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# The Mysterious Geminid Meteor Shower

**On December 13, 1998, fragments of a curious object called 3200 Phaethon will produce a beautiful sky show**

**December 4, 1998:** 1998 was a great year for meteor watching. In November the much-anticipated Leonids produced an [outburst](#) of nearly 600 meteors per hour, punctuated by a spectacular [display of fireballs](#) seen worldwide. The [October Giacobinids](#) were also a pleasant surprise for many, thanks to an [outburst over Japan](#) and east Asia. As 1998 winds down, there is one more opportunity to view a dazzling sky show: the annual Geminids meteor shower.



**Right:** Artist Duane Hilton's concept of a Geminid fireball streaking above an eerie 12-ft salt tower (or "tufa") in Mono Lake, California.

The shower officially begins on December 6th, but it doesn't peak until the night of the 13th. Unlike the Giacobinids and Leonids, the Geminid's broad maximum lasts nearly a full day, so observers around the globe have a good chance to see the show. At its peak the Geminids are expected to produce about one shooting star every 30 seconds.

Follow the shower from

<http://comets.amsmeteors.org/meteors/showers/geminids.html>

Most well known meteor showers, like the Perseids and Leonids, are old. They've been observed for hundreds or even thousands of years. The earliest record of a modern-day meteor shower is probably a notation in Chinese annals dated 36 AD, regarding the Perseids, where it is said that "more than 100 meteors flew thither in the morning." ([ref.](#))



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The Geminids are a different story. The first Geminid meteors suddenly appeared in the mid-1800's. Those early showers were unimpressive, boasting a mere 10-20 shooting stars per hour. Since then, however, the Geminids have grown in intensity until today it is one of the most spectacular annual showers. In 1996, the last time the Geminids appeared in a dark moon-less sky, observers saw as many as 110 per hour. Sky-watchers with clear skies should see at least that many this year if the Geminids continue to intensify.

After the discovery of the Geminids in 1862 astronomers began searching for the parent comet. Most meteor showers result from debris that boils off a comet's nucleus when it passes close to the sun. This debris orbits the sun along with the comet, forming a thin,

elongated stream of meteoroids that become shooting stars when they hit Earth's atmosphere.

Years of searching proved to no avail until finally, in 1983, NASA's Infrared Astronomical Satellite discovered a curious object moving in the same orbit as the Geminid meteoroid stream. The orbital match was so good that it had to be the source of the debris, but to the surprise of many it wasn't a comet. The source of the Geminids was apparently a rocky asteroid.

3200 Phaethon, as the asteroid is now known, is in a highly elliptical 1.4 year orbit that brings it within 0.15 AU (astronomical units) of the Sun. It made its closest recent approach to Earth in December 1997 when it passed within 0.31 AU of our planet.



**3D Solar System Simulator**  
Take a virtual tour of the solar system, complete with the curious asteroid 3200 Phaethon, the source of the Geminid meteors.



But how does an asteroid produce a meteoroid debris stream? Comets do it easily whenever they pass close enough to the sun to heat their frozen nucleus. Tiny bits of ice and dust naturally bubble away into interplanetary space. Rocky asteroids are made of tougher stuff, however, so it is unclear how bits of 3200 Phaethon would break or boil off to form a meteoroid stream.

**Above:** This image of Comet Hale-Bopp shows its spectacular tail stretching for millions of miles. The tail is composed of gas, dust, and icy meteoroids that bubble off the comet's frozen nucleus as a result of solar heating. Although 3200 Phaethon has some of the characteristics of a comet it does not develop a cometary tail when it passes close to the Sun.

One of the earliest ideas was that Phaethon might occasionally collide with other asteroids. Collisions would create a stream of pulverized rocks that would account for the Geminid meteor shower. Phaethon's orbit passes through the asteroid belt just beyond Mars, so at first this hypothesis seemed likely, but more detailed studies disagree. The orbits of individual Geminid meteoroids are not consistent with the idea that they broke free while in the asteroid belt. Instead, they appear to have crumbled away when Phaethon was closer to the Sun. In this respect Phaethon is behaving like a comet.



**Above:** Imaged by NASA spacecraft, the three potato-shaped objects above are large rocky asteroids orbiting between Mars and Jupiter. Shown to the same scale from left to right are Mathilde, Gaspra, and Ida. Mathilde has dimensions of about 37 by 29 miles. If 3200 Phaethon is indeed an asteroid, it probably looks like these objects.

So, is Phaethon a comet or an asteroid?

There are arguments in favor of both. Phaethon's spectra look like those of a rocky asteroid, but its orbit is similar to that of a comet. When Phaethon passes by the sun it doesn't develop a cometary tail, but bits and pieces do break off to form the Geminid meteoroids. By studying photographic records of fireballs, scientists have estimated the density of the Geminid meteoroids to be between 1 and 2 gm/cc. That's less dense than typical asteroid material (3 gm/cc), but several times denser than cometary dust flakes (0.3 gm/cc). Many astronomers now believe that Phaethon is an extinct or dormant comet that has accumulated a thick crust of interplanetary dust grains. Phaethon's thick mantle gives it the outward appearance of an asteroid, but underneath lies the nucleus of a comet.

The origin of the Geminids may not be fully understood until future space travelers pay a visit to the asteroid-comet 3200 Phaethon. Until then we can still enjoy the sky show and savor the mystery of the enigmatic Geminids.

## How to View the Geminids

### Geminids at a Glance

- The meteor shower is active from December 6 until December 19.
- The night of December 13/morning of December 14 is the best time to watch
- The radiant is at RA= $^{\text{h}}30^{\text{m}}$ , DEC= $+33^{\circ}$
- The waning crescent moon will make for good, dark sky observing conditions.

### Current Moon Phase



Updated every 4 hours.

The waning crescent moon around December 13 will be favorable for dark skies and good meteor observing.



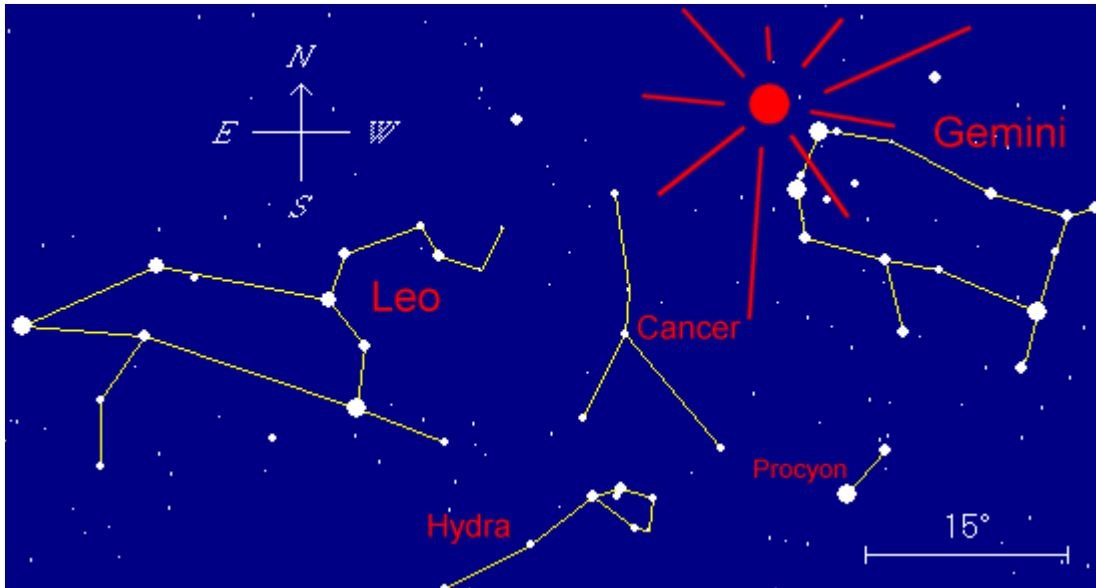
Geminids meteors can be seen anytime after 10 p.m. local time, when the constellation Gemini is well above the horizon, but the best time to look is during the early morning hours between about 2 a.m. and dawn. That's when the local sky is pointing directly into the Geminid meteor stream.

Gemini rises about 08:00 p.m. local time at mid-latitudes in the Northern hemisphere. The radiant of the Geminid shower is located near Castor, one of the two bright stars in Gemini (the other bright star is Pollux). To find the constellation at 2:00 a.m., go outside and face south. Castor and Pollux will appear approximately 45 degrees above the horizon. Earlier in the evening, from 10:00 p.m. until midnight, Gemini will be about 30 degrees above the horizon in the southeast.

You won't need binoculars or a telescope, the naked eye is usually best for seeing meteors which often streak more than 45 degrees across the sky. The field of view of most binoculars and telescopes is simply too narrow for good meteor observations.

Experienced meteor observers suggest the following viewing strategy: **Dress warmly** as the mid-December nights are likely to be cold in the Northern hemisphere.

Bring a reclining chair, or spread a thick blanket over a flat spot of ground. Lie down and look up somewhat toward the south. Meteors can appear in any part of the sky, although their trails will tend to point back toward the radiant.



The image indicates the general region of the sky from which the Geminid meteors appear to emanate (red dot). This point, called the radiant, is really an optical illusion - the meteors are moving along parallel paths, but appear to come from a single point, just as a stretch of parallel railroad tracks will appear to meet at a point on the horizon.

### Web Links



**[Meteors for kids](#)** - from the NASA Liftoff Space Academy

**[NASA Liftoff meteor shower pages](#)** - learn the basics about meteor showers. Includes tutorials, Java animations, and educational activities.

**[Eyewitness accounts of the historic 1966 Leonid storm](#)** -- an Ames Research Center Archive

**[Satellite Tracking](#)** - monitor satellites as they weather the storm

**[NASA's Office of Space Science](#)** - press releases and other news related to NASA and astrophysics

**External Links:**

### Related Stories:

**27 Nov. 1998: [A bust or a blast?](#)** -- New images of 1998 Leonid fireballs and their smokey remnants.

**23 Nov. 1998: [Leonids Sample Return payload recovered!](#)** -- Scientists are scanning the "comet catcher" for signs of Leonid meteoroids.

**19 Nov. 1998: [Early birds catch the Leonids](#)** -- The peak of the Leonid meteor shower happened more than 14 hours earlier than experts had predicted.

**18 Nov. 1998: [A high-altitude look at the Leonids](#)** -- NASA science balloon catches video of 8 fireballs.

[The Geminids](#) -- from Gary Kronk Meteors and Comets web site

[December's generous Geminids](#) -- Sky & Telescope article

[International Meteor Organization](#)

*16 Nov. 1998:* [The Leonid Sample Return Mission](#) -- NASA scientists hope to capture a Leonid meteoroid and return it to Earth.

*16 Nov. 1998:* [NASA Spacecraft take cover from the Leonids](#) -- but the Hubble Space Telescope won't stop observing.

*10 Nov. 1998:* [Great Expectations: the 1998 Leonid meteor shower](#) -- the basics of what the Leonids are and what might happen on November 17.



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