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October 2004 astro bytes

A nearby star blast, tides make quakes, satellite contortions can change orbits, and more



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October 28, 2004

A nearby star blast

In 1999, an interdisciplinary team of German scientists led by K. Knie of Munich's Technical University discovered supernova debris in 2-million-year-old ocean sediments. The debris took the form of high concentrations of iron-60 (^{60}Fe , half-life: 1.5 million years) — radioactive atoms produced on Earth in smaller amounts — in three layers on the South Pacific seafloor.

Now, Knie and colleagues report finding the isotope in 28 sediment layers from another site 1,900 miles (3,000 kilometers) away. The new samples, says the German team, represent the remains of a star that exploded 2.8 million years ago (give or take 0.3 million years) less than 300 light-years away. One effect of Earth's scooping up this star-stuff, they argue, might have been a 300,000-year-long increase in the flux of cosmic rays. The work appears in the October 22, 2004, issue of *Physical Review Letters*. — *Francis Reddy*

Tides can prompt earthquakes

UCLA scientists discovered strong ocean tides can trigger earthquakes. The researchers conducted a statistical analysis of more than 2,000 earthquakes worldwide of magnitude 5.5 and higher that occurred between 1977 and 2000. They found a strong correlation between when earthquakes occurred and when tidal stress on faults was high. The gravitational pull of the Sun and Moon on Earth creates tides, which raise and lower the amount of stress on faults twice a day.

"The earthquakes would have happened anyway," explains graduate student and team member Elizabeth Cochran, "but they can be pushed sooner or later by the stress fluctuations of the tides." The scientists studied subduction zones (where tectonic plates overlap) along continental coasts, where tides are strong. For California and most other places, the correlation between tides and earthquakes is minimal — tides may influence the earthquake rate by only as much as 2 percent — because the faults are inland and the tides are much smaller.

The team confirmed its results October 21 in *Science Express*, the on-line journal of *Science*; the research will appear in a November issue. — *Laura Baird*

Change shape, change orbit

Earlier this month, scientists showed that Earth's rotation swirls nearby space-time — the fabric of our universe, according to Einstein's general relativity — and measurably alters satellite orbits. Last year, scientists proposed that space-time's properties also allow a satellite to make tiny orbital changes just by changing its shape, without using rockets or thrusters. Now, Michael Longo, a physicist at the University of Michigan, predicts a much larger effect from old-style Newtonian physics alone.

Imagine a dumbbell-shaped satellite orbiting Earth. If one mass remains slightly farther from Earth than the other, the outer mass feels slightly less gravity than the inner mass. Pull the two masses together, and the differential force on the separate masses will cause the dumbbell's center-of-mass to move inward slightly. According to Longo, if this were done to a 100-meter-long dumbbell in a highly elliptical orbit, the satellite's closest approach to Earth would move inward 1 millimeter on each pass. Such a satellite could use sunlight or other stored energy to change its shape — and thus its orbit — without the need for propellant. Longo's work appears in the October 2004 issue of *American Journal of Physics*. — *Francis Reddy*

DART launch delayed

NASA has delayed the launch of the Demonstration of Autonomous Rendezvous Technology (DART) spacecraft due to a possible contamination. The next possible launch date is November 4.

DART team members discovered loose foil on the spacecraft's launch vehicle. It has since been returned to the vehicle-assembly building for closer inspection.

The DART mission will help scientists plan and direct future autonomous spacecraft rendezvous. The unmanned spacecraft will use only computers and sensors to perform all of its docking functions. The project's results will enable NASA to prepare in-space assembly, services, and rendezvous operations better.

The launch has been delayed twice already. — *Jeremy McGovern*

"Marsquakes" shaped Red Planet

Scientists from the Southwest Research Institute (SwRI) in San Antonio, Texas, believe seismic activity on the Red Planet shifted its landscape. This created crater chains that could have served as channels for past water flow.

"These faults could now serve as reservoirs for water or ice, making these locations of potentially great interest to the scientific community searching for signs of life on Mars," says David Ferrill, a senior program manager at SwRI.

SwRI team members compared data and photographs of features on the martian surface with pit chains, strings of depressions, found in Iceland. They conducted laboratory experiments to reconstruct the processes they believe formed the pit chains.

It is more difficult to locate pit chains on Earth than Mars because surface erosion and higher gravity on Earth results in smaller pits that are rapidly erased. — *Jeremy McGovern*

October 26, 2004

NASA's newest number-cruncher

What do you get when you wire together 20 of Silicon Graphics Inc.'s Altix 512-processor computer systems? Columbia, NASA's latest supercomputer and one of the fastest in the world. The machine sports 10,240 Intel Itanium-2 processors, but it took the space agency less than 120 days to build and install it.



Columbia, a new 10,240-processor supercomputer, enables scientists in a variety of disciplines to conduct research and analyze complex data much faster. NASA [\[larger image\]](#)

G. Scott Hubbard, director of NASA's Ames Research Center, spoke at today's ribbon-cutting ceremony at the center's advanced supercomputing facility. Columbia, he says, "is already having a major impact on NASA's science, aeronautics, and exploration programs, in addition to playing a critical role in preparing the space shuttle for return to safe flight next year."

According to Walt Brooks, chief of NASA's [Advanced Supercomputing Division](#), 16 of Columbia's 20 nodes computed 42.7 trillion floating-point operations per second, or 42.7 teraflops, when running the widely used

[Linpack benchmarking software](#). This is about 19 percent faster than Japan's 5,120-processor Earth Simulator, currently considered [the world's fastest machine](#).

What do scientists do with all that computing power? Research ranges from climate change, to galaxy formation, supernova explosions, and black holes. Columbia has already helped scientists develop an improved global circulation model that accurately predicts a hurricane's landfall 5 days in advance — 3 days sooner than current methods.

The supercomputer's name honors the crew of space shuttle Columbia, which was lost February 1, 2003. — *Francis Reddy*

October 22, 2004

Site recommended for the world's largest solar telescope

The Science Working Group of the Advanced Technology Solar Telescope (ATST) has proposed that Haleakala atop Maui, Hawaii, be the future home of the instrument. After nearly ten months of deliberations, the group selected the location over candidate sites in California and the Canary Islands.

If approved, the Hawaii-based scope will become the world's largest optical solar telescope. The Haleakala site is based 10,000 feet (3,050 meters) above sea level.

While a major step forward, the selection process is not over yet.

"The ATST co-principal investigators must review the scientific report and recommendations and discuss them with the National Science Foundation and the Association of Universities for Research in Astronomy, which provides management oversight for the NSO," explains Stephen Keil, the ATST project director of the National Solar Observatory (NSO), which is leading the project

A final decision on the project will be made in December 2004. Depending on funding, the group hopes that the ATST will reach first light sometime between 2010-2012.

— *Jeremy McGovern*

October 19, 2004

Sunlight surprise

One significant aspect of laser light is its high degree of spatial coherence, the extent to which its fluctuations at different points in space have precise interrelationships. But this feature exists to some degree in all light, including sunlight. In 1869, French physicist Émile Verdet made the first rough calculation of sunlight's coherence properties using a geometrical model of light's propagation.

"Traditional diffraction theory, however, suggests that such a model is only valid once one is far enough away from the source, that is, in the 'far zone,'" explained Greg Gbur, a physicist at the University of North Carolina in Charlotte. The far zone begins at the distance where the Sun appears as a point source — about 32 billion light-years away, or two quadrillion times farther away than Earth is. "Later calculations also never directly addressed the issue of the far zone, probably because one tends to think of solar-system-scale distances as 'far enough,'" Gbur told *Astronomy*. This suggested such calculations were technically inaccurate.

So Gbur and colleagues Girish Agarwal (Physical Research Laboratory, Navrangpura Ahmedabad, India) and Emile Wolf (University of Rochester, Rochester, New York) reexamined the problem. They performed computer simulations of filtered light emanating from an incoherent spherical source, a stand-in for the Sun. Surprisingly, light behaved as if it were in the far zone even when viewed only a few wavelengths from the source.

"Our results showed the far zone begins much closer to the source than typically appreciated," said Gbur, so Verdet and others were correct despite their omission. This suggests the definition of the far zone depends not only on the size of the radiation source and the source/object distance, as traditional theories hold, but also must include the coherence properties of the light source itself. The study appears in the March 1, 2004, issue of *Optics Letters*. — *Francis Reddy*

October 18, 2004

Crawler needs a new pair of shoes

Actually, it's 228 pairs. This month, NASA begins a \$10-million project to replace the tread-belt shoes, each weighing more than one ton, on the two crawler transporters at Kennedy Space Center (KSC) in Florida. Each of these vehicles carries a mobile launcher platform — complete with assembled space shuttle — from the center's Vehicle Assembly Building to launch pads 39A and 39B.

The crawlers have been in use since 1965, when they were pressed into service ferrying Apollo/Saturn Moon-rockets to and from their launch pads. Most of the shoes date back to that time, but in late 2003, inspections revealed cracks in many of them, spurring the current project. "This is by far the most active maintenance period in the history of the crawlers," says Mark Hamilton, NASA crawler transporter systems engineer.



New crawler shoes arrive at KSC in truckloads of 20 to comply with shipping-load limits. One of NASA's two crawlers is in the background. NASA [\[larger image\]](#)

Each crawler runs on eight tread belts, and each tread is composed of fifty-seven 2,200-pound (990 kilogram) shoes. The new models, each 7.5 feet long and 1.5 feet wide (2.3 by 0.5 meters), are being made by ME Global Manufacturing of Duluth, Minnesota.

Crawler transporter facts	
Weight:	5.5 million pounds 2.5 million kilograms
Load:	Launch platform and space shuttle 12.0 million pounds 4.5 million kg
Top speed:	2 mph (3.2 km/h) unloaded 1 mph (1.6 km/h) loaded
Fuel efficiency:	126 gallons per mile 296 liters per km

Hamilton notes most of the mechanical crawler parts are unique to the vehicle and are specially manufactured. "We are fortunate that the massive precision components, such as the large drive-gear sets and gear-shaft bearings, still look new."

Crawler transporter No. 2, designated for Discovery's Return to Flight mission to the International Space Station, will be the first to receive its

new shoes. — *Francis Reddy*

October 14, 2004

Room with an extraordinary view

A new module created for the International Space Station (ISS) will provide onboard astronauts with the ultimate observation deck, a control tower for robotics in space, and an impressive sunroom. The cupola, built in Italy by Alenia Spazio, is now housed at the Kennedy Space Center in Florida, where it awaits inspection by NASA and European Space Agency technicians.

The module provides a 360° view, six windows around the perimeter, and one atop the structure. Astronauts aboard the ISS will use the module to monitor outside projects, including robotic activities, spacewalks, and docking exercises.

The cupola is scheduled to launch aboard a shuttle in early 2009. — *Jeremy McGovern*

October 13, 2004

Exhibit highlights space technology

An exhibit titled "Space technology and human development" will be on display in the United Nations General Assembly Visitors' Lobby in New York City from October 11–22. The exhibit marks the fifth anniversary of the implementation of recommendations made by the Third United Nations Conference on the Exploration and Peaceful Uses of Outer Space. The recommendations included specific actions for managing our planet's resources, promoting space education, and protecting the space environment. The exhibit contains scale model spacecraft as well as posters showing applications of space technologies in agriculture and water resource management, aviation navigation, refugee operations, and other challenging areas in both developed and developing countries.

— *Laura Baird*

October 11, 2004

Max Faget (1921 - 2004)

Last week, Gordon Cooper, one of the original seven Mercury astronauts, passed away. A few days later, one of the people responsible for designing his Mercury spacecraft also died.



Max Faget, seen here in his NASA portrait, was instrumental to America's success in manned space missions. *NASA*

Maxime (Max) Faget played a significant role in designing NASA spacecraft — from those used in Project Mercury to the space shuttle. His NASA career dates back to 1946 at the Langley Research Center in Virginia. In 1958, he joined the Space Task Group, which evolved into the NASA Johnson Space Center. Before he retired from NASA in 1981, Faget helped determine the feasibility of shuttle development.

"Without Max Faget's innovative designs and thoughtful approach to problem solving, America's space program would have had trouble getting off the ground," says NASA Administrator Sean O'Keefe. "He also was an aeronautics pioneer."

Christopher C. Kraft, former director of Johnson Space Center, also remembered his colleague and friend: "He was a true icon of the space program. There is no one in space flight history in this or any other country who has had a larger impact on man's quest in space exploration." — *Jeremy McGovern*

October 8, 2004

Wide-field Infrared Survey Explorer receives approval

NASA recently gave the go-ahead for the Wide-field Infrared Survey Explorer to proceed into the preliminary design phase. The space-based telescope will scan the entire sky in infrared light searching for nearby, cool stars; planetary nurseries; and the brightest galaxies. The instrument will use infrared detectors up to 500,000 times more sensitive than previous survey missions.

"Approximately two-thirds of nearby stars are too cool to be detected with visible light," says Edward Wright, who proposed the mission to NASA. "The Wide-field Infrared Survey Explorer will see most of them."

The Wide-field Infrared Survey Explorer, scheduled to launch in 2008, is part of NASA's Explorer program to produce low-cost, innovative, and efficient space missions. — *Jeremy McGovern*

October 5, 2004**Gordon Cooper (1927 - 2004)**

Gordon Cooper, one of the original seven Mercury program astronauts, has died at age 77.

Cooper's flight in a Faith 7 capsule stretched the capabilities of the Mercury spacecraft to the limits. The mission, May 15-16, 1963, lasted more than 34 hours and 22 orbits. That was more than three times the longest United States human space flight until that time, and it far exceeded the capsule's initial design capability. During his flight, Cooper also became the first astronaut to sleep in space.

In 1965, Cooper and Charles "Pete" Conrad, Jr., flew the troubled Gemini 5 flight. The goal of the mission was to prove astronauts could survive in space long enough to perform a lunar mission, which takes 8 days.

Despite numerous problems during the mission, the duo stayed in orbit for almost 191 hours, 122 orbits. In orbit, they accomplished a "shadow rendezvous" with an imaginary spacecraft, an exercise that demonstrated it could be done. — *Jeremy McGovern*



Gordon Cooper waiting for test activities to resume in preparation for his Mercury launch in May 1963. NASA

Hurricane damage delays shuttle launch

While NASA still is assessing damage to its southeastern United States facilities hit by various hurricanes this season, the administration is certain the next manned mission will be delayed. NASA hoped to launch the space shuttle Discovery during a window in March-April 2005.

Although no spacecraft hardware was damaged during the four storms, Hurricanes Charley, Frances, and Jeanne closed down NASA's Kennedy Space Center in Florida for nearly 9 days and damaged several buildings. Hurricane Ivan caused shorter closures at the Stennis Space Center in Mississippi, Marshall Space Flight Center in Alabama, and Michoud Assembly Facility in Louisiana.

NASA's Space Flight Leadership Council asked the Space Shuttle Program (SSP) to determine if it could meet Return to Flight milestones for the next available launch window beginning May 14, 2005. The SSP will present its report later this month.
— *Jeremy McGovern*

October 4, 2004**World Space Week**

Today kicks off World Space Week, held annually October 4-10. A celebration of the contributions of space science and technology to the betterment of humans, World Space Week will be marked by events in almost 50 countries. Endorsed by the United Nations, events are coordinated by Spaceweek International Organization, a non-governmental, educational group. This year's theme is "Space and Sustainable Development," and many events involve school children. Kids in Vienna, Austria, for example, will hold a mock UN conference to discuss their ideal planet. At the SOS Children's Village in Asiakwa, Ghana, there will be a World Space Poster Exhibition. In the United States, Lance Bass of the band NSYNC will visit Los Angeles schools to promote math and science education, and many other schools, museums, and organizations nationwide have planned activities. For more information on events, visit www.spaceweek.org. — *Laura Baird*



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