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Year in Astronomy: 2005

By the Editors of *Sky & Telescope*

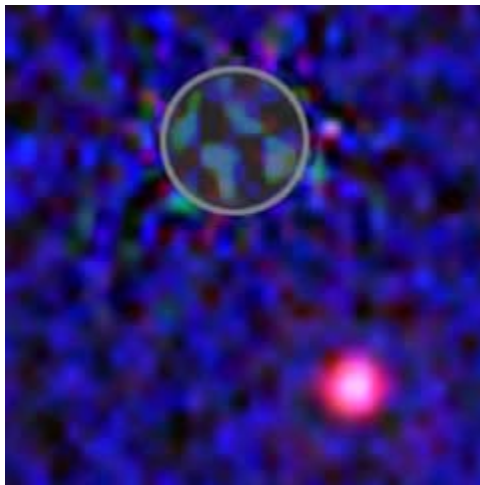
December 30, 2005 | As 2005 comes to a close, let's take a look back at the show-stopping new stories that rocked the astronomical community. Last year, all eyes were on NASA's Mars rovers, but while the pair still miraculously cruise along the Martian landscape, many new and exciting developments have climbed their way to the top of this year's list.

Huygens Arrives on Titan

2005 kicked off with a spectacular feat. After a 7½-year interplanetary journey aboard *Cassini*, the European Space Agency's *Huygens probe* finally reached Saturn's moon Titan on January 14. Shortly after touchdown, the findings — along with 350 or so first images of the large moon's surface — came flooding in to ESA headquarters. Among them: water ice and methane on the moon's surface, haze in its atmosphere, possible drainage channels, and much more. Planetary scientists will be working this treasure trove of data for years to come.



Titan's surface looks orange in full-color images. This shot was taken after the Huygens probe touched down onto Titan's surface on January 14th. The two "large" rocks in the middle of the image are really only about 15 centimeters (left) and 4 centimeters (center) across. *Courtesy ESA/NASA/University of Arizona.*



The pink dot in this Hubble Space Telescope infrared image might not look like a big deal, but in all likelihood it's a planetary-mass companion to the brown dwarf 2M 1207, whose location is marked by the gray circle. *Courtesy NASA / ESA / Glenn H. Schneider, et al.*

First Exoplanet Image

The first direct image of an extrasolar planet was an elusive goal this year. But

thanks to a team led by Gael

Chauvin (European Southern Observatory) astronomers have finally captured the photograph. Chauvin's team found the planet candidate in April 2004, but the discovery was not picture perfect; its pitiful mass, just 5 times that of Jupiter, depended on an unproven physical connection with a brown dwarf called 2M 1207. But in May, Chauvin's team released follow-up VLT observations that clinched the case for the two objects being bound. "This confirmation, by common proper motion, that the companion is really orbiting the brown dwarf puts the entire system on firm footing," says independent commentator Geoff Marcy (University of California, Berkeley), who leads the team that has discovered the majority of the 160 or so known exoplanets.

Amateurs Make Exoplanet Discoveries

Among those known exoplanets, amateur astronomers made one of the most important discoveries this year — an exoplanet milestone for the amateur community. New Zealand amateurs Grant W. Christie and Jennie McCormick made crucial observations in April that helped several international collaborations of professional astronomers nail down the existence of the planet. The newly discovered planet, just the second one found by gravitational microlensing, is roughly three times the mass of Jupiter and orbits its unnamed host star at approximately three times the average Earth-Sun distance.

Amateur astronomers have [previously detected exoplanets](#) transiting their parent stars, but only after professionals made the initial findings. However, later in the year this proved not to be the case. A day before professional astronomers announced a new transiting planet, California amateur astronomer [Ron Bissinger detected a partial transit](#) of the same object. HD 149026b is now the third transiting exoplanet detected by amateurs.

NASA Gets New Chief and Returns to Flight

Physicist and aerospace engineer [Michael D. Griffin took the helm](#) as NASA's next administrator on April 13th, just one month following [his nomination](#). Griffin succeeded Sean O'Keefe, who resigned from the space agency in mid-February. In his first year on the job Griffin set the tone by participating in a study of the Bush administration's "Vision for Space Exploration." Along with many resolutions, the group recommended phasing out the Space Shuttle sooner than the president's proposed date of 2010, accelerating the development of a new piloted space vehicle, and curtailing spending on the International Space Station (ISS) to help fund future missions to the Moon and Mars.

An [overdue servicing mission](#) to the Hubble Space Telescope seems within reach now that the space shuttle has [returned to flight](#). Space Shuttle *Discovery* launched from NASA's Kennedy Space Center on July 26, ending a 2½ year lull following the tragic *Columbia* disaster that grounded the fleet in 2003. *Discovery* returned to Earth August 9th at Edwards Air Force Base in California. A mandated follow-up "return to flight" mission is currently set for launch in May 2006.

Asteroid 2004 MN₄: The Near Miss and ?

The recently discovered near-Earth asteroid 2004 MN₄ [made headlines](#) early this year when astronomers estimated that it had a 1-in-38 chance of hitting Earth in 2029. The threat quickly passed when old images narrowed down the asteroid's orbit well enough to guarantee that it would *not* hit our planet in 2029. [Extremely precise radar observations](#) by NASA's Near Earth Object Program calculate that the asteroid will pass 4.7 Earth radii (30,000 kilometers, or 18,600 miles) from Earth's surface on April 13, 2029. With an estimated diameter of 320 meters, 2004 MN₄ will appear up to 2 arcseconds wide, making it barely resolvable in amateur telescopes.

?The Almost Miss: April's Total Solar Eclipse

To eclipse chasers in the Pacific Ocean on April 8th, a near miss would have been devastating. The year's [hybrid solar eclipse](#) was viewed across the land in parts of Central America and the Caribbean where the eclipse was partial. But the total phase of this hybrid solar eclipse was viewed by an estimated 1,500 passengers and crew members aboard three cruise ships since the path of totality never made landfall. Experienced eclipse-chasers aboard the *MV Discovery* described the eclipse as the most colorful one they'd ever seen. *S&T* editor in chief and observer Rick Fienberg [reported the event](#) vividly: "When totality set in, the Moon's black silhouette was rimmed with a thin and nearly complete ring of magenta fire that was in turn enveloped by a fainter and more expansive white glow — the solar corona, or outer atmosphere — that extended in opposite directions like a bow tie."

The next total solar eclipse happens on March 29, 2006, for parts of western and northern Africa, the eastern Mediterranean, Turkey, and Central Asia. A partial eclipse will be visible across Europe, the Middle East, most of western Asia, and most of Africa.



For observers aboard the *MV Discovery*, totality was breathtaking but brief, lasting only 33 seconds. This frame from a video recording, snapped at 11:51 a.m. local time, doesn't do justice to the spectacle. It overexposes numerous electric-pink solar prominences around the Moon's silhouette and shows only the innermost corona, which stretched at least one solar diameter as seen by eye. *Sky & Telescope* photo by Rick Fienberg.



Bursting Stars: Gamma Ray Bursts, Magnetars, and Supernovae



Not a place you'd want to be. An artist depicts the violent merging of two neutron stars. According to theory, this cataclysmic collision sets off a chain of events that triggers a short GRB. *Courtesy NASA.*

A slew of observations made this year have led the way to a better understanding short-lived species of gamma-ray bursts (GRBs). Short GRBs (those lasting less than 2 seconds) flash in every direction of the sky. Until this year, astronomers could only theorize about their cause, since the bursts notoriously expire almost as quickly as they shine. The first breakthrough came as [NASA's Swift Observatory](#) recorded a [short burst on May 9th](#) lasting just 0.03 second. The space telescope swiveled around and imaged a weak, fast-fading X-ray afterglow — the first ever captured from a short GRB source. By targeting the event's location, Swift took a crucial first step toward discovering the mechanism causing these types of events.

Then in mid-year, the long-standing mystery of these bursts' origins cracked open. A [short burst flared on July 24th](#) and observations of the afterglow, which lingered for 35 hours, support the [leading theoretical model](#): that a binary system, consisting of either two neutron stars or a black hole and a neutron star, come together in an explosive flash of gamma rays. Furthermore, the observed events each occurred in the outskirts of old elliptical galaxies with minimal star formation — evidence that strengthens the merger theory.

While the May 9th and July 24 events provide strong evidence that short GRBs come from mergers, a similar event observed on December 27, 2004, is too fresh in this year's recollection to be ignored. Powerful flares on magnetars — neutron stars with stupendously powerful magnetic fields — are viable sources of gamma rays in the universe, as the [giant flare from the Milky Way magnetar SGR 1806-20](#) reminded us. This event was the brightest gamma-ray source from outside the solar system ever observed in the history of astronomy, perhaps only the Sun has doused Earth with more total energy than SGR 1806-20's superflare did during the two-tenths of a second that it peaked in intensity. (Thanks to the magnetar's great distance, the superflare posed no threat to humanity or Earth's biosphere.)

Then, on November 3rd, [another flare occurred](#). Lasting just one-tenth of a second, that flare possibly originated from a magnetar in another galaxy. The powerful burst of gamma rays were detected originating from an area in Ursa Major, near M81 and M82, two relatively large galaxies located about 12 million light-years away. If the burst originated in M81 or M82, its total energy and spectrum closely resemble those of the December 2004 giant flare from SGR 1806-20.

The next most energetic explosions in the universe's arsenal are supernovae. They may seem common, but there are still quite a few attention getters waiting to happen. With impressive diligence, the powerhouse Puckett Observatory Supernova Search (POSS), an international team of volunteer amateur astronomers, made its [100th supernova discovery](#) on July 15th. Tim Puckett, Ajai Sehgal, and Jack Newton found the 18th-magnitude stellar explosion by taking an image and manually "blinking" (comparing) it with those in the archives. The discovery was confirmed the following night. To date, Puckett and his POSS team have taken more than 850,000 images, which are distributed via the Internet. On the flip side, using his eyes, a 12-inch Newtonian reflector, and uncanny intuition, [Robert O. Evans made his 40th visual discovery of a supernova](#) on August 4th — a world record. Evans spotted and recognized the new 14th-magnitude star in the barred spiral galaxy NGC 1559 and recognized the newcomer, supernova 2005df, with his prodigious memory for star fields.



Astronomers Discover "10th Planet" and Pluto Bulks Up with Two New Moons

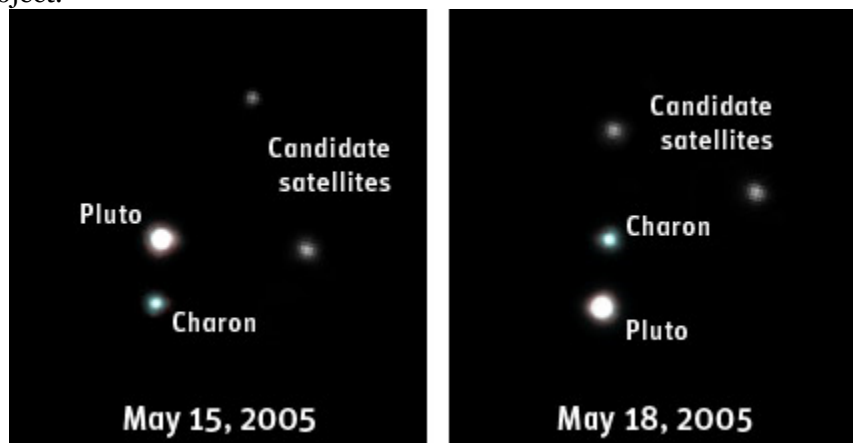
2005 will forever be remembered as the year a new planet was discovered. Or will it? The planet debate will rage on as the year comes to a close, but one thing is for sure: In July Michael E. Brown (Caltech) and his team of astronomers announced the discovery of the largest Kuiper Belt object (KBO) ever — and it's bigger than Pluto.

[Supernova 2005cs](#) is the bright star at the intersection of the two arrows in this image of M51, the Whirlpool Galaxy, taken by [R. Jay GaBany](#) of San Jose, CA. He used a 12-inch f/9 Takahashi Mewlon 300 telescope and a SBIG ST10XME CCD camera for 6 hours of luminance exposure and 2 hours each of red, green, and blue exposures from July 1 to 7, 2005. Click on the image for a before-and-after comparison; he made the supernova-free image about seven months earlier. *Imaging by R. Jay GaBany*



S&T Diagram: Gregg Dindermann

The object, designated [2003 UB₃₁₃](#), is more than twice Pluto's average distance from the Sun, making it the farthest object ever seen in the solar system. At magnitude 18.9 with a highly inclined (44°) orbit, it's no wonder it was only discovered recently; no one was looking for planets so far from the plane of the solar system. Brown and his colleagues later discovered that the potential new planet has a [small moon](#). The satellite is about 100 times (5 magnitudes) fainter than 2003 UB₃₁₃ and its diameter is about a tenth that of the main body. 2003 UB₃₁₃ is currently under review by an International Astronomical Union (IAU) committee charged with deciding whether the object should be officially classified as the solar system's tenth planet or a mere trans-Neptunian object.



Pluto's newest moons were spotted by the Hubble Space Telescope in mid-May using the Advanced Camera for Surveys. *Courtesy NASA, ESA, H. Weaver (JHU/APL), A. Stern (SwRI), and the HST Pluto Companion Search Team*

Perhaps to bolster its own newly exposed planet status, Pluto revealed [two new moons](#) this year. The Hubble

Space Telescope (HST) took the images that revealed the discovery, giving the ninth planet three satellites in total and making it the first quadruple Kuiper Belt object.



This raw image was shot by the Deep Impact flyby craft just moments after the mission's impactor slammed into comet Tempel 1. *Courtesy NASA/JPL/Caltech/UMD*

Deep Impact Leaves Its Mark

Finally, 2005 was marked as a year of fireworks on July 4th when NASA scientists successfully slammed [Deep Impact's](#) 372-kilogram (820-pound) projectile into Comet Tempel 1. The head-on collision took place at more than 37,000 kilometers (23,000 miles) per hour, generating the explosive force of nearly 5 tons of TNT. The impactor's camera relayed a steady stream of [detail-rich images](#) until just seconds before its demise.

It's been months since the Deep Impact comet crash, and astronomers are continuing to learn about the physics of the event, the nature of the excavated debris, and the structure of the comet's nucleus. The [latest findings](#) of the \$333-million mission were discussed last September, when the American Astronomical Society's Division for Planetary Sciences met in Cambridge, England.

Ring in the New Year

As a quick search of our online news archive makes abundantly clear, this annual review only scratches the surface of another amazing year in amateur astronomy and scientific space exploration. That's why *S&T's* editors and contributors — with the help of the worldwide astronomical community — work overtime to keep you in touch with the sky and its endless mysteries. In the meantime, we wish you a safe and happy New Year.