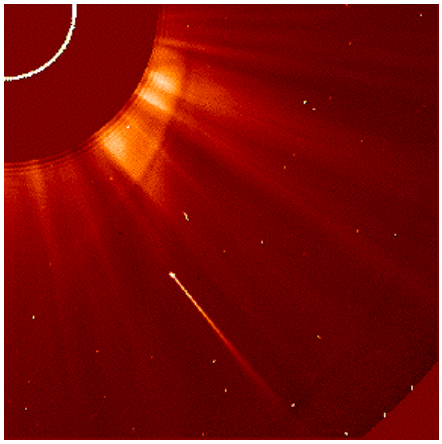
Astronomy News



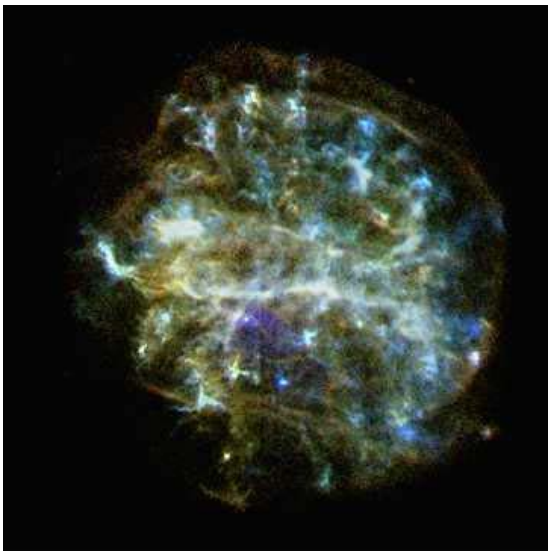
Comet approaches the sun on October 22, 2001.
Image by Solar and Heliospheric Observatory courtesy SOHO/NASA.

November 1, 2001 - As a comet approached the sun on October 22, the Solar and Heliospheric Observatory (SOHO) was monitoring two coronal mass ejections from the sun headed for Earth. Solar radiation heated the comet's ice and rocks causing an outgassing of water and dust. The water molecules broke down in the sun's ultraviolet light into oxygen and hydrogen atoms. The hydrogen atoms interacted with the sun's coronal plasma and glowed brightly. The dark circle in upper left corner is the sun masked by an instrument that blots out sunlight. The white circle within the disk shows the size and position of the actual sun.

During SOHO's operations the past six years, it has discovered more than 365 comets, the most of any instrument in astronomy's history. Most of those have been discovered by amateur stargazers studying the SOHO Sungazer website, not professional astronomers.

The Chandra X-Ray Observatory operating since 1999 continues to give astronomers unprecedented images of, and insights into, some new and old cosmic objects. The following are summaries of recent Chandra news releases.

Supernova of G292.0+1.8

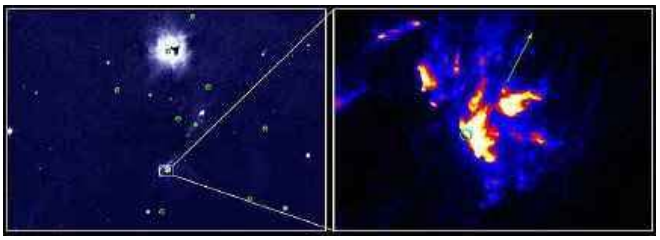


G292 is a young, oxygen-rich supernova remnant with a pulsar
at its center surrounded by outflowing material.
Photo courtesy Chandra/NASA/CXC/Rutgers/J. Hughes et al.

NASA's Chandra X-Ray Observatory captured this rapidly expanding gas shell from an exploded sun (supernovae) known as G292.0+1.8. The gas shell measures 36 light years across and contains large amounts of elements such as oxygen, neon, magnesium, silicon and sulfur. In fact, G292 is one of three known oxygen-rich supernovae in our Milky Way Galaxy. Scientists are intrigued by them because they are one of the primary sources of heavy elements necessary to form planets and life forms. G-292 exploded some 1600 years ago.

Embedded at the center of this cloud of multimillion degree gas is a point-like source of high x-ray energies suspected to be a rapidly spinning neutron star. "This finding is very important since it would allow us to conclusively associate this young, oxygen-rich supernova remnant with a core collapse in a massive star supernova explosion," said John Hughes of Rutgers University in the October 1, 2001 Astrophysical Journal. Astronomers have been trying to confirm that the trigger for supernova explosions in oxygen-rich stars is due to the collapse of a massive star into a neutron star, one of the most dense objects in the universe. In that collapse, tremendous amounts of energy and gasses are released.

First X-rays of Herbig-Haro Objects Reveal Shockingly High-Speed Gas Jet from Young Star



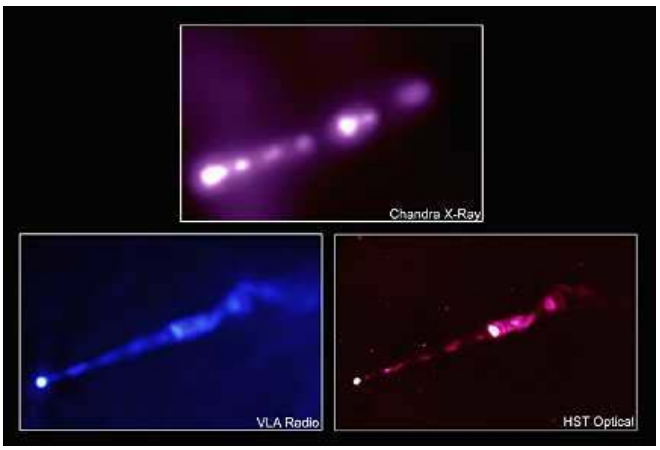
First x-rays detected on October 8, 2000 in Herbig-Haro (HH2) object on left, a high-velocity gas jet
where new stars are forming in Orion Nebula. Green circle in image on right shows position of X-ray source
detected for first time in HH2 by Chandra X-Ray Observatory courtesy Chandra/NASA/HST.

For years astronomers have tried to "see" x-ray emissions from very hot objects called Herbig-Haro objects named after astronomers who first discovered them in the Orion Nebula. HH objects are found in regions where new stars are forming and it's hypothesized their origin is in collisions of high-velocity gas emitted from young stars with clouds of dust and gas. But only recently on

October 8, 2000 with the refined resolution of the Chandra X-ray Observatory's CCD Imaging Spectrometer have x-rays finally been detected.

The image on the left is a Palomar Digital Sky Survey of the region in the Orion Nebula that contains the Herbig-Haro objects known as HH1 and HH2. The enlargement on the right shows a green circle around X-ray source HH2. The x-rays indicate a gas jet moving at the shocking speed of 600,000 miles per hour. At that speed, you could go from Los Angeles to San Diego and back in one second. It is thought that in this instance the high-speed jet is slamming into a slower moving cloud of gas. The resulting shock wave heats gas up to a million degrees Fahrenheit.

Mysterious M87 Gas Jet



NASA's Chandra X-ray Observatory has given astronomers their most detailed look to date at the X-ray jet
blasting out of the nucleus of M87, a giant elliptical galaxy 50 million light years away in the
constellation Virgo. The extreme left bright object shown in the above images is the bright galactic nucleus
of what is thought to be a supermassive black hole. Image courtesy Chandra/NASA/MIT.

A team of astronomers at the Massachusetts Institute of Technology in Cambridge, Massachusetts used the Chandra X-ray Observatory on July 17-18, 2000 to observe M87, a giant elliptical galaxy 50 million light years away in the constellation Virgo. There astronomers have puzzled over an irregular series of "beads" that blast out of the nucleus of M87. The MIT team's leader, Herman Marshall, says that one of the remarkable findings of the investigation is that the beads, or "knots," near the M87 core are much brighter in X-rays than the farthest beads, relative to the radio bands and the optical discovery of the intense jet by the Hubble Telescope. While the exact reason for this progressive X-ray dimming is unknown, it is likely to be related to the slowing of the jet as it moves outward.

The extremely bright bead to the far left in the above images is the bright galactic nucleus of what is thought to be a supermassive black hole. The jet itself is perhaps produced by strong electromagnetic forces created by matter swirling toward the supermassive black hole. These forces pull gas and magnetic fields away from the black hole along its axis of rotation in a narrow jet. Inside the jet, shock waves produce high-energy electrons that spiral around the magnetic field. As they do, there is a "synchrotron" process that creates the clumps or knots. Synchrotron radiation is caused by high-speed charged particles, such as electrons, that emit radiation as they are accelerated in a magnetic field.

The spectrum and intensity of the X-rays from the galactic nucleus also indicate that this radiation is not caused by hot gas from material falling into the supermassive black hole. Instead, scientists think that a high-energy outflow close to the black hole could be producing the X-rays by a synchrotron process.

Websites:

http://sohowww.nascom.nasa.gov/

http://chandra.harvard.edu/

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