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ULYSSES CAPTURES GAMMA-RAY FLARE FROM SHATTERED STAR

The signal of a cataclysmic magnetic flare emanating from a star that cracked apart halfway across the galaxy has been captured by NASA's Ulysses spacecraft and is providing important clues about some of the most unusual stars in the universe.

The magnetic burst from the star SGR1900+14, located in the constellation Aquila 20,000 light-years away, was observed by Ulysses and other spacecraft with high-energy radiation detectors in space on August 27, 1998, as its heavy metal crust fractured and released the most powerful wave of gamma radiation yet observed from this type of star.

"Soft gamma repeaters (SRGs) emit magnetic radiation sporadically, every few years, unlike gamma ray bursts, which explode and disappear," said Dr. Edward J. Smith, Ulysses project scientist at NASA's Jet Propulsion Laboratory, Pasadena, CA. "This was the fourth soft gamma repeater to be observed, but unlike the others we have studied, this one emitted an exceedingly intense burst of radiation. We estimate that it released as much energy in a few seconds as the Sun emits in 300 years." Ulysses is a joint mission of NASA and the European Space Agency.

SGR1900+14 is a newly discovered type of star called a "magnetar" - a dense ball of super-heavy matter about the size of a city, but weighing more than the Sun. Objects in this class have the greatest magnetic fields known in the universe. A magnetar is so intense that it powers a steady glow of X-rays from the star's surface, often punctuated by brief, intense gamma-ray flashes and, occasionally, by catastrophic flares like the one observed on August 27. Astronomers think that all these effects are caused by an out-of-control magnetic field -- one capable of heating, mixing and sometimes cracking the star's rigid surface.

Using several spacecraft detectors, including the Ulysses gamma ray burst instrument, scientists were able to measure this extremely rare event and pinpoint the precise source of the explosion with unprecedented clarity.

"The star, which has an extremely strong magnetic field, appears to have experienced a 'star quake' so powerful that it created a temporary ionosphere on the night side of Earth and sent two spacecraft into protective safe modes," Smith said.

Data from the Ulysses experiment, showed radiation counts that rocketed from background (near zero) levels to several thousand electrons per second. Dr. Kevin Hurley of the University of California, Berkeley, who is principal investigator of the gamma ray burst experiment on Ulysses, reported that energy measurements were two times greater than any other

recorded burst.

"The radiation, as seen by the gamma ray burst detector, spiked quickly and soon settled into a series of ever-smaller spikes that clearly revealed the neutron star's rotational period," Hurley reported at a NASA science press briefing on September 29. "The star reminded us of a dying lighthouse. It kept rotating, but the lamp steadily faded away."

Hurley, who had been part of a team observing the star, recorded pulses or flashes of magnetic radiation emanating from the star every 5.16 seconds using another satellite, known as the Japanese/NASA Advanced Satellite for Cosmology and Astrophysics (ASCA). Comparisons of the ASCA data and measurements from other satellites showed that the X-ray pulses were gradually slowing down after the radiation burst subsided.

From its intensity and rotational slowing, scientists calculated that SGR1900+14 has a magnetic field about a thousand trillion times stronger than Earth's magnetic field and about one thousand times stronger than any found elsewhere in the universe, Smith said. During the flashing episode, Dr. Chryssa Kouveliotou of NASA's Marshall Space Flight Center in Huntsville, AL, who led another team observing the star with sensitive X-ray detectors aboard NASA's Rossi X-ray Timing Explorer satellite, found faint X-rays coming from the star, similar to what they had observed in another soft gamma repeater which turned out to be a magnetar.

Three of the four confirmed soft gamma repeaters - designated 1900+14, 1806-20 and 0526-66 -- have localized X-ray emissions; 1806-20 and 1900+14 have regular pulsations and 0526- 66 had an eight-second period during its magnetic explosion observed in 1979. It is by comparing the change in the rotational period of these stars across several observations that scientists can measure their magnetic fields.

"Magnetars seem to answer several mysteries about the structure and evolution of stars," said Kouveliotou. "We think magnetars spend their first 10,000 years as soft gamma repeaters. As they weaken with age and slow their rotation, they become anomalous X-ray pulsars -- stars that do not have enough 'juice' to flash anymore, but which emit a steady flow of X-rays for perhaps another 30,000 years. After that, they fade to black and drift for eternity through the heavens. The absence of observable pulsars in some supernova remnants just means that the pulsar's lights have gone out sooner than we expected."

Additional information on magnetars or the August 27 burst is available on the Internet at http://www1.msfc.nasa.gov/NEWSROOM/ and http://www.magnetars.com/

The Ulysses mission to study the poles of the Sun is managed jointly by NASA and the European Space Agency. The Jet Propulsion Laboratory manages the U.S. portion of the mission for NASA's Office of Space Science, Washington, DC. JPL is a division of the California Institute of Technology, Pasadena, CA.

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