The Cassini spacecraft, which began its tour of the Saturn system just over a month ago, has detected lightning and a new radiation belt at Saturn.

The spacecraft’s radio and plasma wave science instrument detected radio waves generated by lightning. “We are detecting the same crackle and pop one hears when listening to an AM radio broadcast during a thunderstorm,” said Dr. Bill Kurth, deputy principal investigator on the radio and plasma wave instrument, University of Iowa, Iowa City. “These storms are dramatically different than those observed 20 years ago.”

Cassini finds radio bursts from this lightning are highly episodic. There are large variations in the occurrence of lightning from day to day, sometimes with little or no lightning, suggesting a number of different, possibly short-lived storms at middle to high latitudes. Voyager observed lightning from an extended storm system at low latitudes, which lasts for months and appeared highly regular from one day to the next.

The difference in storm characteristics may be related to very different shadowing conditions in the 1980s than are found now. During the Voyager time period when lightning was first observed, the ring cast a very deep shadow near Saturn’s equator. As a result, the atmosphere in a narrow band was permanently in shadow — making it cold — and located right next to the hottest area in Saturn’s atmosphere. Turbulence between the hot and cold regions could have led to long-lived storms. However, during Cassini’s approach and entry into Saturn’s orbit, it is summer in the southern hemisphere and the ring shadow is distributed widely over a large portion of the northern hemisphere, so the hottest and coldest regions are far apart.

A major finding of the magnetospheric imaging instrument is the discovery of a new radiation belt just above Saturn’s cloud tops, up to the inner edge of the D-ring. This is the first time that a new Saturnian radiation belt has been discovered with remote sensing.

This new radiation belt extends around the planet. It was detected by the emission of fast neutral atoms created as its magnetically trapped ions interact with gas clouds located planetward of the D-ring, the innermost of Saturn’s rings. With this discovery, the radiation belts are shown to extend far closer to the planet than previously known.

This new radiation belt had eluded detection by any of the spacecraft that previously visited Saturn. With its discovery we have seen something that we did not expect, that radiation belt particles can ‘hop’ over obstructions like Saturn’s rings, without being absorbed by the rings in the process,” said Dr. Donald G. Mitchell, instrument scientist for the magnetospheric imaging instrument at the Johns Hopkins University Applied Physics Laboratory, Laurel, Md.

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Cassini uncovers new radiation belt

By Carolina Martinez

This artist’s concept shows how Cassini is able to detect radio signals from lightning on Saturn.

Nearly one year since its launch, the Spitzer Space Telescope is busy capturing intriguing views of the cosmos.

In this new picture, the observatory has revealed a never-before-seen ring of material amidst the shimmering embers of a dying star. Spitzer’s infrared vision has revealed what could not be seen before — a massive ring of material that was expelled from the core of a dying star, said Dr. Joseph Hora, a Spitzer scientist at the Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.

“The composition of the ring and how it formed are mysteries we hope to address with further Spitzer studies.”

The dying star is part of a “planetary nebula” called NGC 246. When a star like our own Sun begins to run out of fuel, its core shrinks and heats up, boiling off the star’s outer layers. Leftover material shoots outward, expanding in shells around the star. This ejected material is then bombarded with ultraviolet light from the central star’s fiery surface, producing huge, glowing clouds — planetary nebulae — that look like giant jellyfish in space.

NGC 246 is located 1,800 light-years away in the Cetus constellation of our galaxy. Previous observations of this object by visible-light telescopes showed a glistening orb of gas and dust surrounding a central, compact star.

By cutting through the envelope of dust with its infrared eyes, Spitzer provides a more transparent view through and behind the nebula. “What we have seen with Spitzer is totally unexpected — a ring component that may consist of hydrogen molecules.”

Ultimately, these data will help astronomers better understand how planetary nebulae take shape, and how they nourish new generations of stars. A scientific paper on this and other planetary nebulae observed by Spitzer will be published on Sept. 1 in The Astrophysical Journal Supplement, along with 75 other papers reporting Spitzer early mission results.

Spitzer was launched on August 25, 2003, from Cape Canaveral Air Force Station, Florida. Additional images and information about the Spitzer Space Telescope are available at http://www.spitzer.caltech.edu.

Dying star goes out with a ring

By Whitney Clavin

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JPL Origins proposal selected
NASA has selected nine initiatives, including one from JPL, to investigate new ideas for future mission concepts within its Astronomical Sciences Program. Some of the new mission ideas will survey 1 billion stars within our own galaxy, measure the distribution of galaxies in the distant universe, study dust and gas between galaxies, study the early universe, search for life in our galaxy, and investigate their role in planetary system formation, and create an optical-gravitational tomography to trace NASA’s Hubble Space Telescope.

The products from these selected studies will be used for future planning of missions comprising the existing suite of operating missions, including the Hubble and Spitzer Space Telescopes, and developmental missions such as the James Webb Space Telescope and Terrestrial Planet Finder. Each of the selected studies will have eight months to further develop and refine concepts for missions addressing different aspects of Origins Program science. The Origins Program seeks to address the fundamental questions “Where did we come from?” and “Are we alone?” NASA received 26 proposals in response to this call for mission concepts. JPL’s Matt Bradford is the principal investigator of a “Background Limited Infrared Submillimeter Spectrograph for Spica: Revealing the Nature of the Far-Infrared Universe.” The study will enable far-infrared spectroscopy of the galaxies that make up the far-infrared background out to distances of some of the greatest distances known. To get this spectrograph will chart the history of creation of elements heavier than helium and energy production through cosmic time. Spica is a Japanese mission.

Transformation Dialogue at JPL
The next Transformation Dialogue will be held Aug. 20 at 12:30 p.m. It will be held on NASA TV from JPL, and will feature Dr. Charles Elachi, JPL Director, and Director of Advanced Planning at NASA Headquarters, and Ken足 Petersen, Dryden Flight Advanced Planning at NASA Headquarters. The event will be broadcast live on NASA TV, from 4-3359. Space is limited.

Translating Mars from image to interplanetary networking
One of NASA’s Mars rovers has sent pictures relayed by the European Space Agency’s Mars Express orbiter for the first time, demonstrating that the orbiter could serve as a communications link if needed. The linking was part of a set of interplanetary networking demonstrations paying the way for future Mars missions to rely on these networking capabilities. The American and European agencies planned them as part of continuing efforts to cooperate in space exploration. This aug 4, as Mars Express flew over NASA’s Mars Exploration Rover Opportunity, the orbiter received data previously collected and stored by the rover. The data, including 15 images from the rover’s nine cameras, were subsequently forwarded to the European Space Operations Center, Darmstadt, Germany, and immediately relayed to the rover team based in Pasadena, California. Mars Express also is demonstrating the use of space based networking and for the first time, demonstrating that the orbiter could serve as a communications link if needed. The linking was part of a set of interplanetary networking demonstrations paying the way for future Mars missions to rely on these networking capabilities. The American and European agencies planned them as part of continuing efforts to cooperate in space exploration.

JPL student wins NASA’s largest award
JPL student wins NASA’s largest award

How much is that doggie in the window...?
AlBee, an interactive robot art project, performed in the Mall July 30. The robotic dog interacts with people bringing origami flowers into its hive tent.

As a member of the NASA Faculty Fellowship Program, Professor Shello Tsjadoja from the University of New Orleans has been collaborating this summer with Dr. Ayanna Howard in the Tele-Autonomous Research Group on robot construction workers for building habitats on the Moon and Mars.

AlBee employs the Virtual Synergy Interface developed by Tajoda. Virtual Synergy combines a three-dimensional graphical interface with robots to allow for collaboration among several people, simulated software agents and robots.

For more information on the AlBee project, visit http://www.albee.org/
Moonrise proposes to return lunar samples for NASA's New Frontiers Program

In the July 30 issue, Universe profiled "Juno," one of two proposed missions selected by NASA earlier last month for detailed study in the agency's New Frontiers Program. The other proposal chosen by NASA as a New Frontiers candidate is "Moonrise: Lunar South Pole–Aitken Basin Sample Return Mission." This investigation proposes to land on the far side of the moon, inside a large basin, and to return two kilograms (about five pounds) of lunar materials from a region of the moon's surface believed to harbor materials from the moon's mantle. The proposal teams Dr. Michael Duke of the Colorado School of Mines, principal investigator with JPL, and Lockheed Martin, and a science team that resembles a who's-who listing of experts in the field of planetary science and sample analysis. The project scientist at JPL is Dimitri Papastasiozis (Section 2264). The proposal mission would have many firsts — "Moonrise" would be the first US planetary surface robotic sample return; it would be the first mission to return a sample from the surface of the moon in more than 35 years and the first time that JPL will have a significant role in flight system development for a competed mission. The primary scientific goal of Moonrise is to investigate the evolution of the solar system, through the fate of large impactors in the inner solar system, in the first half billion years of solar system history. Dating of returned Apollo and Luna samples has long indicated a concentration in time of large basin formation by impacts at about 4 billion years ago, for the basins on the front, Earth-facing side, of the moon. Competing theories suggest that the observations were either due to a large, late spike in the frequency of impacts on the moon, and also the early Earth, dubbed the Lunar Cataclysm. Or, alternatively, the data represent the tail-end of the impact history, with many of the impacts on the moon prior to 4 billion years having been obscured by the events around 4 billion years ago. Earth must have also been subject to the same type of impacts, but the surface of Earth is active and this evidence has not been preserved. The fate of impactors is important to understand the evolution of the inner solar system and may be related to the emergence of life on Earth, more than 3 billion years ago. The largest and oldest basin on the moon, the South Pole–Aitken Basin can serve as a starting point to understand lunar impact history between the time of its formation and the age of the near-side basins. The "moon contains a unique record of the external environment within which the Earth's surface took shape in the period when life was just starting. The moon has been and will continue to be the scientific cornerstone for our understanding of the early evolution of the terrestrial planets," said Dimitri Papastasiozis, senior research scientist and Jupiter project scientist for the mission.

Sample analysis is the only way in which the composition and age of mixed rock fragments in the lunar regolith can be precisely determined and is therefore critical to science objectives of the Moonrise mission. Moonrise will return samples for analysis in laboratories on Earth, where the expertise of the science team and the full breadth of techniques available can yield valuable scientific data. Speaking about the selection of the Moonrise and Juno missions, Dr. Ed Weiler, NASA's associate administrator for space science, said "These two outstanding proposals were judged to be the best science value among the seven submitted to NASA in 2004. It was a very tough decision, but we're excited at the prospect of the discoveries either of them could make in continuing our mission of exploration of the solar system, and what they could tell us about our place in the universe."

Each proposal will now receive up to $12 million to conduct a seven-month implementation feasibility study focused on cost, management and technical plans, including educational outreach and small business involvement. Following detailed mission concept studies by Moonrise and Juno, due for submission by March 2005, NASA intends to select one of the mission proposals for full development as the second New Frontiers mission by May 2005. The selected New Frontiers science mission must be ready for launch no later than June 30, 2010, within a mission cost cap of $700 million. The two selected proposals were submitted to NASA in February 2004, in response to the New Frontiers Program 2003 and Missions of Opportunity Announcement of Opportunity. The New Frontiers Program is designed to provide opportunities to conduct several of the medium-class missions identified as the top priority objectives in the Decadal Solar System Exploration Survey, conducted by the Space Studies Board of the National Research Council.