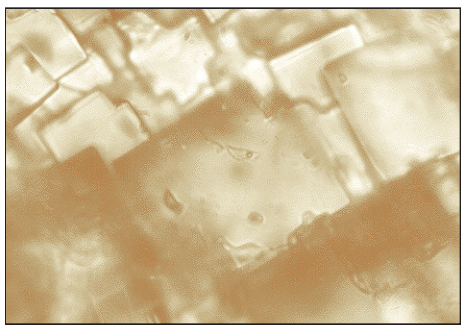
Extraterrestrial liquid water found in meteorite

For the first time, liquid water has been found in an object from space. This discovery has led to speculation that life may exist elsewhere.

On the 22nd of March last year in Monahans, Texas, a meteorite streaked across the sky and fell to Earth. Upon quitting their basketball game, a group of seven boys went over to inspect it. What they found was a black, grapefruit-size rock.

The next day, NASA-JSC space scientist Dr. Everett Gibson arrived and took the meteorite, later named Monahans 1998, back to JSC for analysis. In a JSC clean room two days later, the rock was carefully opened with a hammer and chisel. To their surprise, researchers found halite crystals (table salt) inside, and within these crystals they found bubbles of water, marking the first time that anyone has found liquid water in an object recovered from space-and a potential indication that life may exist outside our planet. A team led by NASA-JSC scientist Dr. Michael Zolensky reports this discovery in a recent issue of the journal *Science*.



"The existence of a water-soluble salt in this meteorite is astonishing," writes Robert N. Clayton of the Enrico Fermi Institute at the University of Chicago in the August 27, 1999, issue of *Science*. "Also, this sample of aqueous solution trapped within the meteorite provides the first opportunity to study solar nebular water directly."

Because Monahans 1998 was recovered rapidly and isolated from terrestrial contaminants such as moisture from our atmosphere within two days after it hit Earth, researchers had an atypically fresh sample to test. The scientists were excited to find blue and purple crystals of halite inside. Halite is a salt crystal that is usually formed from evaporation of briny water.

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The crystals were up to 3 millimeters (less than a tenth of an inch) in size. These are the largest halite crystals ever seen by scientists in any extraterrestrial material. The presence of briny water inside the crystals was confirmed by shining a laser beam through the bubbles and measuring the resultant light spectrum. The brine could have been flowing within the asteroid itself when it was in space or it could have been deposited on the asteroid by a passing object, such as a comet.

The crystals have turned blue and purple because of the radiation they received while in space. JSC scientists Dr. Larry Nyquist and Don Bogard have dated the halite and found it to be 4.5 billion years old. That means that the trapped water could predate the sun and planets in our solar system.

Still to be determined is how the meteorite got wet. One possibility is that a passing comet smashed into the rock, dropping off a load of liquid water. Or perhaps the rock may have chipped off an asteroid that holds pools of fluid. The JSC research team still needs to determine whether the water comes from our own solar system or is from interstellar space.

Look for a follow-up article on this subject in an upcoming issue of the *Roundup*. ■

Chandra's first images reveal X-ray vision

By Nicole Cloutier

Only seven weeks into its orbital life, the Chandra X-ray Observatory has already dazzled observers with vibrant and crisp imaging of violent stellar activity. One image depicts a gaseous projection stemming from a luminous distant quasar 6 billion light years away. Another image proves a remarkable exhibition of Chandra's sharp detail capability, revealing what may be a neutron star or black hole near the center of the expanding Cassiopeia A supernova.

"This is just a beautiful sight," said Harvey Tananbaum, director of the Smithsonian Astrophysical Observatory's Chandra X-ray Center. "Those of us who've worked on it are absolutely enthralled with it."

Chandra was deployed July 23 by the STS-93 crew as NASA's third Great Observatory. Its impressive X-ray capability was designed to complement the Hubble Space Telescope, which captures ultraviolet and optical images, and the Compton Gamma Ray Observatory. A fourth observatory, the Space Infrared Telescope, is scheduled for launch in 2001 and will complete the observatory collection allowing scientists to view the complete spectrum of radiation.

The X-rays Chandra collects are emitted by extremely hot sources, and are more than 1,000 times more energetic than the photons of normal light perceived by our eyes. Chandra's instruments, powerful enough to separate details as small as this newsprint from half a mile away, are able to produce images using radiation invisible to other telescopes.

"When you look at the optical picture you can ask yourself, 'Where is the massive star? Where is the neutron star?'" explained Professor Robert Kirshner of Harvard University. "You don't really see them in the optical [images]. It's in the X-ray where you have the opportunities to see these things."

Additionally, Chandra has tools that enable it to measure the mass and chemical makeup of the stellar objects, such as sulfur, silicon, calcium and iron identified in the Cassiopeia A observation.

The Cassiopeia A image represents the remnant from a violent explosion some 320 year ago. Once a massive star, likely 10 - 30 times brighter than the sun, the stellar material escapes from the explosion at 10 million miles per hour, creating powerful shock waves. As the waves collide with surrounding material, an ever-expanding sphere of hot X-ray emitting gas is formed. It is these emissions that Chandra detects and images to create the "first light" picture which excited scientists around the world.

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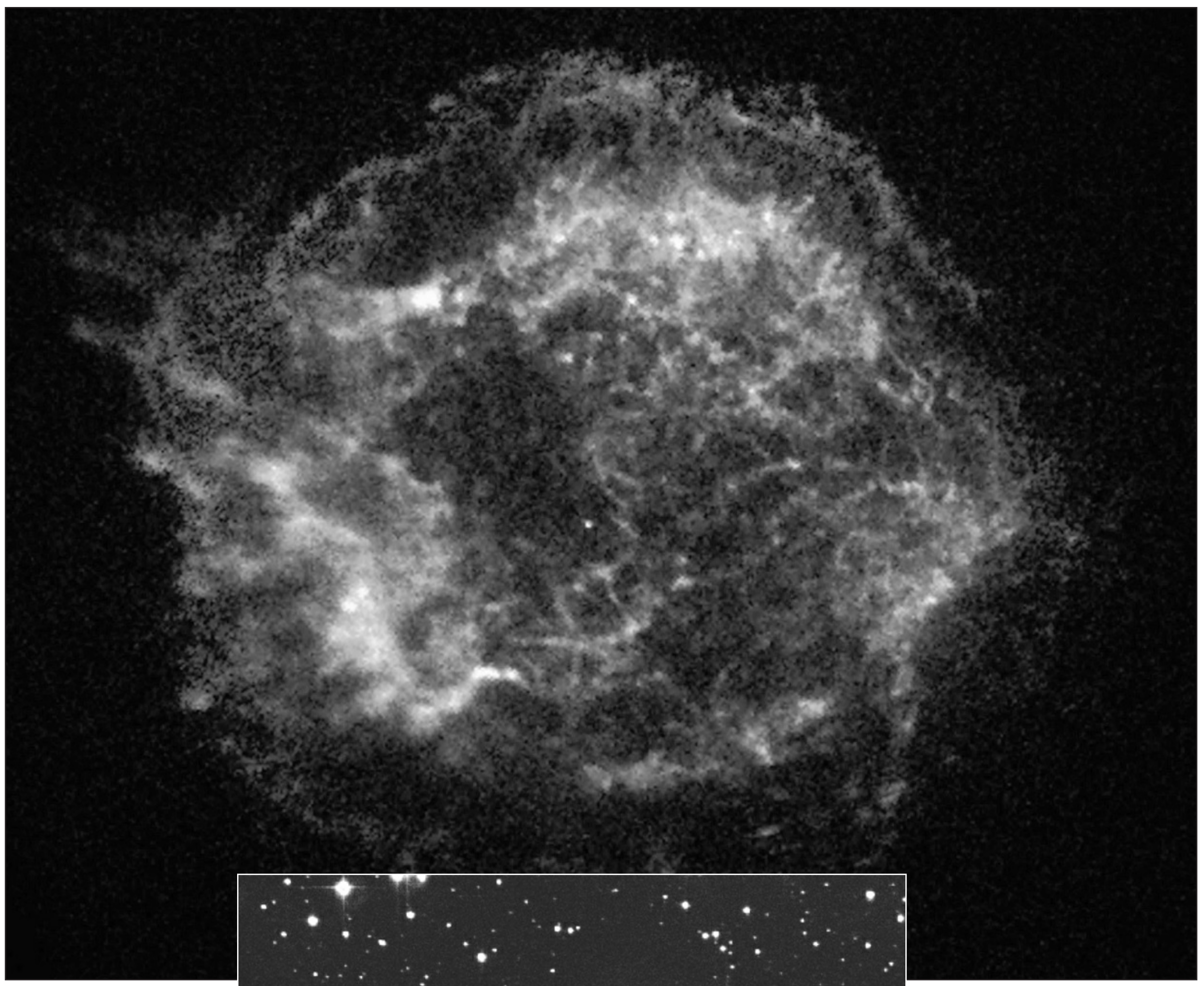
>
> –Robert Kirshner
> Harvard University

As an unanticipated bonus, while homing in on a calibration target, scientists also identified a protruding X-ray jet from a remote quasar. Scientists believe an enormous black hole at the quasar's center gives it the immense power equal to 10 trillion suns. Coupled with radio telescope observations, researchers anticipate that Chandra's imagery will help explain how such cosmic jets are formed from the regions near massive black holes.



Above: Chandra's first X-ray image of the Cassiopeia A supernova remnant reveals a fast outer shock wave and slower inner shock wave. The inner wave is believed to result from material ejected from the supernova explosion colliding with the matter around it, heating it to a temperature of 10 million degrees. The outer wave may be related to an awe-some shock wave result-ing from this collision. The bright object near the center may be the long-sought neutron star or black hole remnant of the explosion that produced Cassiopeia A.

Optical telescope image of Cassiopeia A shows much less detail than that taken by the Chandra Observatory.

"This is a fabulous discovery," said Kirshner. "And to do this, on day one, is like an infant opening its eyes for the first time and discovering a new planet. Chandra has a tremendous amount of promise and we're going to have many more discoveries that come from its excellent properties" ■

More information on Chandra and its first images can be found at http://chandra.nasa.gov or http://chandra.harvard.edu.