

# The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

**Calendar of Events**

**SUMMER  
DOWNTOWN  
OBSERVING**

**June 11**

**June 25**

**July 09**

**9:00 PM—10:00 PM**

**after the Band Concerts**

**SOUTH PARK**

**west side of  
Massachusetts St.**

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**Report from the Officers:**

ASTRONOMY DAY 2008 was a resounding success, despite our usual problems due to the weather. Rick did a great job organizing the event with lots of help from the usual suspects. As you can see from the photo below, while the sun wasn't observable through the clouds, it still didn't stop the observing thanks to Bill Winkler and his scopes. In addition to the talks, DVDs, and information stations set up by Rick and his family, Rex Powell had a very popular display of meteorites and Dave Kolb exhibited some of his beautiful photos to illustrate what amateur astronomical photography can produce. The Edwards contributed time and insight and helped arrange for the planned observing at the Prairie Park Nature Center, though the bad weather from the day extended well into the evening, forcing cancellation of the scheduled observing event. As stated last issue, the Prairie Park site is respectably dark and could become a regular stop for AAL Star Parties in the future since the people in charge of the park would love to expand the number of visitors to the site. All told, over 100 visitors stopped by the Lawrence Public Library to check out the display and talk to the participants.

We had hoped to build on the advertising done at the Astronomy Day event to enhance the crowd for our post-band-concert sessions this summer (a poster advertisement).

*(Continued on page 2)*



**ASTRONOMY DAY—2008: Lawrence Public Library**

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## From the Officers, continued



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ing the dates is found on pg. 7). Unfortunately, the weather has remained wet and stormy, so the first session at the end of May was cancelled. Our next shot is on June 11 so, if you can help or would like to join in by observing, let Rick know. We have 3 potential events scheduled so it would be nice to spread the work load rather than have 10 people at one session and 2 at the next.

There is, as always, a lot going on in regional amateur astronomy this summer. Some reminders of potential events. The **Mid-States Region of the Astronomical League (MSRAL)** has its convention at St. Charles Community College in Cottleville, Missouri (western St. Louis suburbs) on **June 20-21**. Details can be found at the web site [www.ASEMonline.org](http://www.ASEMonline.org). (The AAL is part of the Mid-States Region of the Astronomical League.) The **Heart of America Star Party**, sponsored by the ASKC, will run from **June 26 through July 5** at the ASKC 40-acre observing site 75 miles south of Kansas City. The site is bordered by the 7200-acre Marais des Cygnes Wildlife Area and offers pristine dark skies. For more info, their web site is [www.hoasp.org/](http://www.hoasp.org/). The national convention of the Astronomical League, **ALCON 2008**, takes place in Des Moines, Iowa on **July 18-19**. For more info, their web site is [www.alconexpo.com](http://www.alconexpo.com). Finally, the 15th annual **Nebraska Star Party** takes place from **July 27 through August 1** at the Snake Campground at Merritt Reservoir, 27 miles south of Valentine, Nebraska. Info on this event can be obtained at [www.NebraskaStarParty.org](http://www.NebraskaStarParty.org).

If you have any suggestions for talks, speakers, or public events, please feel free to contact us, particularly Rick Heschmeyer ([rcjbm@sbcglobal.net](mailto:rcjbm@sbcglobal.net)), the events coordinator for the club. Hope to see you at one of the observing sessions downtown this summer, assuming the weather finally begins to cooperate. If you are planning on attending but aren't sure if the event is on, after 6PM on the night of the event, we will send email out to all members for which we have email addresses or you can call the observatory phone line—864-3166—to get the recorded message stating whether the observing is on or has been cancelled. on the 10th. ALL for now.

### MORE MISSING COSMIC MATTER FOUND

After an extensive search, astronomers say they have definitely found half of the universe's missing normal matter in the spaces between galaxies. Astronomers have long known that the amount of matter we can see doesn't match up with what's actually there. Normal matter (which includes galaxies, stars and us) makes up only about 4 percent of the universe. This type of matter is also called "baryonic" because it is made of baryons (protons, neutrons and other sub-atomic particles). The missing part of baryonic matter has largely escaped detection because it is too hot to be seen in visible light but too cool to be seen in X-rays. Dubbed the "intergalactic medium," or IGM, it extends essentially throughout all of space like a cosmic spider web. (This missing matter is not to be confused with dark matter, an exotic form of matter that can only be detected by its gravitational pull.) A team of astronomers from the University of Colorado in Boulder used the light from distant quasars (the bright cores of galaxies with active black holes) to probe the almost-invisible web-like structure, like shining a flashlight through a fog. Their results are detailed in the May 20 issue of the *Astrophysical Journal*.

Using Hubble's Space Telescope Imaging Spectrograph (STIS) and NASA's Far Ultraviolet Spectroscopic Explorer (FUSE), the astronomers found the spectral "fingerprints" of highly ionized hydrogen and oxygen, thought to form the IGM. "We think we are seeing the strands of a web-like structure that forms the backbone of the universe," said study team member Mike Shull. "What we are confirming in detail is that intergalactic space, which intuitively might seem to be empty, is in fact the reservoir for most of the normal, baryonic matter in the universe." Another group of astronomers recently found another filament of the missing baryonic matter connecting two distant galaxies. The Cosmic Origins Spectrograph, to be installed on Hubble by astronauts later this year, will help search for weaker signals of this missing matter.

### About the Astronomy Associates of Lawrence

The club is open to all people interested in sharing their love for astronomy. Monthly meetings are typically on the second Friday of each month and often feature guest speakers, presentations by club members, and a chance to exchange amateur astronomy tips. Approximately the last Sunday of each month we have an open house on Memorial Stadium. Periodic star parties are scheduled as well. For more information, please contact the club officers: Luis Vargas at [lvargas@ku.edu](mailto:lvargas@ku.edu),

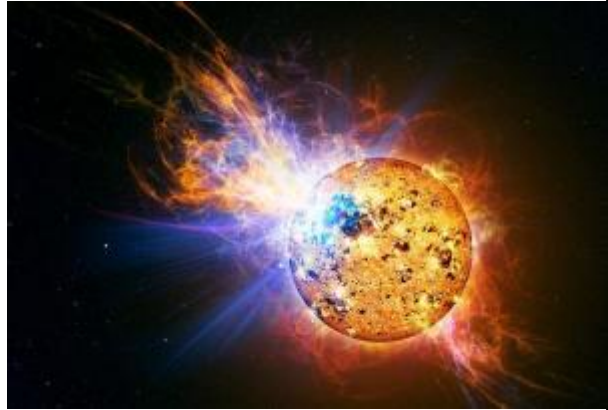
Gary Webber at [gwebber@ku.edu](mailto:gwebber@ku.edu), our faculty advisor, Prof. Bruce Twarog at [btwarog@ku.edu](mailto:btwarog@ku.edu), our events coordinator, Rick Heschmeyer at [rcjbm@sbcglobal.net](mailto:rcjbm@sbcglobal.net). Because of the flexibility of the schedule due to holidays and alternate events, it is always best to check the Web site for the exact Fridays and Sundays when events are scheduled. The information about AAL can be found at <http://www.ku.edu/~aal>.

Copies of the *Celestial Mechanic* can also be found on the web at  
<http://www.ku.edu/~aal/celestialmechanic>

## The Mouse That Roared: Pipsqueak Star Unleashes Monster Flare

ScienceDaily—On April 25, NASA's Swift satellite picked up the brightest flare ever seen from a normal star other than our Sun. The flare, an explosive release of energy from a star, packed the power of thousands of solar flares. It would have been visible to the naked eye if the star had been easily observable in the night sky at the time.

The star, known as EV Lacertae, isn't much to write home about. It's a run-of-the-mill red dwarf, by far the most common type of star in the universe. It shines with only one percent of the Sun's light, and contains only a third of the Sun's mass. At a distance of only 16 light-years, EV Lacertae is one of our closest stellar neighbors. But with its feeble light output, its faint magnitude-10 glow is far below naked-eye visibility.



"Here's a small, cool star that shot off a monster flare. This star has a record of producing flares, but this one takes the cake," says Rachel Osten, a Hubble Fellow at the University of Maryland, College Park and NASA's Goddard Space Flight Center in Greenbelt, Md. "Flares like this would deplete the atmospheres of life-bearing planets, sterilizing their surfaces."

The flare was first seen by the Russian-built Konus instrument on NASA's Wind satellite in the early morning hours of April 25. Swift's X-ray Telescope caught the flare less than two minutes later, and quickly slewed to point toward EV Lacertae. When Swift tried to observe the star with its Ultraviolet/Optical Telescope, the flare was so bright that the instrument shut itself down for safety reasons. The star remained bright in X-rays for 8 hours before settling back to normal.

EV Lacertae can be likened to an unruly child that throws frequent temper tantrums. The star is relatively young, with an estimated age of a few hundred million years. The star rotates once every four days, which is much faster than the sun, which rotates once every four weeks. EV Lacertae's fast rotation generates strong localized magnetic fields, making it more than 100 times as magnetically powerful as the Sun's field. The energy stored in its magnetic field powers these giant flares.

EV Lacertae's constellation, Lacerta, is visible in the spring for only a few hours each night in the Northern Hemisphere. But if the star had been more easily visible, the flare probably would have been bright enough that the star could have been seen with the naked eye for one to two hours. The flare's incredible brightness enabled Swift to make detailed measurements. "This gives us a golden opportunity to study a stellar flare on a second-by-second basis to see how it evolved," says Stephen Drake of NASA Goddard.

Since EV Lacertae is 15 times younger than our Sun, it gives us a window into our solar system's early history. Younger stars rotate faster and generate more powerful flares, so in its first billion years the sun must have let loose millions of energetic flares that would have profoundly affected Earth and the other planets. Flares release energy across the electromagnetic spectrum, but the extremely high gas temperatures produced by flares can only be studied with high-energy telescopes like those on Swift. Swift's wide field and rapid repointing capabilities, designed to study gamma-ray bursts, make it ideal for studying stellar flares. Most other X-ray observatories have studied this star and others like it, but they have to be extremely lucky to catch and study powerful flares due to their much smaller fields of view.

### Red Dwarfs, Killer Flares, and Earth-Like Planets

"Data like this on the flares of red dwarfs, also known as M stars, are important not only to help up understand the nature of these flares, but also because of renewed interest in searching for Earth-like planets around M stars," explained Osten.

About 75 percent of all stars in our Galaxy are M stars, which are long-lived, stable, and burn hydrogen. Until recently, M stars have been considered poor candidates for harboring habitable planets. This was, in part, because it was thought the violent flares generated by intense magnetic activity, could erode or even blast away planetary atmospheres. This problem was seemingly heightened by the fact that habitable zone for planets around a red dwarf would be much closer than that for larger, much more radiant stars like the sun.



## Ozone, the Greenhouse Gas

We all know that ozone in the stratosphere blocks harmful ultraviolet sunlight, and perhaps some people know that ozone at the Earth's surface is itself harmful, damaging people's lungs and contributing to smog. But did you know that ozone also acts as a potent greenhouse gas? At middle altitudes between the ground and the stratosphere, ozone captures heat much as carbon dioxide does. In fact, pound for pound, ozone is about 3000 times stronger as a greenhouse gas than  $\text{CO}_2$ . So even though there's much less ozone at middle altitudes than  $\text{CO}_2$ , it still packs a considerable punch. Ozone traps up to one-third as much heat as the better known culprit in climate change.

Scientists now have an unprecedented view of this mid-altitude ozone thanks to an instrument aboard NASA's Aura satellite called the Tropospheric Emission Spectrometer—"TES" for short. Most satellites can measure only the total amount of ozone in a vertical column of air. They can't distinguish between helpful ozone in the stratosphere, harmful ozone at the ground, and heat-trapping ozone in between. By looking sideways toward Earth's horizon, a few satellites have managed to probe the vertical distribution of ozone, but only to the bottom of the stratosphere.

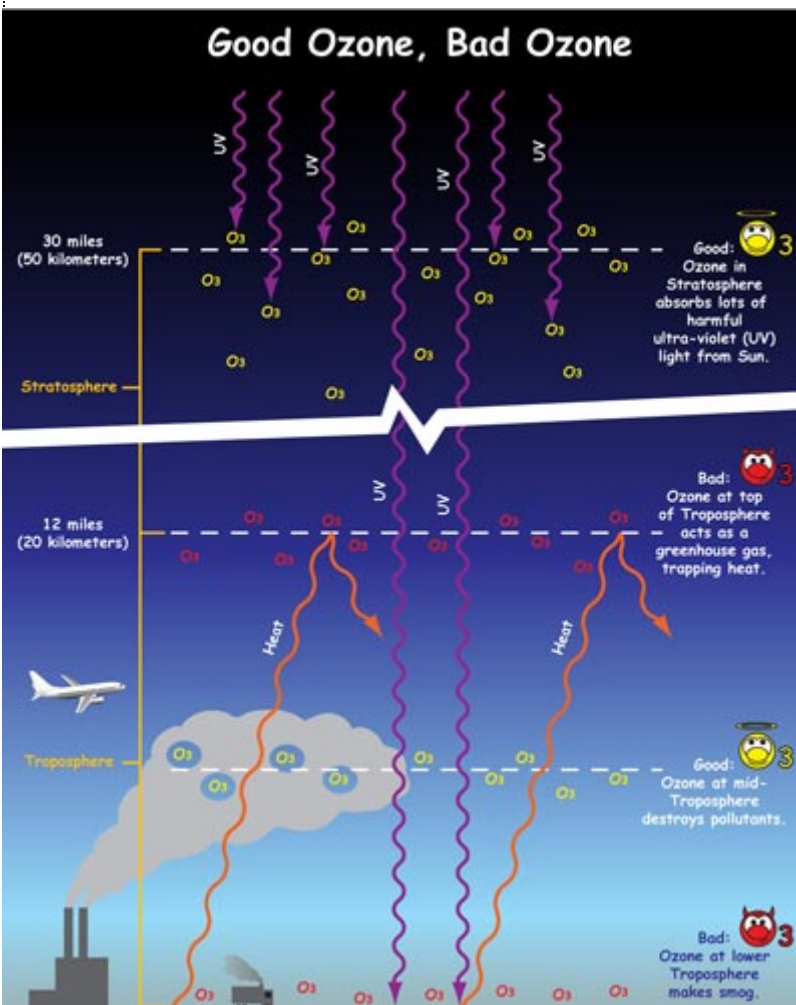
Unlike the others, TES can measure the distribution of ozone all the way down to the heat-trapping middle altitudes. "We see vertical information in ozone that nobody else has measured before from space," says Annmarie Eldering, Deputy Principal Investigator for TES.

The global perspective offered by an orbiting satellite is especially important for ozone. Ozone is highly reactive. It is constantly being created and destroyed by photochemical reactions in the atmosphere and by lightning. So its concentration varies from region to region, from season to season, and as the wind blows.

Data from TES show that ozone's heat-trapping effect is greatest in the spring, when intensifying sunlight and warming temperatures fuel the reactions that generate ozone. Most of ozone's contribution to the greenhouse effect occurs within 45 degrees latitude from the equator. Increasing industrialization, particularly in the developing world, could lead to an increase in mid-altitude ozone, Eldering says. Cars and coal-fired power plants release air pollutants that later react to produce more ozone.

"There's concern that overall background levels are slowly increasing over time," Eldering says. TES will continue to monitor these trends, she says, keeping a careful eye on ozone, the greenhouse gas.

Learn more about TES and the science of ozone at [tes.jpl.nasa.gov/](http://tes.jpl.nasa.gov/). Kids can get a great



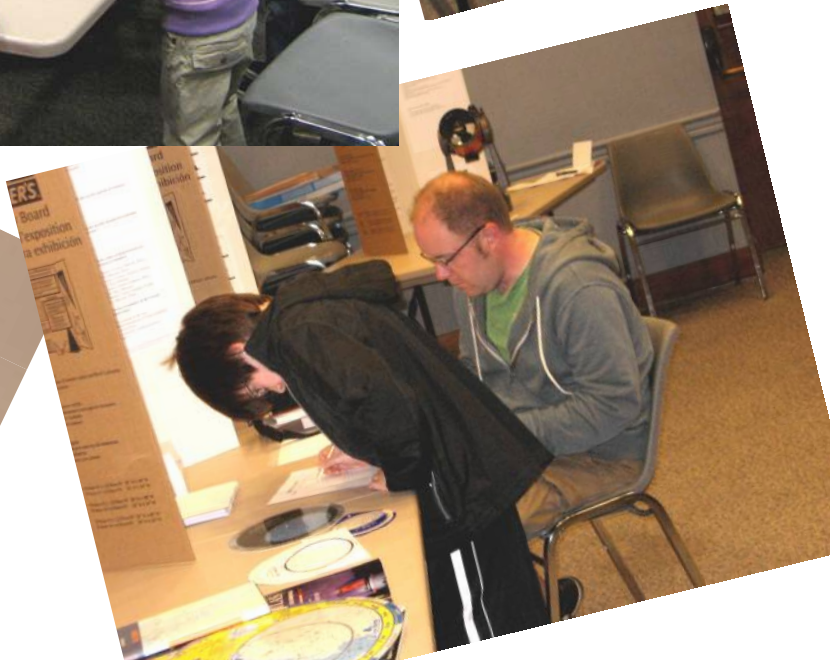
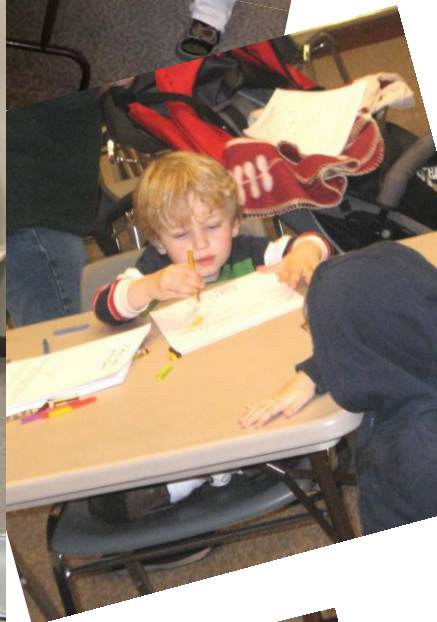
*Ozone behaves differently at different altitudes in the atmosphere. High in the stratosphere and at mid-troposphere it has positive effects on life at the surface. At the top of the troposphere ozone is a greenhouse gas and at the surface it makes smog.*

introduction to good ozone and bad ozone at [spaceplace.nasa.gov/en/kids/tes/gases](http://spaceplace.nasa.gov/en/kids/tes/gases).

*This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.*

# ASTRONOMY DAY

# 2008



## Tapping The Early Universe For Secrets Of Fundamental Physics

Science Daily

The future of fundamental physics research lies in observing the early universe and developing models that explain the new data obtained. The availability of much higher resolution data from closer to the start of the universe is creating the potential for further significant theoretical breakthroughs and progress resolving some of the most difficult and intractable questions in physics. But this requires much more interaction between astronomical theory and observation, and in particular the development of a new breed of astronomer who understands both is was the key conclusion from a recent workshop organised by the European Science Foundation (ESF), bringing together experts in cosmology, astrophysics and particle physics. "I think the realization of how important this is, and of how much needs to be done to get to that stage, will be the main long-term legacy of the workshop," noted Carlos Martins, convenor of the ESF workshop. "In particular, a lot of work needs to be done in order to provide a stronger 'theoretical underpinning' for future observational work. Ultimately this means that when training the next generation of researchers in this area, a lot more effort needs to be put into forming 'bilingual' researchers, that are fluent both in the language of observations and in that of theory."

In effect astronomy is returning to its roots, since the early great discoveries were made by the likes of Galileo for whom theory and observation were two sides of the same coin. The field subsequently split into two, with theorists and observers becoming divorced and ceasing to communicate effectively with each other. Now though the emergence of highly sophisticated observing platforms, capable of making different types of measurement depending on theoretical considerations, means that the two are once again becoming closely entwined.

Two key developments are the ability to take the observing instruments into space, where more accurate observations can be made beyond the influence of the earth's atmosphere and magnetic field, and availability of high precision atomic clocks for measurement of timing down to nanoseconds. At the same time it has become clear there is a limit to how much can be discovered in earth-bound laboratories, even those as big as the Large Hadron Particle Accelerator run by CERN, the European Organization for Nuclear Research, in Switzerland. The early universe on the other hand is a natural laboratory with the required scale and energy, providing the potential for probing deeper into fundamental processes relating to matter and energy.

"The idea was to bring together the top European expertise in cosmology, astrophysics and particle physics, get the various sub-communities to be aware of what is being done 'elsewhere', and focus our efforts on using the early universe as a laboratory in which we can probe fundamental physics - in ways that we'll never be able to do if we restrict ourselves to laboratory tests," said Martins.

The workshop also discussed some of the fundamental questions that these new observations could help resolve, notably whether or not scalar fields exist across the whole the universe. Unlike say gravitational or magnetic fields, which have both strength and direction, scalar fields have strength alone, varying from point to point. They definitely exist within some closed systems, such as the temperature distribution within the earth's atmosphere, but it is not yet known whether they exist on the scale of the universe.

As Martins pointed out, this is a vital question because the existence of scalar fields could help explain how the universe developed after the Big Bang and became as we observe it today. For example scalar fields could explain the existence of dark matter and energy, which can only be observed indirectly from their gravitational effects on the part of the universe we can see. New observations could also help confirm aspects of current theories, such as the existence of gravitational waves as predicted by Einstein's General Relativity. Gravitational waves are supposed to be ripples through space time radiating outwards from a moving object. However the ripples are so small as to be very difficult to measure, with the only observational evidence so far coming from pulsars, which are very dense binary neutron stars revolving around each other. The revolution of pulsars appears to slow down in a manner consistent with the existence of gravitational waves causing them to lose energy, but further confirmation is needed.

Finally there is also the prospect of making further progress in the field of astronomy itself, for example by using space borne atomic clocks to calibrate advanced spectrographs that in turn will be used to search for "extra-solar" planets in neighboring star systems.

# Astronomy Associates of Lawrence

## 2008 DATES

June 11, June 25  
& July 9

Time: 9:00 PM—10:00 PM

Join the  
Astronomy Associates of Lawrence  
in South Park as they share views of the  
night sky through a variety of telescopes.  
It's free!

# Astronomy in the Park\*

Online: <http://groups.ku.edu/~astronomy>

Telescopes will be set up in  
South Park on the WEST  
side of Massachusetts Street  
after the City Band  
concerts on the dates listed  
above.



Astronomy Associates of Lawrence  
C/O KU Physics and Astronomy Dept.  
1251 Wescoe Hall Drive  
Room 1082 Malott  
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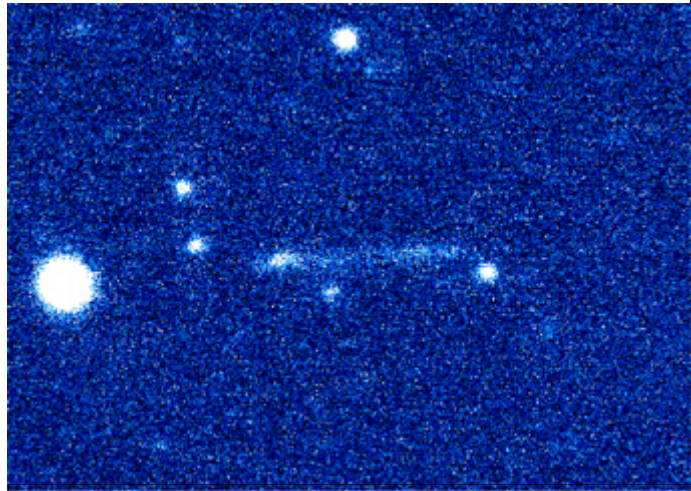
**\* WEATHER PERMITTING**

## Amateur Finds the Fastest-Spinning Asteroid

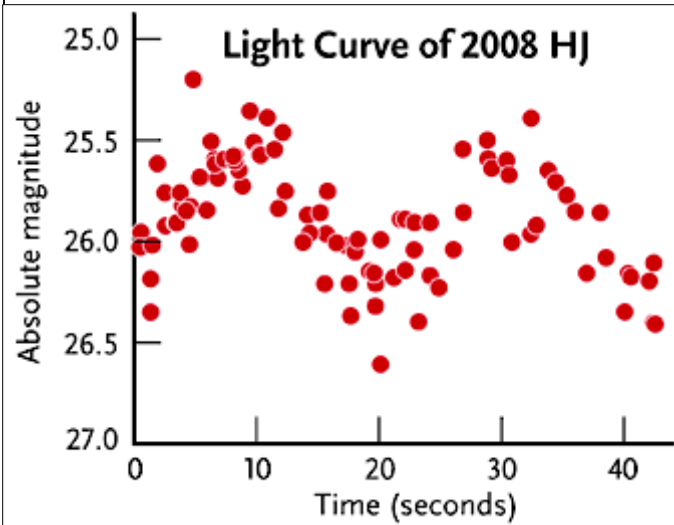
When a tiny object called 2008 HJ flew past Earth last month, observations by British amateur astronomer Richard Miles showed it to be about 12 by 24 meters long (the size of a nice yacht), tumbling end over end as it hurtled by. More surprising is that it turned once every 42.7 seconds — 66 times faster than Seattle's Space Needle — making this the fastest-spinning natural body yet known in our solar system.

It's got to be a barren, stony mass, because any pebbles on its surface would be flung off into space. Each end of 2008 HJ turns at more than 200 times the escape velocity!

Miles, a past president of the British Astronomical Association, wasn't simply using his backyard observatory in Dorset for this find. He was logged on to the 2.0-meter (80-inch) [Faulkes Telescope South](#) at Siding Spring, Australia, via the Internet. This is one of two similar instruments operated by Cardiff University in a partnership with the Las Cumbres Observatory Global Telescope Network (LCOGTN) in Santa Barbara, California. LCOGTN was founded by Wayne Rosing, a former executive at Google.



*During Richard Miles's 30-second exposure, asteroid 2008 HJ made almost a full turn and varied greatly in brightness. There are peaks at each end of its trail (the left end being enhanced by a faint background star), and there's a clear brightness minimum in the middle. Courtesy Richard Miles*



*Miles measured 2008 HJ's brightness repeatedly during its flyby on April 28th and 29th, then combined the results in this plot, which assumes a 42.668-second rotation period. The object has two similar peaks during each rotation, suggesting it is oblong and tumbles end over end. All magnitudes are adjusted to the asteroid's brightness if it were one Earth-Sun distance from both the Sun and the observer (with zero phase angle). Courtesy Richard Miles*

### New Tack Pays Off

These days, whenever a near-Earth object (NEO) is discovered, growing numbers of advanced amateurs swing into action to acquire repeated accurate positions (astrometry) of the body as it flies by — essential for learning about its orbit and future close encounters.

But instead of astrometry, Miles was going after something else: high-quality brightness measurements, which are clues to size, shape, and rotation rate. He belongs to a small group of amateurs and affiliated UK colleges involved with the Faulkes Telescope Project in a concerted effort to secure this type of data for newly discovered NEOs.

In fact, had he concentrated on positional measurements, he might not have noticed this object's rapid spin. "To do accurate astrometry, you have to avoid trailing the image too much," Miles comments, "so most folk doing astrometry would certainly miss detecting fast rotators." Shortly after 2008 HJ was discovered on April 25th with the LINEAR robotic survey telescope in Socorro, New Mexico, Miles suggested adding it to his group's photometric observing program.

As it turned out, he was the only member to get images during the flyby on April 28th and 29th. The asteroid was visible for just a few days as it passed within three lunar distances of Earth.

"If you write this one up," Miles told me, "be prepared — we already have an interesting follow-up object that I am still working on!"

## Strange Ring Found Circling Dead Star



*This image shows a ghostly ring extending seven light-years across around the corpse of a massive star. (Credit: NASA/JPL-Caltech)*

NASA's Spitzer Space Telescope has found a bizarre ring of material around the magnetic remains of a star that blasted to smithereens.

The stellar corpse, called SGR 1900+14, belongs to a class of objects known as magnetars. These are the cores of massive stars that blew up in supernova explosions, but unlike other dead stars, they slowly pulsate with X-rays and have tremendously strong magnetic fields.

"The universe is a big place and weird things can happen," said Stefanie Wachter of NASA's Spitzer Science Center at the California Institute of Technology, Pasadena, who found the ring serendipitously. "I was flipping through archived Spitzer data of the object, and that's when I noticed it was surrounded by a ring we'd never seen before." Wachter is lead author of a paper about the findings in this week's *Nature*.

Wachter and her colleagues think that the ring, which is unlike anything ever seen before, formed in 1998 when the magnetar erupted in a giant flare. They believe the crusty surface of the magnetar cracked, sending out a flare, or blast of energy, that excavated a nearby cloud of dust, leaving an outer, dusty ring. This ring is oblong, with dimensions of about seven by three light-years. It appears to be flat, or two-dimensional, but the scientists said they can't rule out the possibility of a three-dimensional shell.

"It's as if the magnetar became a huge flaming torch and obliterated the dust around it, creating a massive cavity," said Chryssa Kouveliotou, senior astrophysicist at NASA's Marshall Space Flight Center, Huntsville, Ala., and a co-author of the paper. "Then the stars nearby lit up a ring of fire around the dead star, marking it for eternity."

The discovery could help scientists figure out if a star's mass influences whether it becomes a magnetar when it dies. Though scientists know that stars above a certain mass will "go supernova," they do not know if mass plays a role in determining whether the star becomes a magnetar or a run-of-the-mill dead star. According to the science team, the ring demonstrates that SGR 1900+14 belongs to a nearby cluster of young, massive stars. By studying the masses of these nearby stars, the scientists might learn the approximate mass of the original star that exploded and became SGR 1900+14.

"The ring has to be lit up by something, otherwise Spitzer wouldn't have seen it," said Enrico Ramirez-Ruiz of the University of California, Santa Cruz. "The nearby massive stars are most likely what's heating the dust and lighting it up, and this means that the magnetar, which lies at the exact center of the ring, is associated with the massive star-forming region."

Rings and spheres are common in the universe. Young, hot stars blow bubbles in space, carving out dust into spherical shapes. When stars die in supernova explosions, their remains are blasted into space, forming short-lived beautiful orbs called supernova remnants. Rings can also form around exploded stars whose expanding shells of debris ram into pre-existing dust rings, causing the dust to glow, as is the case with the supernova remnant called 1987A. But the ring around the magnetar SGR 1900+14 fits into none of these categories. For one thing, supernova remnants and the ring around 1987A cry out with X-rays and radio waves. The ring around SGR 1900+14 only glows at specific infrared wavelengths that Spitzer can see.

At first, the astronomers thought the ring must be what's called an infrared echo. These occur when an object sends out a blast wave that travels outward, heating up dust and causing it to glow with infrared light. But when they went back to observe SGR 1900+14 later, the ring didn't move outward as it should have if it were an infrared echo. A closer analysis of the pictures later revealed that the ring is most likely a carved-out cavity in a dust cloud -- a phenomenon that must be somewhat rare in the universe since it had not been seen before. The scientists plan to look for more of these rings.

"This magnetar is still alive in many ways," said Ramirez-Ruiz. "It is interacting with its environment, making a big impact on the young star-forming region where it was born."

*Celestial Mechanics June 2008*



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