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This NASA image of Crab Nebula combines information from three separate space observatories: “The Chandra X-ray image is shown in light blue, the Hubble Space Telescope optical images are in green and dark blue, and the Spitzer Space Telescope’s infrared image is in red. The size of the X-ray image is smaller than the others because the outwardly streaming higher-energy electrons emitting X-ray light radiate away their energy more quickly than the lower-energy electrons emitting optical and infrared light. The neutron star, which has the mass equivalent to the sun crammed into a rapidly spinning ball of neutrons twelve miles across, is the bright white dot in the center of the image.” Credit: NASA; ESA; CXC; JPL-Caltech; J. Hester and A. Loll (Arizona State Univ.); R. Gehrz (Univ. Minn.) and STScI.

Observing the night sky, in 1744, a teenaged boy from Badonviller, France - Charles Messier - saw something unusual. It wasn’t the first time this keenly observant lad had studied the heavens. But on this night, he saw a comet which had developed six tails.

A contemporary artist recorded how the comet appeared when its head was below the horizon. By March 8, 1744, the comet was visible in the predawn sky, its tails resembling a Japanese fan. Messier, for years thereafter, continued to search the sky hoping to see (or discover) more comets.

The Frenchman thus grew up with a profound love of astronomy. Observing, and recording, what he saw in the heavens became a career for him. Astronomers still use “M” designations, based on a catalog he created, to identify deep-sky objects with fixed positions.

His list includes such things as “fuzzy” non-comets known as nebulae. M1 (or, Messier 1), for example, is another name for the Crab Nebula.

Observed by Chinese astronomers in 1054 AD - when it was an exploding supernova - and discovered in 1731 by John Bevis (a British physician and amateur astronomer), the Crab Nebula is still one of the most studied of all objects in the sky. It takes its name from an 1844 (or thereabouts) drawing by William Parsons, the Third Earl of Rosse, who observed it with a 36-inch reflector at his home, Birr Castle, near Parsonstown, County Offaly, Ireland.

Thanks to the Hubble telescope, we can examine it in much greater detail than Lord Rosse could have ever imagined - even with his later 72-inch telescope which, for nearly a century, was the biggest in the world.

Hubble’s image of the Crab - assembled from twenty-four separate exposures - provides astronomers with incredible detail of the nebula. And, because of the space telescopes (Hubble, Spitzer and Chandra), scientists have learned how the Crab moves through space: It is propelled by a dynamic pulsar [PULSating stAR] at its core.

As we continue our virtual visit to space, let’s examine a few more notable nebulae.

See [Alignments to State and Common Core standards for this story online at:](http://www.awesomestories.com/asset/AcademicAlignment/THE-CRAB-NEBULA-Exploring-Space-Images-from-NASA)

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See [Learning Tasks for this story online at:](#)

## Media Stream



### Observing the Night Sky in 1744

The "Great Comet of 1744" caused much excitement wherever it was viewable. Many artists created illustrations depicting it.

In this illustration, we see the work of Johann Georg Puschner (1680-1749). He called his work:

*Der Große Komet von 1744 über Nürnberg*

*In English, that means:*

*The Great Comet of 1744 over Nuremberg.*

*Click on the image for a better view.*

*Image online via Wikimedia Commons.*

*View this asset at: <http://www.awesomestories.com/asset/view/Observing-the-Night-Sky-in-1744>*

### Comet - 1744 Drawing

This drawing illustrates the "Great Comet of 1744," as it appeared at about 4 am on the 9th of March in 1744.

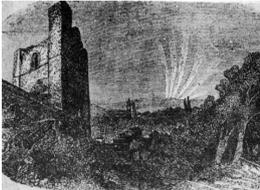
Also known as *Comet C/1743 X1*, and the "Comet de Cheseaux-Klinkenberg," it had six tails rising above the horizon. At the moment this happened, however, the "head" of the Comet was not visible (due to the morning light).

It is believed that the original of this drawing was created by Jean-Philippe de Cheseaux (whose name appears in the Comet's alternative description).

*Click on the image for a better view.*

*Image online via Wikimedia Commons. Public Domain.*

*View this asset at: <http://www.awesomestories.com/asset/view/Comet-1744-Drawing>*



## Comet - Anatomy of a Comet

This drawing might seem a bit simplistic because it merely describes the main parts of a much-more complicated object. What we see here are the main parts of a comet.

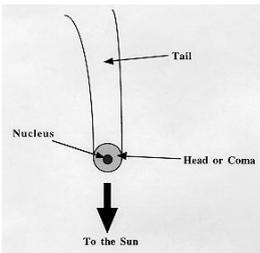
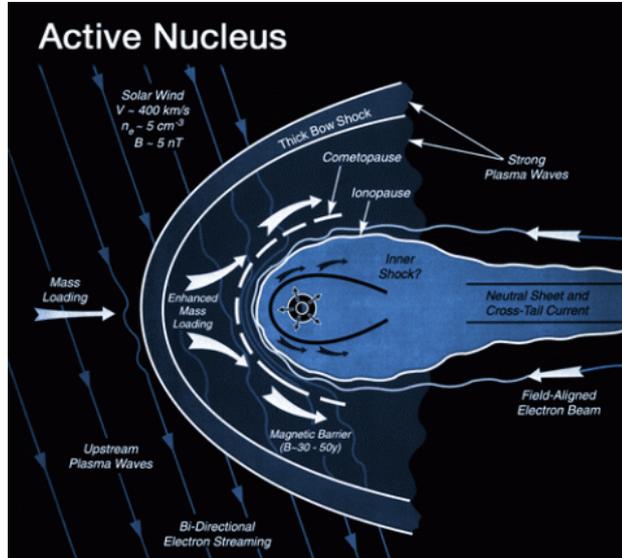
NASA and the ESA (European Space Agency) help us to put "flesh on these bones" with the following [lesson about comets](#).

### Anatomy of a Comet

The comet's structure, or total environment, includes:

1. The interior of the nucleus;
2. The surface of the nucleus which morphs as the comet approaches the sun;
3. The coma that emerges from and surrounds the nucleus;
4. The tails that eventually trail behind the comet as it approaches the sun.

### The nucleus



When far from the sun, comets are usually big, asymmetrical chunks of ice mixed with dust or rock, typically less than ten miles across. This is the comet's nucleus. Scientists used to think that it was solid and firm, but NASA's Deep Impact mission (2005), in which Rosetta participated, surprised them. They found that the nucleus of comet Tempel-1 was more silicate or dusty than they expected. It was also harder than they expected.

When a comet is in the deep freeze of space, very far from the Sun, it is completely frozen. But when it approaches to within about 140 to 280 million miles (about 225 million to 450 million km) of the sun, its ices begin to [sublime](#).

They boil off of the surface or burst out of the interior as jets of gas, carrying dust with them. This spewing gas and dust create a huge "coma" around the nucleus. The coma can grow as large as 60,000 miles (100,000 km) or more in diameter! The nucleus and coma together are the "head" of the comet.

### The coma

As the coma grows larger, it becomes an obstacle to the streaming solar wind, creating a bow shock in front of the coma. This bow shock is a bit like the reactive wave that forms off the bow of a ship as it plows against the waves pushing against it.

Similarly, the comet "plows" through the solar wind, and this confrontation expands the coma more and more as the comet approaches the sun. As the pressure of the coma begins to equal the pressure of the solar wind, the solar wind and its associated magnetic field lines slow down, compress against the coma, and then stream around the comet, carrying cometary ions and dust with them, eventually forming the comet's tails.

As the coma grows, different regions, similar to those found in Earth's own upper atmosphere and magnetosphere, form within it, including:

1. The inner shock;
2. The ionopause and ionosphere; and
3. The cometosphere and cometopause.

A particle leaving the surface of the comet will fly out, accelerate through the inner shock, and perhaps interact with light from the Sun. It may interact with other molecules, or possibly photoelectrons, and it may even continue accelerating even beyond the bow shock. For more on this process, see "[How a Comet Works](#)."

### The tails

As the solar wind and magnetic field lines wrap around the coma, they push ionized gas and dust away from, and around, the head of the comet, to form tails that always stream directly away from the sun. The first kind of tail, the [dust tail](#), contains microscopic dust particles which usually form a broad and gently curved tail that can stretch up to 60 million miles (100 million km)!

The second kind of tail, the [ion tail](#), is straighter and thinner, and consists of ionized gas. Ion tails can become quite long. Comet Hyakutake's ion tail stretched an amazing 360 million miles! That's about four times the distance between the Earth and the sun, and the longest ever observed by humans. That's an amazing long tail to wag in space!

Scientists studying the comet Hale-Bopp also noted a faint sodium tail, something not seen frequently on visible comets. There's no doubt about it. Comets put on some of the most amazing shows you'll ever see.

Images online via NASA. Public Domain.

View this asset at: <http://www.awesomestories.com/asset/view/Comet-Anatomy-of-a-Comet->



### Crab Nebula Drawing - by William Parsons

Image, described above, included (among other places) as Figure 81 in *The Scientific Papers of William Parsons, Third Earl of Rosse 1800-1867*, by William Parsons, facing [page 106](#). Online via Google Books.

PD

View this asset at: <http://www.awesomestories.com/asset/view/Crab-Nebula-Drawing-by-William-Parsons>

### William Parsons and the Leviathan of Parsonstown

William Parsons, also known as the 3rd Earl of Rosse KP (June 17, 1800 - October 31, 1867), was born in the English town of York. Extremely intelligent, he studied at Trinity College in, Dublin, and graduated from Oxford University's Magdalen College, in 1822, with first-class honors in math.

From the time he was about seven years old, and throughout his university years, Parsons was also known as "Baron Oxmantown." He kept that title until the death of his father.

When his father Lawrence, the 2nd Earl of Rosse, died in 1841, William inherited both an earldom and a large estate in King's County (known today as County Offaly) in Ireland.

Shortly thereafter, Parsons—who was an avid astronomer—had several optical reflecting telescopes built. One of them—which measured 72-inches—was the largest telescope in the world, for the time, and was often called the "Leviathan of Parsonstown." It was completed in 1845.

Thomas Langlois Lefroy, who was greatly impressed by Parsons' telescope, said this about his observations through the gigantic sixteen-ton "monster" (which remained the largest telescope of the 19th Century):

*The planet Jupiter, which through an ordinary glass is no larger than a good star, is seen twice as large as the moon appears to the naked eye ... But the genius displayed in all the contrivances for wielding this mighty monster even surpasses the design and execution of it.*

*The telescope weighs sixteen tons, and yet Lord Rosse raised it single-handed off its resting place, and two men with ease raised it to any height. (See Memoir of Chief Justice Lefroy, by Thomas Lefroy, at [page 242](#).)*

*Parsons, who died in 1867, discovered 226 NGC objects.*

*His son published those findings in "Observations of Nebulae and Clusters of Stars Made With the Six-foot and Three-foot Reflectors at Birr Castle From the Year 1848 up to the Year 1878," in Scientific Transactions of the Royal Dublin Society Vol. II, during 1878.*

*Image online via Wikimedia Commons.*

View this asset at: <http://www.awesomestories.com/asset/view/William-Parsons-and-the-Leviathan-of-Parsonstown>

### William Parsons 36-inch Reflector

This nineteenth-century illustration depicts William Parsons' 3-foot telescope which the astronomer, also known as Lord Rosse, had constructed in 1839. The telescope was situated on the Birr Castle property in Parsonstown, Ireland.

Among other things, this telescope was used to measure the temperature of Earth's Moon in 1868. In this drawing, we see the telescope with its alt-azimuth mount. In 1876, the telescope was redesigned, and remounted, as an equatorial telescope.

The illustration is from *The Cycle of Celestial Objects Continued at the Hartwell Observatory to 1859*, by William Henry SMYTH (Rear Admiral), published in London during 1860.

Illustration online via [University of Virginia, Department of Astronomy](#).

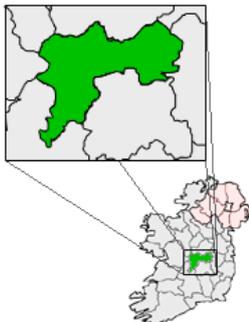
View this asset at: <http://www.awesomestories.com/asset/view/William-Parsons-36-inch-Reflector>

### Birr Castle

Image online, courtesy Wikimedia Commons.

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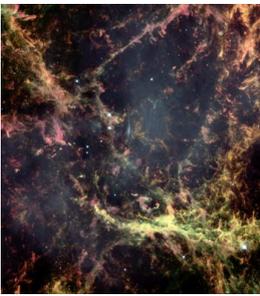
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### County Offaly - Map Locator

Image online, courtesy Wikimedia Commons.

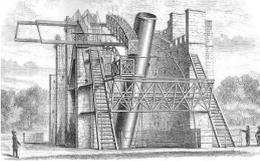
View this asset at: <http://www.awesomestories.com/asset/view/County-Offaly-Map-Locator>



### Hubble Image - Crab Nebula

Image online, courtesy NASA.

View this asset at: <http://www.awesomestories.com/asset/view/Hubble-Image-Crab-Nebula>



### William Parsons 72 Inch Reflector

Image online, courtesy Wikimedia Commons.

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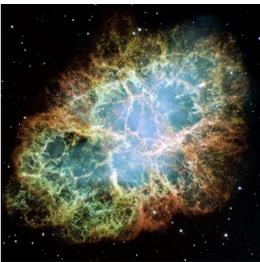
View this asset at: <http://www.awesomestories.com/asset/view/William-Parsons-72-Inch-Reflector>



### Leviathan of Parsonstown

Image online, courtesy the Canadian Space Agency website.

View this asset at: <http://www.awesomestories.com/asset/view/Leviathan-of-Parsonstown>



### The Incredible Detail of Hubble Images

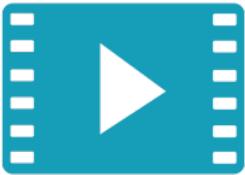
Image online, courtesy the NASA website.

View this asset at: <http://www.awesomestories.com/asset/view/The-Incredible-Detail-of-Hubble-Images>



### THE CRAB NEBULA

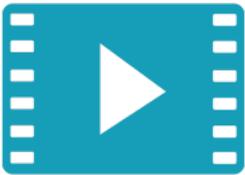
View this asset at: <http://www.awesomestories.com/asset/view/THE-CRAB-NEBULA>



### Animated Telescopes: Hubble, Spitzer and Chandra

Animation, online courtesy NASA.

View this asset at: <http://www.awesomestories.com/asset/view/Animated-Telescopes-Hubble-Spitzer-and-Chandra>



### Crab Nebula - Animated Tour

Online clip, courtesy NASA.

Credit for this animation, as follows:

**X-ray:** NASA/CXC/ASU/J.Hester et al.;

**Optical:** NASA/ESA/ASU/J.Hester & A.Loll;

**Infrared:** NASA/JPL-Caltech/Univ. Minn./R.Gehrz

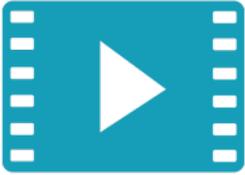
View this asset at: <http://www.awesomestories.com/asset/view/Crab-Nebula-Animated-Tour>



### Crab Nebula - Seen by Space Telescopes

Video, courtesy NASA.

View this asset at: <http://www.awesomestories.com/asset/view/Crab-Nebula-Seen-by-Space-Telescopes>



### PULSAR - Animated Travel Through Space

Animated clip, courtesy NASA.

View this asset at: <http://www.awesomestories.com/asset/view/PULSAR-Animated-Travel-Through-Space>



### Supernova - Exploding Death Star

Animation: NASA/CXC/A.Hobart - online, courtesy NASA.

View this asset at: <http://www.awesomestories.com/asset/view/Supernova-Exploding-Death-Star>