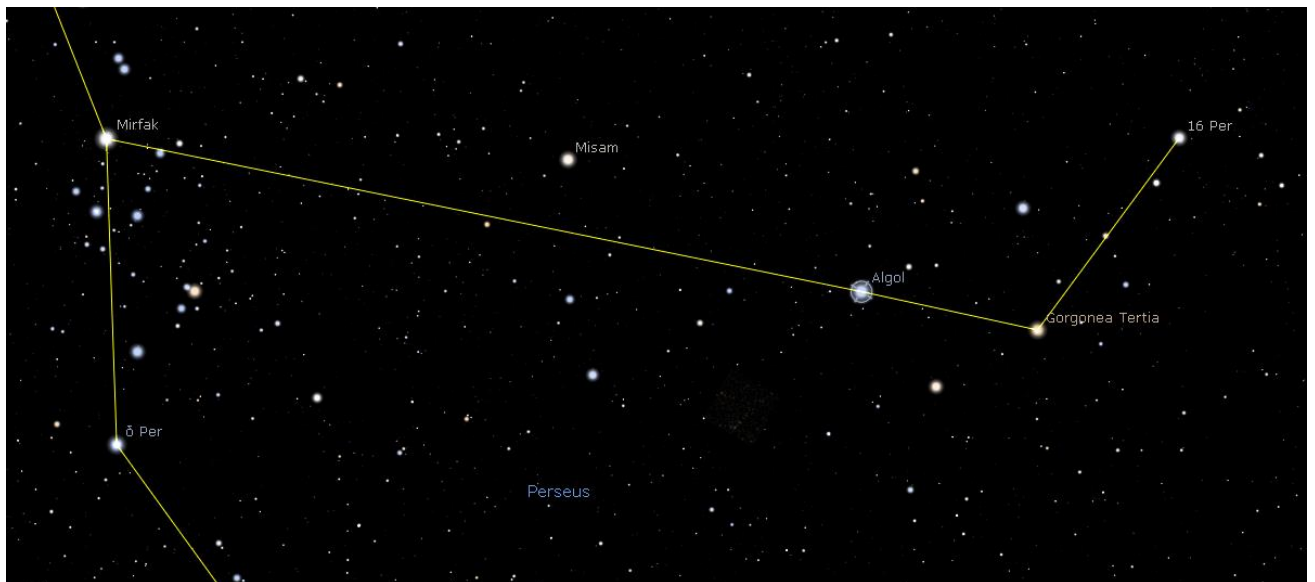
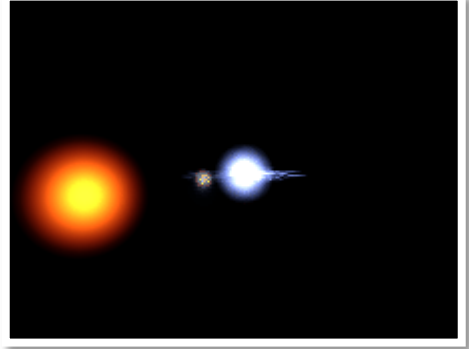




## Demon Star Algol

The Demon Star, Algol, Beta Persei, in Perseus, 93 light years away. This is the first found and brightest eclipsing binary star. Algol consists of a blue white dwarf star and an orange subgiant star, separated by 20% the distance from Mercury to the sun. The blue star is about 100 times brighter than the sun and 3 times its diameter. The orange star is about 4 times brighter than the sun and a little larger than the blue star.

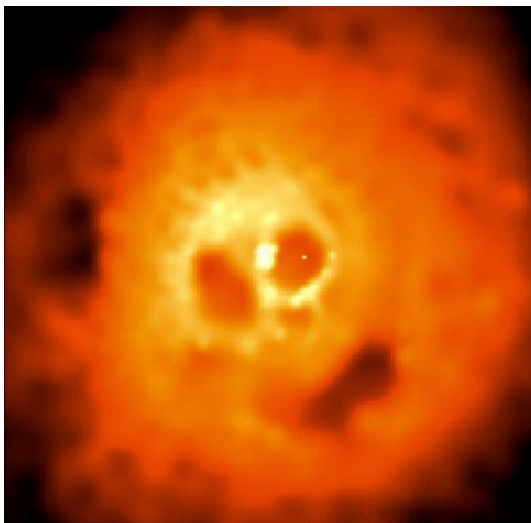
Every 59 hours, Algol dips from magnitude 2.1 to 3.4 over the next 5 hours and returns to magnitude 2.1 over the following 5 hours. This is the second known variable star, first published by Geminiano Montanari in 1667. In 1782, John Goodricke figured out the period and that it was an eclipsing binary.



## Perseus Cluster's X-Ray Skull

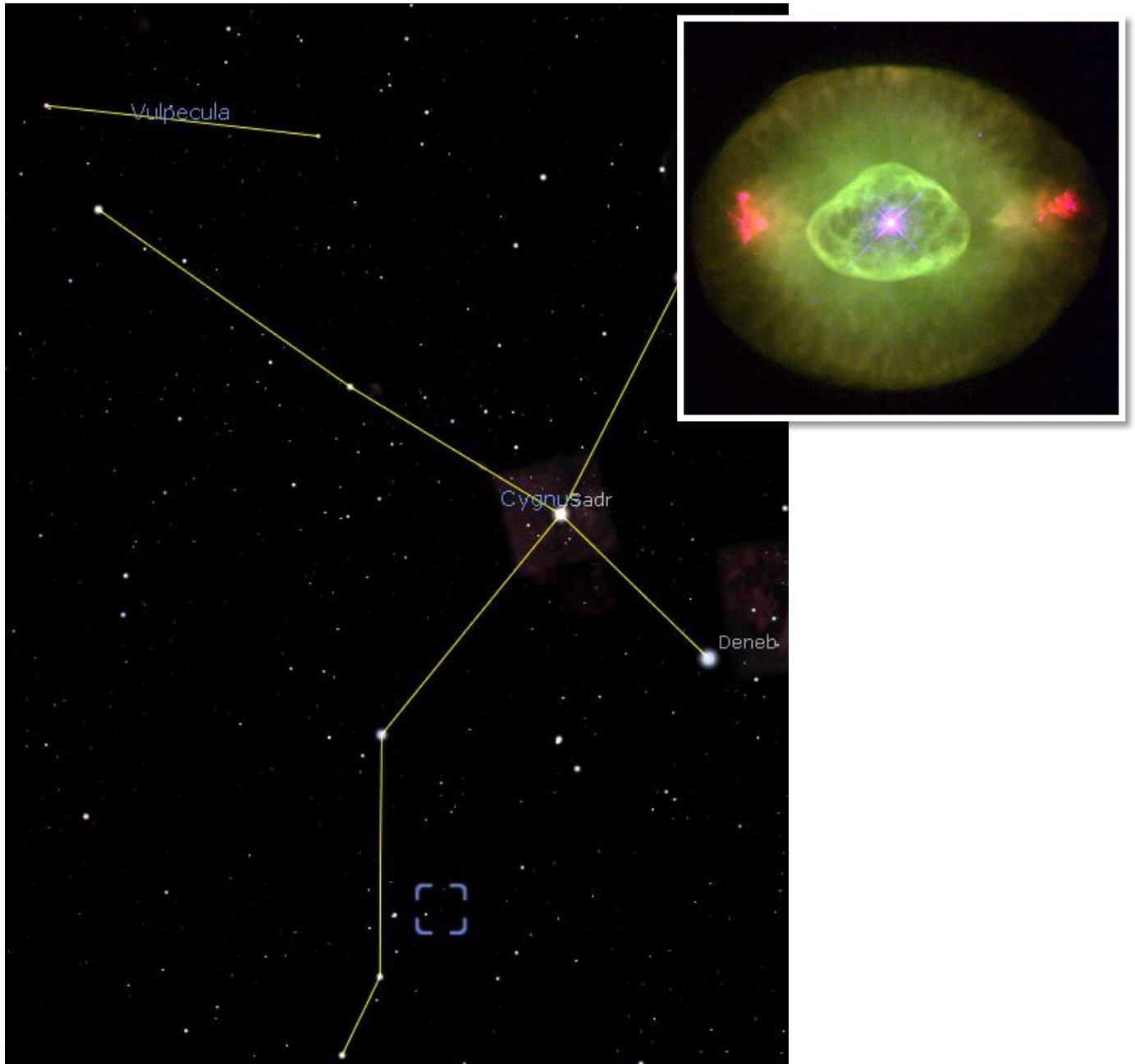
This is a galaxy cluster, about 230 million light years away, located about 2 degrees east and one half degree north of Algol, the Demon Star. The APOD for May 20, 2008 shows part of the Perseus Cluster of Galaxies (Abell 246) ((top right below). The weird looking large galaxy to the right of center of this image is NGC 1275, the dominant member of this cluster. NGC 1275 is a strong radio source and is also known as Perseus A.

The APOD for July 25, 2005 (lower right image below) shows NGC 1275 surrounded by filaments of hydrogen gas (image below right). These filaments may be held together by the magnetic field of a super massive black hole at the center of NGC 1275. Finally the APOD for October 31, 2000 (lower left image below) shows the X-Ray skull image (image below, left). This is a cloud of 50 million degree intracluster gas shining in X-rays, centered on the Perseus Cluster of Galaxies. This cloud of gas is more massive than all of the cluster's galaxies combined.



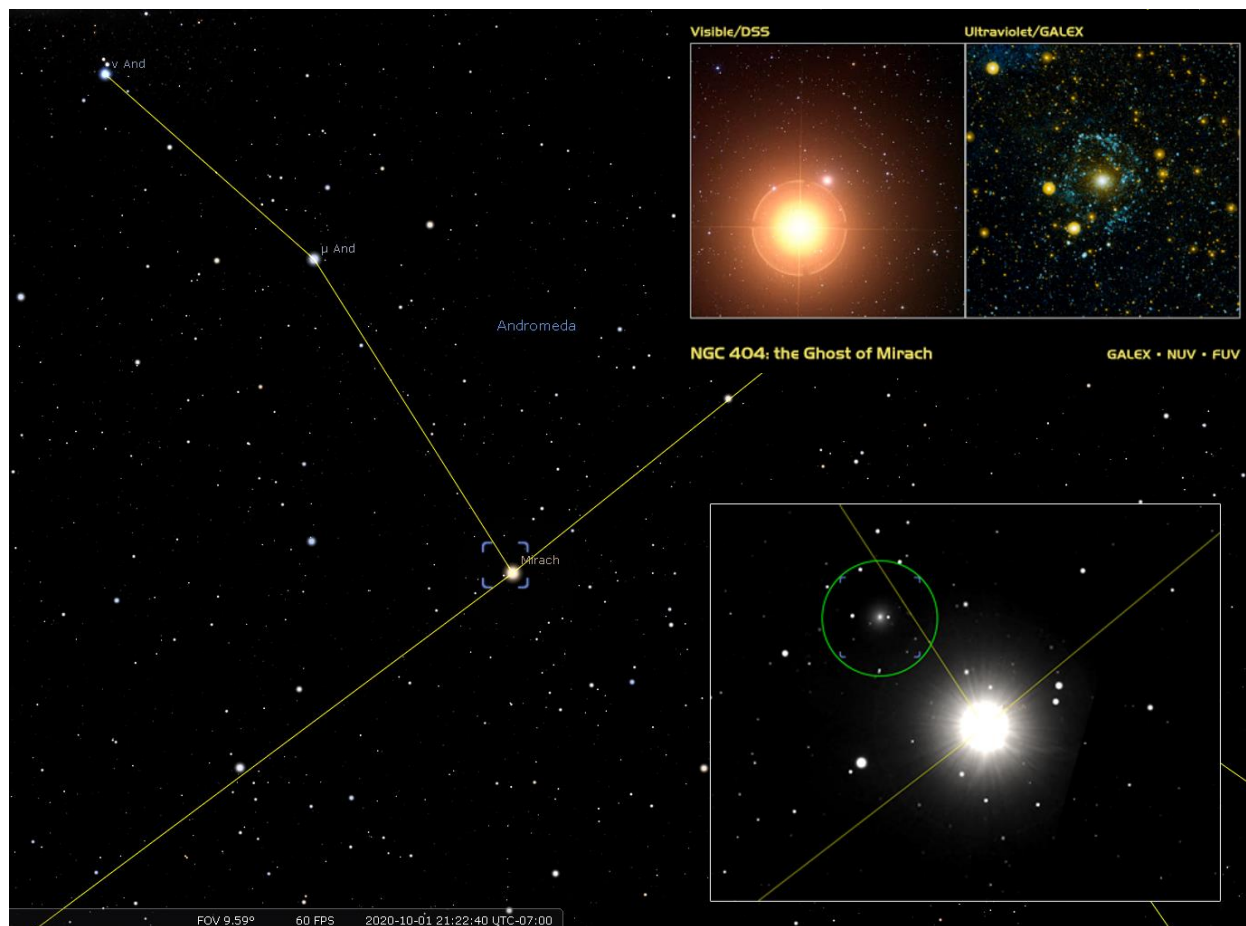
## Blinking Nebula (NGC 6826)

In the constellation Cygnus, there's a star in the center of a cloud that blinks on and off, in a haunting way. It's a planetary nebula (mag 8.8) disk that has a center star that is bright enough that when you stare at it, it becomes dominant, and it engages a different part of your eye and the disk goes away. When you use averted vision, the disk pops back into view.



## Ghost of Mirach (NGC 404)

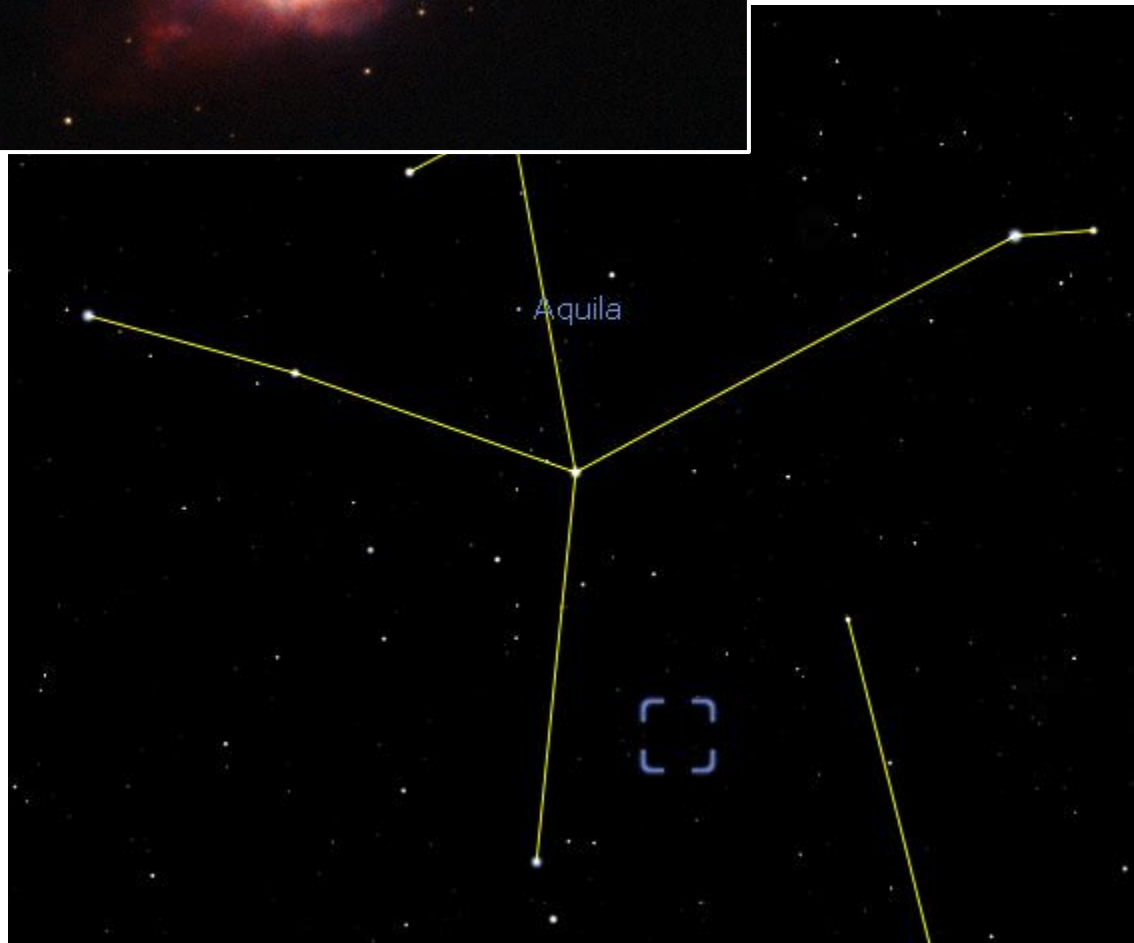
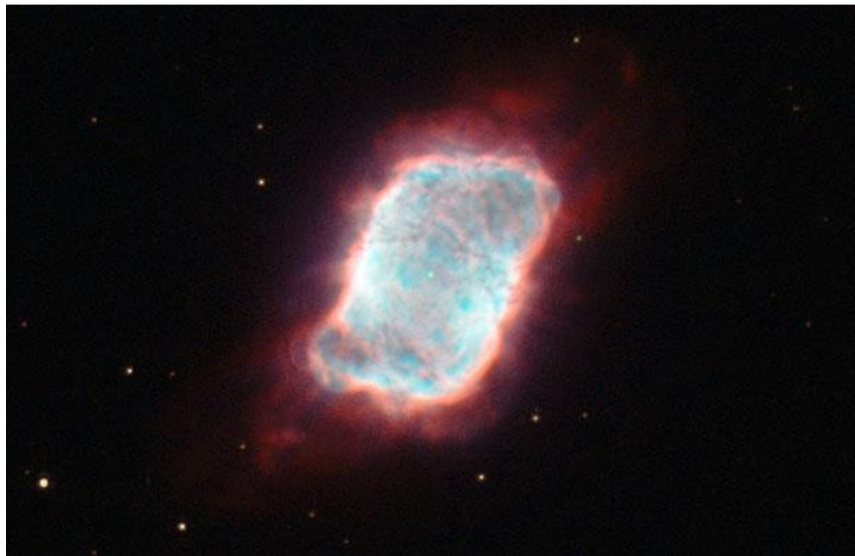
An interesting, and often overlooked, object in Andromeda is the "Ghost of Mirach." In a galaxy very near to Beta Andromeda, Mirach's Ghost is easily seen in an 8" telescope (mag 11.7). It's known as the "Ghost" because NGC 404 is lost in the glare of the red giant star of Mirach.



In the image at the right, this object is shown in visible light on the left and ultraviolet on the right using NASA's Galaxy Evolution Explorer, both views are identical in their field of view. You can see the galaxy come to life (see the ring in green?) which contains new stars, an amazing discovery for scientists! The galaxy is 8 million light years away. Beta (the actual star Mirach) is only 75 light years away). It's 6.4 arcminutes NW of beta (mag is 2.03), and the galaxy is mag 11.7.

## Phantom Streak (NGC 6741)

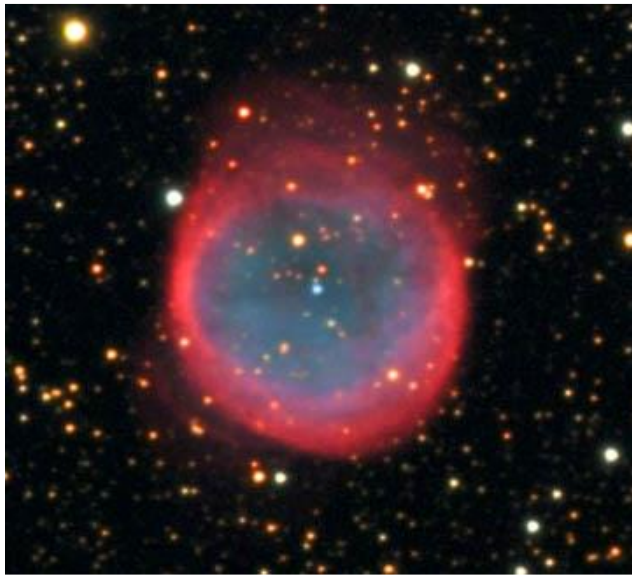
The Phantom Streak (NGC 6741, planetary nebula) in Aquila. A very tiny but relatively bright nebula that really pops when blinked with a UHC or O III filter. The Hubble Space Telescope photograph (above) reveals a fascinating shape and texture. Magnitude 11, Size: 6". Discovered by Edward Pickering in 1882. It was named by John Mallas using a 4" refractor to survey planetary nebula.





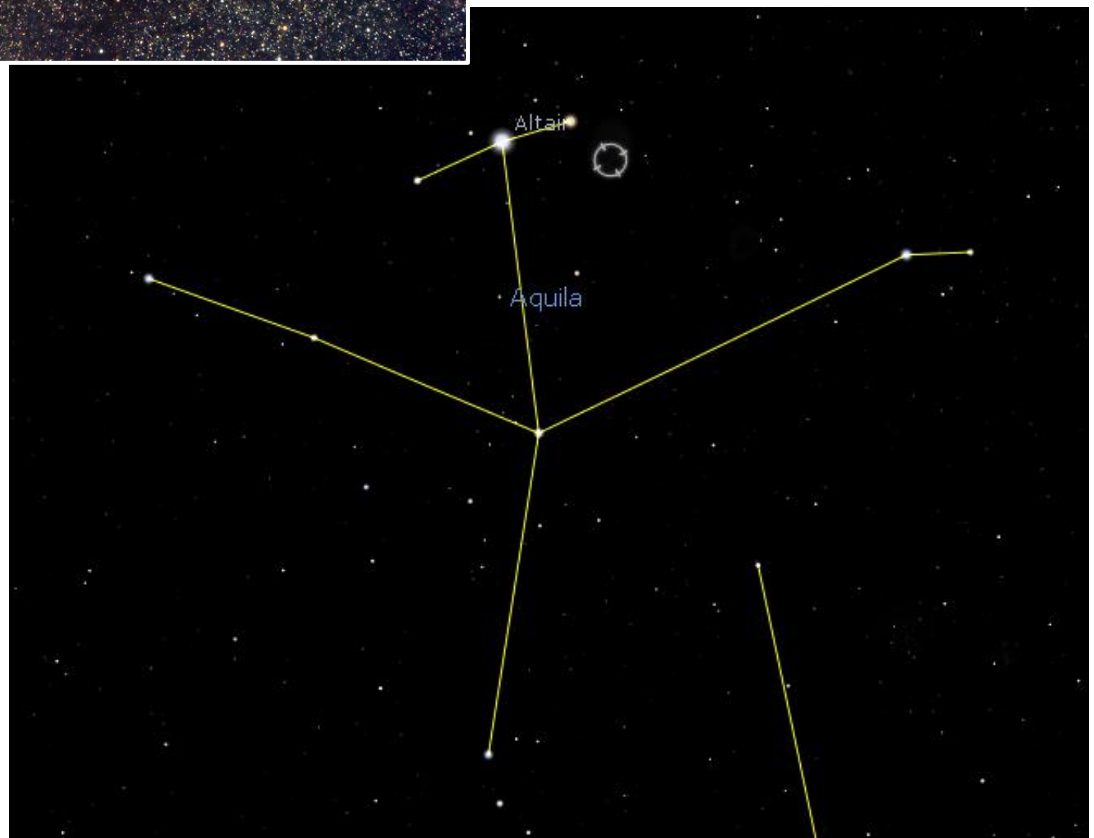
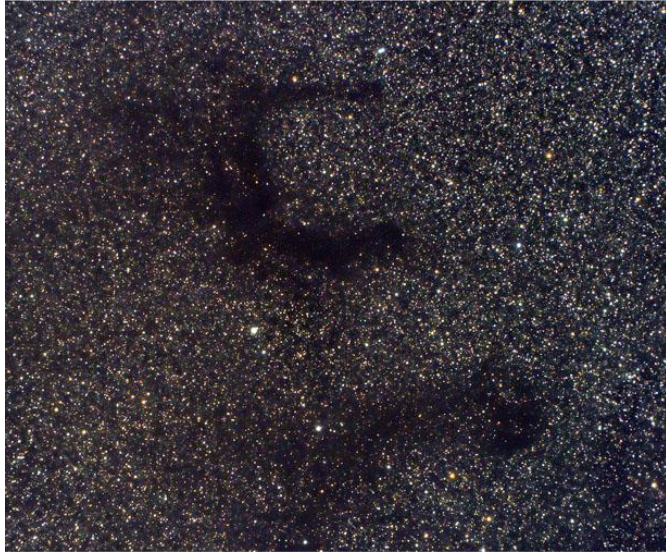
## Ghost of the Moon (NGC 6781)

Ghost of the Moon Nebula (NGC 6781, planetary nebula) in Aquila at 19h 18.5m, +06° 32'. Hands down, the visually scariest-looking nebula of the bunch. A faint, ghostly bubble at 64× without a filter. With the O III in place, the nebula becomes much more distinct with a crisp circumference but still retains the delicate look of ectoplasm afloat in the celestial void. The combination of 142×, a UHC filter and averted vision exposed a big, dark hole in center of the bubble, while the southern half of the ring appeared thicker and brighter than the northern.



## Barnard's "E for Evil" Nebula

(Barnard 142–143 dark nebulae pair) in Aquila. It is northwest of Altair. Two neighboring dark nebulae with high opacity are evil enough to make a good show even in 10×50 binoculars. Together they spell the letter "E." In the happy light of day, they're known as "Barnard's E" after the American astronomer E. E. Barnard, but at Halloween-time, I'm going with "E for Evil." All in good fun, of course. Short-focus telescopes with wide fields of view show the pair in striking contrast to the rich, starry backdrop. Sizes: Barnard 142, 30' × 30'; Barnard 143, 30' × 15'.

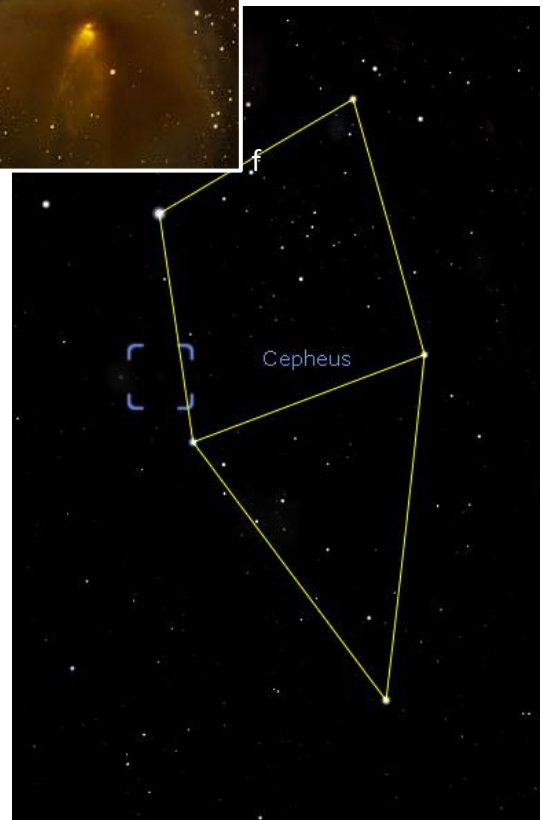


## Ghost Nebula (Sharpless 2-136, VdB 141, reflection nebula)

The Ghost Nebula (designated Sharpless 2-136 (Sh2-136) and vdB 141) is a rather isolated reflection nebula over 2 light-years across, located some 1200 light-years away at the edge of the Cepheus Flare molecular cloud complex in the constellation Cepheus.

It is nicknamed the “Ghost Nebula” due its spooky appearance and to several human-like figures with arms raised, rising up from the top of the cloud structure to the left of the bright reflection.

The complex process of star formation creates dust clouds of many shapes and sizes. In the case of the Ghost nebula, spooky shapes seem to haunt this starry expanse drifting through the night. Of course, these shapes are also cosmic dust clouds. Several stars are embedded in the nebula, and their light gives it a ghoulish brown color.



## Specter Nebula

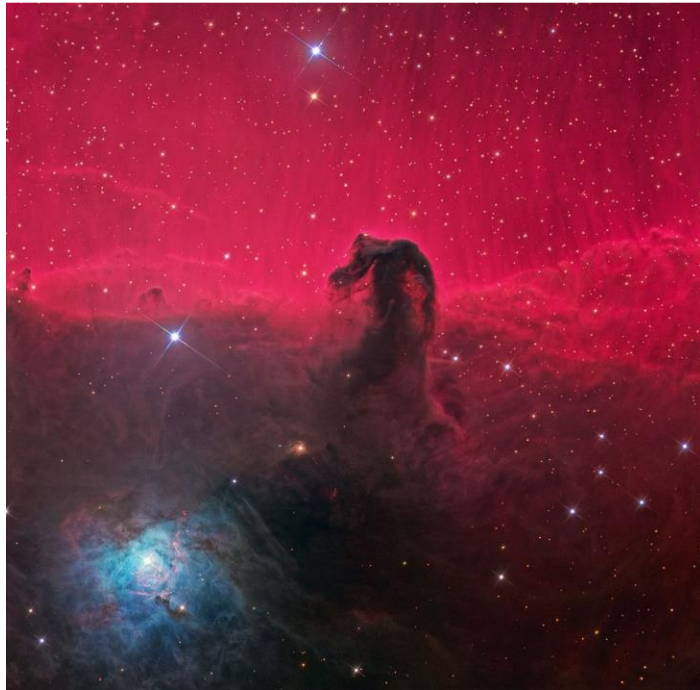
**Specter of Death Nebula** (NGC 1999, reflection nebula) in Orion at  $5^{\text{h}} 36.5^{\text{m}}$ ,  $-06^{\circ} 43.3'$ , Located only  $1^{\circ}$  south-southeast of the Orion Nebula. Very nice dense ball with a distinct dark hole visible at 100× and higher magnifications. The hole appears round and slightly off-center and pops in and out of view while switching from direct to averted vision. Magnitude +9.5, Size: 1.5'





## The Horsehead Nebula

The **Horsehead Nebula** (also known as **Barnard 33**) is a small dark nebula in the constellation Orion. The nebula is located just to the south of Alnitak, the easternmost star of Orion's Belt, and is part of the much larger Orion Molecular Cloud Complex. It appears within the southern region of the dense dust cloud known as Lynds 1630, along the edge of the much larger, active star-forming H II region called IC 434.

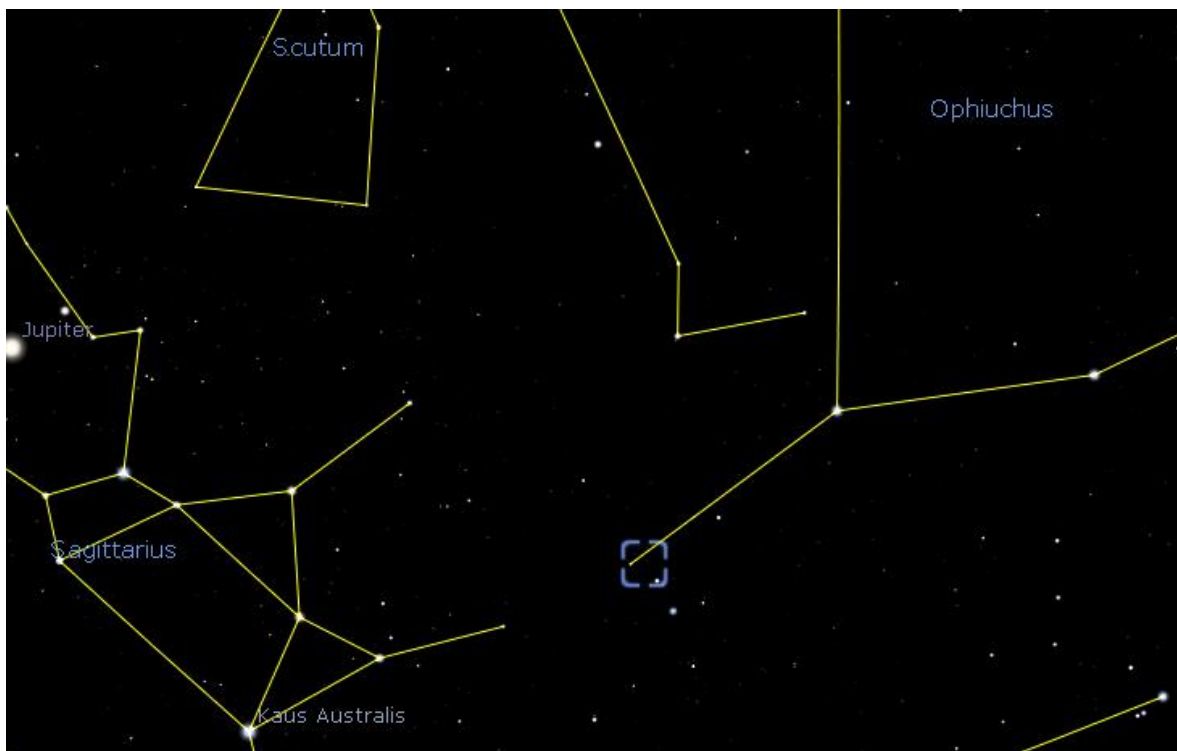




## Little Ghost Nebula

**Little Ghost Nebula** (NGC 6369, planetary nebula) is in the constellation Ophiuchus. It was discovered by William Herschel.

Round and planet-shaped, the nebula is also relatively faint. Planetary nebulae are created at the end of a sun-like star's life as its outer layers expand into space while the star's core shrinks to become a white dwarf. The transformed white dwarf star, seen near the center, radiates strongly at ultraviolet wavelengths and powers the expanding nebula's glow. The nebula's main ring structure is about a light-year across and the glow from ionized oxygen, hydrogen, and nitrogen atoms are colored blue, green, and red respectively.



## The Spider and the Fly Nebula

The spider part of "The Spider and the Fly" nebulae, IC 417 abounds in star formation, as seen in this infrared image from NASA's Spitzer Space Telescope and the Two Micron All Sky Survey (2MASS).

Located in the constellation Auriga, IC 417 lies about 10,000 light-years away. It is in the outer part of the Milky Way, almost exactly in the opposite direction from the galactic center. This region was chosen as the subject of a research project by a group of students, teachers and scientists as part of the NASA/IPAC Teacher Archive Research Program (NITARP) in 2015.

A cluster of young stars called "Stock 8" can be seen at center right. The light from this cluster carves out a bowl in the nearby dust clouds, seen here as green fluff. Along the sinuous tail in the center and to the left, groupings of red point sources are also young stars.



## Red Spider Nebula

The **Red Spider Nebula** (also catalogued as *NGC 6537*) is a planetary nebula located near the heart of the Milky Way, in the northwest of <sup>[3]</sup> the constellation Sagittarius. The nebula has a prominent two-lobed shape, possibly due to a binary companion or magnetic fields and has an 'S'-shaped symmetry of the lobes – the lobes opposite each other appear similar. This is believed to be due to the presence of a companion to the central white dwarf. However, the gas walls of the two lobed structures are not at all smooth, but rather are rippled in a complex way.

The central white dwarf, the remaining compact core of the original star, produces a powerful and hot ( $\approx 10,000$  K) wind blowing with a speed of 300 kilometers per second, which has generated waves 100 billion kilometers high. The waves are generated by supersonic shocks formed when the local gas is compressed and heated in front of the rapidly expanding lobes. Atoms caught in the shocks radiate a visible light.<sup>[5]</sup> These winds are what give this nebula its unique 'spider' shape and also contribute to the expansion of the nebula.

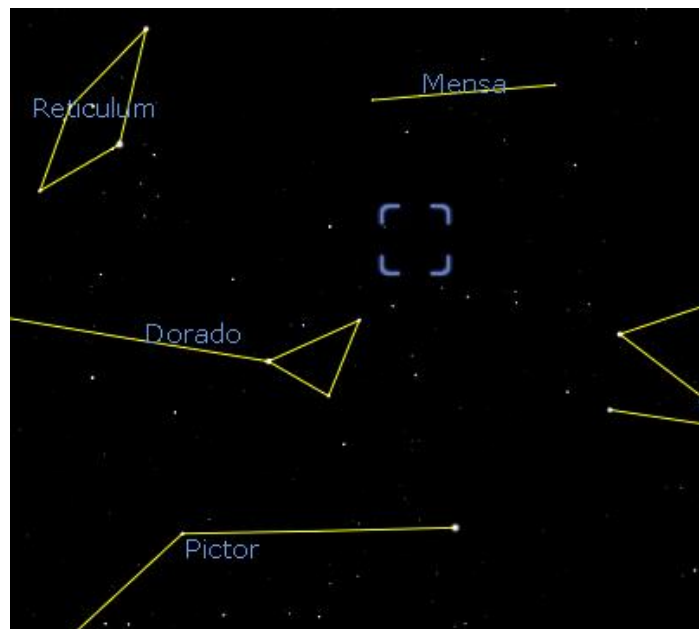


## Tarantula Nebula

The **Tarantula Nebula** (also known as **30 Doradus**) is an H II region in the Large Magellanic Cloud (LMC), from the solar system's perspective forming its south-east corner.

The Tarantula Nebula was observed by Nicolas-Louis de Lacaille during an expedition to the Cape of Good Hope between 1751 and 1753. He catalogued it as the second of the "Nebulae of the First Class", "Nebulosities not accompanied by any star visible in the telescope of two feet". It was described as a diffuse nebula 20' across.

Johann Bode included the Tarantula in his 1801 *Uranographia* star atlas and listed it in the accompanying *Allgemeine Beschreibung und Nachweisung der Gestirne* catalogue as number 30 in the constellation "Xiphias or Dorado". Instead of being given a stellar magnitude, it was noted to be nebulous.





## Dragon's Head Nebula

**NGC 2035** (also known as **ESO 56-EN161** and the **Dragon's Head Nebula**) is an emission nebula and a H II region in the Dorado constellation and part of the Large Magellanic Cloud. It was discovered by James Dunlop on August 3, 1826. Its apparent size is 3.0.

NGC 2035 is part of a complex of nebulae and stars, including NGC 2029, NGC 2032 and NGC 2040, found north of the main bar of the LMC. It consists of large bright gas clouds which are separated by dark dust clouds. NGC 2029, NGC 2032 and NGC 2035 are star-forming regions, while NGC 2040 is a supernova remnant which contains an open cluster.

