

The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

Calendar of Events
KU STADIUM OBSERVING

Tentative Date
Sunday
August 27, 2006
9:00 PM—10:30PM

Fall Meeting Schedule
Friday, Sept. 22
Dr. Barbara Anthony-Twarog
Friday, Oct. 20
Dr. Steve Shawl
Friday, Nov. 17
TBD
Friday, Dec. 08
Dr. Keith Ashman

President:
 Hannah Swift
 hkswift@ku.edu
Treasurer:
 Dr. Steve Shawl
 Shawl@ku.edu
University Advisor:
 Dr. Bruce Twarog
 btwarog@ku.edu
Webmaster:
 Gary Webber
 gwebber@ku.edu
Events Coordinator
 Rick Heschmeyer

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Volume 32 Number 08 **August 2006**



Report From the Officers on the JULY Meeting:

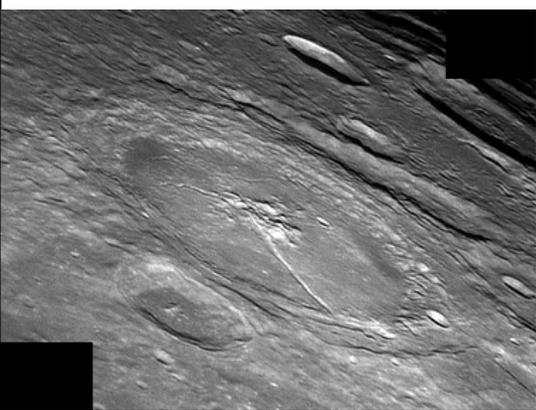
Once again, we didn't have a meeting in July, but we did finally get an opportunity to have a star party after the band concert in South Park. Following the July 12 concert with an emphasis on children, three of our hearty members set up their scopes for viewing primarily Jupiter and its moons. The skies weren't great, with a non-negligible amount of haze, but Jupiter was bright enough to impress anyone who took the time to look. Many thanks to Rick Heschmeyer, Rex Powell, and Bill Winkler for taking the time to do this on a hot and muggy evening. Speaking of observing, we are making progress on replacing and repairing the equipment for the observ-

What's up 2006: 365 days of Skywatching

As we often mention, the AAL and all its members are also members of the Astronomical League. There are a variety of benefits from this, not the least of which is the Astronomical League web site. An example of the useful info you can find on-line is What's Up 2006—365 days of Skywatching. Here's the info on this resource from the Astronomical League: **Do you know what's up in the sky tonight?** If not, there is a new online book you can reference and it is **free**. Our own Tammy Plotner, author of the Universe Today's weekly column "What's up" is the author (she is also part of the Astronomical League web team). Her book, *What's up 2006: 365 days of Skywatching* is great! Be sure to look for a 2007 and 2008 edition as well. Go to this site to download the book: <http://www.universetoday.com/whatsup>

An example of the material for **Saturday, July 29, 2006** is below:

Tonight the Moon will be high enough for us to have a great look at the area just a little southwest of Petavius to identify a small pair of Class I craters, known as Snellius and Stevinus. Power up and notice how these younger craters display much sharper and well defined outlines. If skies are steady, you may spy an odd looking series of confluent craters between the pair and the limb. Showing itself as an odd looking black



(Continued on page 8)

From the Officers, continued

(Continued from page 1)

ing station at the stadium. Assuming everything goes according to schedule, we should be operational about the same time as the start of the academic year. Therefore, we are tentatively scheduling the first open observing session of the semester for Sunday, August 27. If this changes and/or we have an update on the schedule for the remainder of the semester, we will inform you via the newsletter, at minimum, via email, and through the web site. If you are unsure and would like to come by on the 27th, weather permitting, please check the web site or call the observatory number (864-3166), as usual for a recorded message.

With the start of the Fall semester, we return to our regular schedule of meetings. The dates are listed on the first page with the usual caveat that while we like to adopt the 2nd Friday of the month as the standard meeting time, we also try to accommodate the competition with holidays and other events. The first meeting in September is an example. The 15th would be the perfect Friday, but there is a Friday evening KU football game scheduled for broadcast on ESPN—trying to compete with that would be risky, so we moved the date to Friday the 22nd. We have scheduled speakers, all local astronomers, for three of the meetings and we are working on a speaker for the fourth. We will keep you posted.



Reminders on upcoming events: Ark-La-Tex Star Party, Sept. 21-24, 2006. The Red River Astronomy Club will host a four day Star Party beginning September 21st and concluding , Sept. 24th., 2006 at our club property located 13 miles west of Nashville, Ark. The Star Party will have dark skies, plenty of camping space, vendors (Rex's Astro Stuff), PhD and amateur presentations, meals , T-shirts, swap meet, showers, electricity, door prizes, and if cloudy, movies on a 72 inch screen indoors. Even though we have probably the darkest skies in Arkansas our property is located on a county road and may see one or two cars a night but most of the time none. For more info and registration materials, please visit the web site: <http://www.rrac.org>.

The Astronomical League has many activities to encourage amateur astronomy including Observing Clubs. The Observing Clubs offer certificates of accomplishment for demonstrating observing skills with a variety of instruments and objects. Each Club offers a certificate based upon achieving certain observing goals. These are usually in the form of a specific number of objects of a specific group with a given type of instrument. Occasionally there are multiple levels of accomplishment within the club. There is no time limit for completing the required observing, but good record keeping is required. When you have reached the requisite number of objects, your observing logs are examined by the appropriate authority and you will receive a certificate and pin to proclaim to all that you have reached your goal. Many local astronomical societies even post lists of those who have obtained their certificates. **IF YOU WISH TO BECOME A MEMBER OF ONE OF THE OBSERVING CLUBS AND COMPLETE AN OBSERVING PROJECT, WE NOW HAVE A LOCAL CLUB MEMBER TO EXAMINE AND CERTIFY THAT YOU HAVE MET THE QUALIFICATIONS FOR THE SPECIFIC CLUB.** **DOUG FAY** has agreed to take on the job of certifying the observing materials and forwarding the info to the Astronomical League. So, if you have any interest in submitting the log sheets and materials for an observing club, as detailed on the Astronomical League web site, please communicate with Doug; his email address is dfay@ku.edu.

Adding to the extensive list of specialty clubs within the Astronomical League, a new OUTREACH CLUB has been created. This recognition is based upon the public outreach activities of a club and contains levels of achievement that that are well within reach of the AAL. The new League Outreach Award will afford individual Astronomy Outreach recognition. Many club/society members already do outreach, but no one organization recognizes the outreach efforts of the many, many individuals. More on this next month.

If you have any suggestions for talks, speakers, or public events, please feel free to contact us, particularly Rick Heschmeyer (rcjbm@sbcglobal.net), the events coordinator for the club. Hope to see you later this month at the first observing session on Aug. 27th.

ALL for now.

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: Hannah Swift at hksswift@ku.edu, Gary Webber at gwebber@ku.edu, our faculty advisor, Prof. Bruce Twarog at btwarog@ku.edu or our events coordinator, Rick Heschmeyer at 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

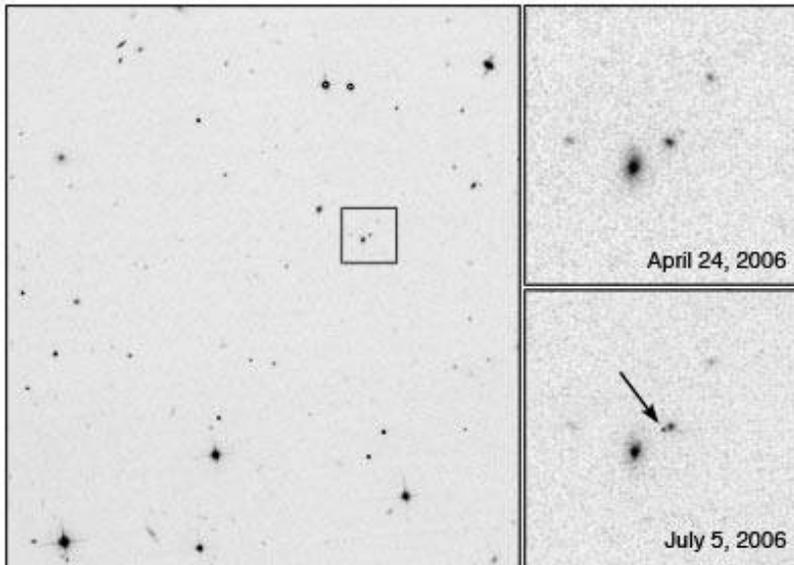
<http://www.ku.edu/~aal/celestialmechanic>

Hubble's Advanced Camera for Surveys Resumes Exploring the Universe

HST Press Release

After a brief hiatus, the Advanced Camera for Surveys aboard NASA's Hubble Space Telescope is back in business, probing the far reaches of space in a quest to understand the true nature of the universe's most dominant constituent: dark energy.

This is one of the first images of the universe taken after the ACS camera resumed science operation on July 4th. The camera was offline for nearly two weeks as NASA engineers switched to a backup power supply after the camera's primary power supply failed.



The picture on the left is of a rich galaxy field containing a distant galaxy cluster 9 billion light-years away (redshift of $z = 1.4$). In a program conducted by Saul Perlmutter of the University of California at Berkeley, Hubble periodically revisits about 20 distant galaxy clusters on a "fishing trip" to capture the glow of a class of exploding star called a Type Ia supernova. The selected clusters were chosen because they allow astrono-

mers to study dark energy at a distance too great to be easily observed from the ground.

Type Ia supernovae are bright celestial distance markers that are invaluable for measuring how dark energy is influencing the universe. Ultimately, detailed observations like this will allow astrophysicists to better understand the nature of dark energy and its influence on the future evolution of the universe.

When Hubble looked at this field in April 2006, (upper right) no supernova was evident. Hubble first saw the supernova in June 2006, in a field galaxy that is one billion light-years closer (redshift value of $z = 1.2$) to us than the more distant cluster. Right after the ACS was returned to operation Hubble revisited the field to make measurements of the fading stellar explosion (arrow lower right). The bright core of the host galaxy is adjacent to the glowing supernova. A supernova can briefly become as bright as an entire galaxy of stars.

The quality of the April and July images demonstrate that the ACS is operating perfectly and sending back detailed images of the distant universe.

Discovered in 1998, dark energy seems to percolate out of empty space and provides a repulsive force that is causing the universe to expand at an ever-faster rate.



Celebrating 40 Years of Intent Listening

By Diane K. Fisher

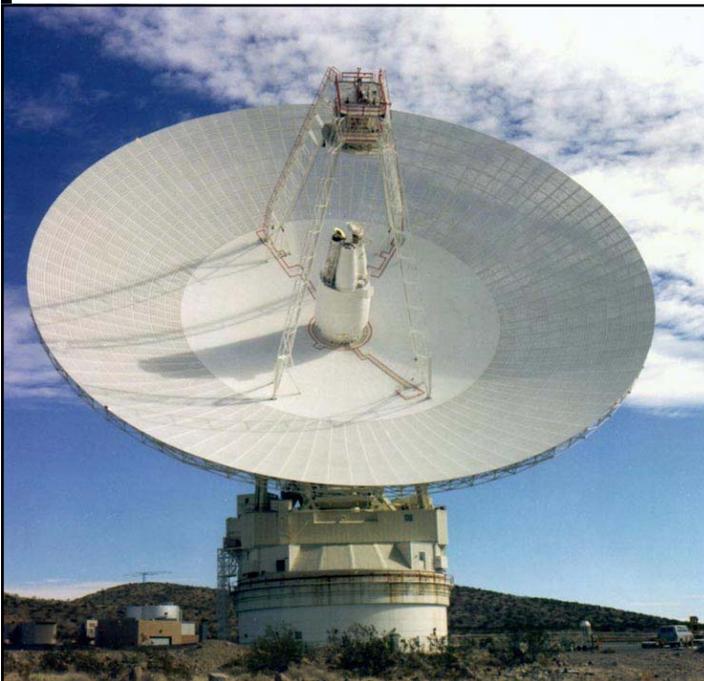
In nature, adjacent animals on the food chain tend to evolve together. As coyotes get sneakier, rabbits get bigger ears. Hearing impaired rabbits die young. Clumsy coyotes starve. So each species pushes the other to "improve."

The technologies pushing robotic space exploration have been like that. Improvements in the supporting communications and data processing infrastructure on the ground (the "ears" of the scientists) have allowed spacecraft to go farther, be smaller and smarter, and send increasingly faint signals back to Earth—and with a fire hose instead of a squirt gun.

Since 1960, improvements in NASA's Deep Space Network (DSN) of radio wave antennas have made possible the improvements and advances in the robotic spacecraft they support.

"In 1964, when Mariner IV flew past Mars and took a few photographs, the limitation of the communication link meant that it took eight hours to return to Earth a single photograph from the Red Planet. By 1989, when Voyager observed Neptune, the DSN capability had increased so much that almost real-time video could be received from the much more distant Planet, Neptune," writes William H. Pickering, Director of JPL from 1954 to 1976, in his Foreword to the book, *Uplink-Downlink: A History of the Deep Space Network, 1957-1997*, by Douglas J. Mudgway.

Mudgway, an engineer from Australia, was involved in the planning and construction of the first 64-m DSN antenna, which began operating in the Mojave Desert in Goldstone, California, in 1966. This antenna, dubbed "Mars," was so successful from the start, that identical 64-m antennas were constructed at the other two DSN complexes in Canberra, Australia, and Madrid, Spain.



For over 40 years, the "Mars" 70-m Deep Space Network antenna at Goldstone, California, has vigilantly listened for tiny signals from spacecraft that are billions of miles away.

As Mudgway noted in remarks made during the recent observance of the Mars antenna's 40 years of service, "In no time at all, the flight projects were competing with radio astronomy, radio science, radar astronomy, SETI [Search for Extra-terrestrial Intelligence], geodynamics, and VLBI [Very Long Baseline Interferometry] for time on the antenna . . . It was

like a scientific gold rush."

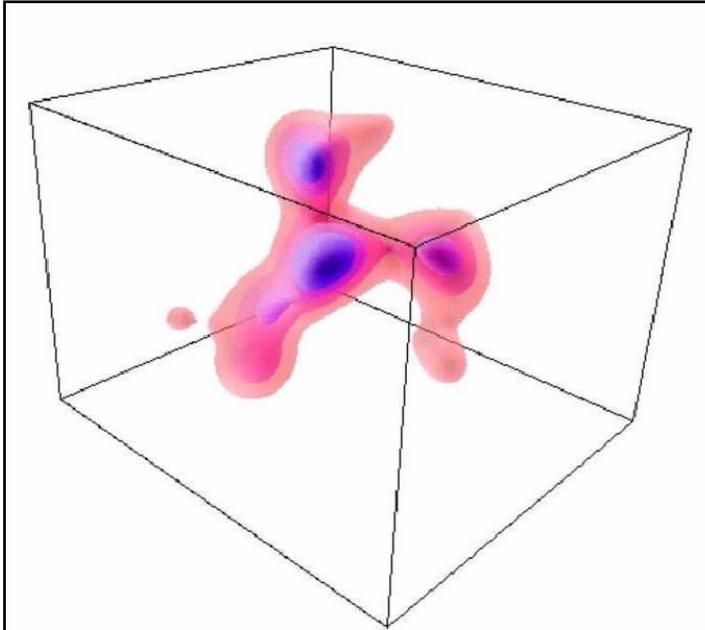
In 1986 began an ambitious upgrade program to improve the antenna's performance even further. Engineering studies had shown that if the antenna's diameter were increased to 70 m and other improvements were made, the antenna's performance could be improved by a factor of 1.6. Thus it was that all three 64-m DSN antennas around the world became 70-m antennas. Improvements have continued throughout the years.

"This antenna has played a key role in al-

(Continued on page 9)

Newfound Blob is Biggest Thing in the Universe

By Ker Than, Space.com



The filamentary structure in 3D. There are at least three intersecting filaments. Credit: National Astronomical Observatory of Japan.

An enormous amoeba-like structure 200 million light-years wide and made up of galaxies and large bubbles of gas is the largest known object in the universe, scientists say.

The galaxies and gas bubbles, called Lyman alpha blobs, are aligned along three curvy filaments that formed about 2 billion years after the universe exploded into existence after the theoretical Big Bang. The filaments were recently seen using the Subaru and Keck telescopes on Mauna Kea.

The galaxies within the newly found structure are packed together four times closer than the universe's average.

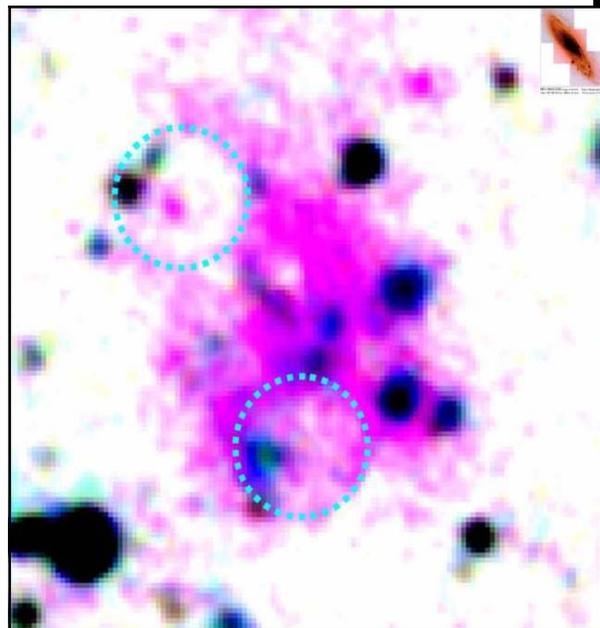
Some of the gas bubbles are up to 400,000 light years across, nearly twice the diameter of our neighboring Andromeda Galaxy. Scientists think they formed when massive stars born early in the history of the universe exploded as supernovas and blew out their surround-

ing gases. Another theory is that the bubbles are giant gas cocoons that will one day give birth to new galaxies.

The finding will give researchers new insight into what the structure of cosmos looks like at the largest scale.

"Something this large and this dense would have been rare in the early universe," said study team member Ryosuke Yamauchi from Tohoku University.

"The structure we discovered and others like are probably the precursors of the largest structures we see today which contain multiple clusters of galaxies," Yamauchi said.



A comparison of a Lyman alpha blob and the Andromeda Galaxy. In the upper right corner is an image of the Andromeda Galaxy, scaled as if were at the same distance as the blob. The red circle indicates a bubble like structure discovered for the first time with the Subaru telescope observations. Credit: University of Tokyo Kiso Observatory

Record meteorite hit Norway

As Wednesday morning (6/7) dawned, northern Norway was hit with an impact comparable to the atomic bomb used on Hiroshima.

At around 2:05 a.m. On Wednesday, June 07, residents of the northern part of Troms and the western areas of Finnmark could clearly see a ball of fire taking several seconds to travel across the sky. A few minutes later an impact could be heard and geophysics and seismology research foundation NORSAR registered a powerful sound and seismic disturbances at 02:13.25 a.m. At their station in Karasjok. Farmer Peter Bruvold was out on his farm in Lyngseidet with a camera because his mare Virika was about to foal for the first time.

"I saw a brilliant flash of light in the sky, and this became a light with a tail of smoke," Bruvold told Aftenposten.no. He photographed the object and then continued to tend to his animals when he heard an enormous crash.

"I heard the bang seven minutes later. It sounded like when you set off a solid charge of dynamite a kilometer (0.62 miles) away," Bruvold said. Astronomers were excited by the news. "There were ground tremors, a house shook and a curtain was blown into the house," Norway's best known astronomer Knut Jørgen Røed Ødegaard told Aftenposten.no. Røed Ødegaard said the meteorite was visible to an area of several hundred kilometers despite the brightness of the midnight sunlit summer sky. The meteorite hit a mountainside in Reisadalen in North Troms.

"This is simply exceptional. I cannot imagine that we have had such a powerful meteorite impact in Norway in modern times. If the meteorite was as large as it seems to have been, we can compare it to the Hiroshima bomb. Of course the meteorite is not radioactive, but in explosive force we may be able to compare it to the (atomic) bomb," Røed Ødegaard said. The astronomer believes the meteorite was a giant rock and probably the largest known to have struck Norway.

"The record was the Alta meteorite that landed in 1904. That one was 90 kilos (198 lbs) but we think the meteorite that landed Wednesday was considerably larger," Røed Ødegaard said, and urged members of the public who saw the object or may have found remnants to contact the Institute of Astrophysics.

Kansas Comet Recovered

Farpoint Observatory Press Release

P/1999 X1 (Hug-Bell), the only comet ever discovered from the state of Kansas has been recovered after a 6 and 1/2 year observing hiatus. The object was once again picked up by astronomers Dan Tibbets and Gary Hug at Farpoint Observatory on the grounds of Mission Valley High School near Eskridge where the comet was discovered in mid-December of 1999. Early Saturday and Sunday mornings (July 15/16) just before dawn the comet was imaged and analyzed at Farpoint Observatory and the data forwarded to the Minor Planet Center. The object had not been seen since early 2000.

Recovering the comet will enhance the orbital data and should provide sufficient precision for the comet to soon become one of less than 200 known periodic comets numbered by the Minor Planet Center the official clearing house for comets and asteroids for the International Astronomical Union.

Rethinking Venus' Volcanoes

Matt Kaplan, Newscientist.com

A pair of planetary geologists at Imperial College, London, studying Venus' craters has thrown widely accepted theories on the planet's volcanic past into question. Computer modeling of our sister planet's impact history led Timothy Bond and Mike Warner to suggest that the global volcanic catastrophe long thought to have resurfaced the planet never happened.

NASA's Magellan spacecraft mapped 98 percent of Venus' surface between 1990 and 1994. When this data was later analyzed, researchers noticed that the distribution of craters was random and that the craters themselves were largely undamaged by volcanic activity. These findings, when coupled with the relatively small number of craters they found — fewer than 1,000 — led them to believe Venus had experienced little volcanic activity in the past 500 million years.

To explain these discoveries, researchers suggested the planet went through an intense and rapid volcanic resurfacing 500 million years ago, during which time magma flowed over old craters and, essentially, wiped the planet clean of past bombardment. They argued the planet then entered a long period of volcanic inactivity, which preserved any subsequent impact craters. These suggestions snowballed into an accepted theory that Venus went through periodic catastrophic eruptions followed by long silent periods throughout its history.

But Bond and Warner would not accept this theory. "No planets that we knew of had experienced eruptions of this size and speed," comments Bond. "That really put doubts in our minds." So, in 2000, they set to work computer modeling the surface of our fiery neighbor.

When they compared the sizes and shapes of impact craters on Venus to craters in their model, they realized an enormous eruption 500 million years ago was not necessary to explain the planet's current surface. Instead, they found that randomly timed volcanic eruptions of varying size — similar to those on Earth — could explain what researchers see today.

"Nobody tested the idea that past eruptions on Venus could have been larger in size than those that happen today," comments Bond. If eruptions happened at random intervals on the planet, and if they steadily decreased in size over time, this explains the planet's crater-marked surface better than the idea that Venus was blown to smithereens 500 million years ago, Bond and Warner maintain. The two presented their findings in March at the Lunar and Planetary Science Conference in Houston.



The Soviet Union's Venera 13 lander captured this view of Venus's surface March 1, 1982. It survived on the surface for 2 hours, 7 minutes. The surface is made up of flat, platy rocks and soil. Parts of the lander and semi-circular lens covers can be seen in the image. NASA

Star explosion makes speedy wave

Laura Baird, NewScientist.com



This artwork shows the binary star system RS Ophiuchi. Hydrogen-rich gas from the red giant transferred onto the surface of the white dwarf has just exploded. David A. Hardy & PPARC

Astronomers clocked a blast wave from a nuclear explosion on the surface of a white-dwarf star racing through space at nearly 4 million mph (6 million kilometers per hour). The discovery team of English and German scientists employed a worldwide array of radio telescopes to make the observations.

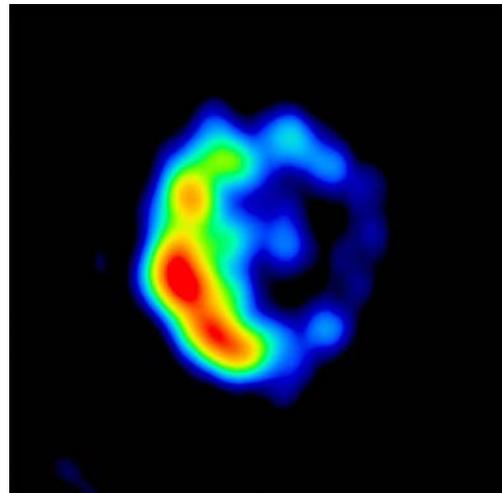
The explosion was observed February 12 in the binary star system RS Ophiuchi, which comprises a red giant and white dwarf closely orbiting each other. The star flares periodically, every few decades, when enough gas from the red giant builds up on the white dwarf's surface to cause runaway thermonuclear reactions. In one day, the white dwarf's energy output increases to more than 100,000 times the Sun's.

The gas shoots off the white dwarf and crashes into the red giant's bloated at-

mosphere. The resulting blast waves accelerate electrons to near light-speed. As the electrons move through the star's magnetic field, they create radio waves, which earthbound telescopes can detect.

When RS Ophiuchi flared, becoming clearly visible in the night sky, astronomers requested observing time to view the explosion's aftermath. Richard Porcas of the Max Planck Institute for Radio Astronomy in Bonn, Germany, who coordinated the worldwide observations, explains, "A week after our first observations, we combined telescopes across Europe with two in China and another in South Africa and were surprised to find that the blast wave had become distorted. Over the next few months, our observations have shown it turning from a ring into a cigar-like shape."

It's unclear what mechanism is responsible for this change. Astronomers also hope to discover if the white dwarf sheds all its accumulated mass each time it flares or whether the dead star is gradually increasing in size. If so, it will explode as a supernova in the distant future, ending its cyclical outbursts. The team reports its discovery in the July 20 issue of the journal *Nature*.



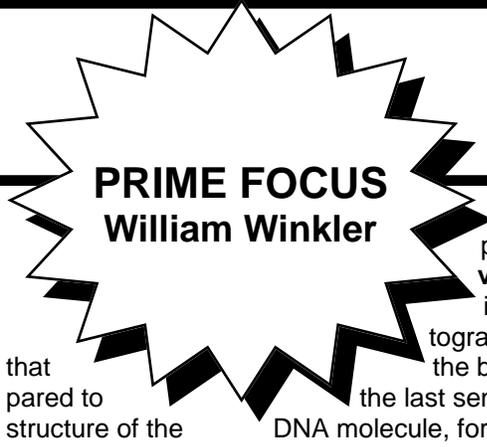
The first radio image of the blast wave, taken 14 days after the explosion, is shown here. The colors relate to radio brightness, with blue being faintest and red brightest. The binary star system itself is invisible. NRAO / AUI / NSF

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streak, take pleasure in the fact that you have just identified Class II Hase! After the Moon sets, revisit the Great Hercules Cluster - M13 - while it remains well placed. Those with very small scopes should avert their vision to detect a dozen or so of the cluster's brightest outlying members well away from its luminous core region. For large aperture, take a very careful look at M13's edge for a dark obscuration known as the "Propeller." Rather than actually being part of this pure population II cluster, it is believed that this dark nebula is between us and the cluster.

**A Review of the book
MISS LEAVITT'S STARS**

George Johnson, NY Times Science Reporter
W.W. Norton, N.Y., 2005



**PRIME FOCUS
William Winkler**

In 1908 Henrietta S. Leavitt (1868—1921) published a report in the **Annals of the Astronomical Observatory of Harvard College**, "1777 Variables in the Magellanic Clouds." It included a list of 16 variable stars with their periods and photographic magnitudes. Her final sentence, "It is worthy of notice that the brighter variables have the longer periods," has been compared to the last sentence in the 1953 **Nature** paper by Watson and Crick on the structure of the DNA molecule, for its understatement leading to a vast new field of knowledge.

Being in the same galaxies, Leavitt's stars' apparent brightnesses are nearly proportional to their intrinsic brightnesses. They demonstrate the period-luminosity relationship that made them among the first "Cepheid variables," a new distance measuring stick.

George Johnson has written a pleasant yet scholarly biography of one of the few women astronomers of or before her day. This 162-page book has 15 pages of notes, a 2-page bibliography, and 11 pages of index. There are 8 historic photos. The author has certainly done due diligence, but it is apparent that Leavitt was a private person, not a diarist, and a rather retiring woman with intense extended family obligations like many in the late Victorian era. Relatively little solid information about her life has been discovered, although she had more than the equivalent of a Harvard B.A. education and was published. As a result, the reader learns far more about the impact of Leavitt's breakthrough on the long struggle to measure the size of the universe, and on some of the greatest astronomers of the 20th Century, than about Leavitt's life and work.

As a non-technical history of understanding the size of the universe, this book is made enjoyable by the many tidbits associated with that progress and its achievers. George E. Hale and the Shapley-Curtis debate, how Shapley became director of Harvard Observatory, the many changes in the value of Hubble's constant, and the life and pay of the Harvard computer women are examples. In some ways Leavitt's life wound up like that of DNA biologist Rosalind Franklin: died too early, did not get full credit. There are well-chosen quotes about people and the enterprise. Note that no Cepheid variable parallax has been directly measured, even from spacecraft.

In the final chapter of **Miss Leavitt's Stars**, Johnson summarizes the great progress that has been made in the age of big science. However, he does not mention the accelerating expansion of the universe, known before 2005, or the Halton Arp controversy. I like his final remark, with regard to determining quasar distance: "Now the measuring stick itself has become one more theory to test."

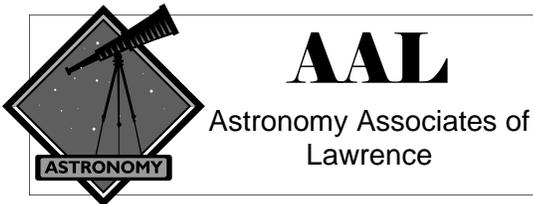
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most every United States planetary mission since 1966 and quite a few international space missions as well. Together with its twins in Spain and Australia, it has been a key element in asserting America's pre-eminence in the scientific exploration of the solar system," remarks Mudgway.

Find out more about the DSN and the history of the Mars antenna at <http://deepspace.jpl.nasa.gov/dsn/features/40years.html>. Kids (and grownups) can learn how pictures are sent through space at http://spaceplace.nasa.gov/en/kids/phonedrmarc/2003_august.shtml .

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Celestial Mechanic August 2006



University of Kansas
Malott Hall
1251 Wescoe Hall Dr, Room 1082
Lawrence, KS 66045-7582