The Celestial Mechanic

The Official Newsletter of the Astronomy Associates of Lawrence

Volume 33 Number 10 OCTOBER 2007

CALENDAR OF EVENTS

Monthly Meeting

Friday, Oct. 19, 7:30 PM
1001 Malott Hall

SEEING THROUGH the DARK

Dr. Bruce Twarog
University of Kansas

FALL PUBLIC OBSERVING SCHEDULE
Weather Permitting
Memorial Stadium
Sunday, Oct. 28
8:00-9:30 PM

President:
Luis Vargas
lcvargas@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
rcjbm@sbcglobal.net
Observing Clubs
Doug Fay
dfay@ku.edu

INSIDE THIS ISSUE

Report from the Officers on the September Meeting:

The meeting in September went very well, with attendance by over 20 people. The presentation by Dr. Anthony-Twarog was so well received that we will be placing a condensed version of it on the AAL website, probably in PDF format. Once it is available, we will pass along the info. For next month, i.e., in two weeks (**Note that the meeting is the 3rd Friday of the month to avoid Fall Break on the KU campus**) , we will have a presentation on some exciting recent observational

(Continued on page 2)

ITEMS of INTEREST

One of the more challenging issues in Astronomy is increasing the number of women involved at both the professional and amateur level. A potential source of insight, advice, and encouragement for this goal is provided by the web site: The Woman Astronomer, Where Woman Are The Stars! Reaching 104,043 visitors in the past 12 months! To subscribe, go to:
http://www.womanastronomer.com/newsletter.htm
Their mission is to promote astronomy as a hobby and science, to encourage women and girls interested in astronomy, and to be a resource to the astronomy community and the public at large. Articles in the current newsletter include -Feature Article: Interview with Dr. Debra Fischer, Planet-Hunter; Ask Urania: What is astronomy?; Cosmic Campus: Website Review: theWoman Astronomer, by Kathryn Piorkowski

News from the Astronomical League

The September 2007 "What's Up with the Astronomical League' flyer is now available for viewing on the League's newly revamped website, www.astroleague.org. Scroll down the page and it will be found on the left side of the page with the link "The ALCor Newsletter 9/7/07".

AlCon 2007 was a great success thanks to the efforts of the Rose City Astronomers. Put a note on your calendars for the next convention, AlCon 2008, which will be held in Des Moines, Iowa on July 18 and 19th, 2008. The Astroleague Store (http://www.astroleague.org/store/index.php) is now open! You may now conveniently purchase items securely online with your favorite credit card. There are several new items available so be sure to check it out.

(Continued on page 2)

From the Officers, continued

(Continued from page 1)

results that are beginning to clarify some of the properties of the strange component of the Universe known as dark matter. Not only is it strange, it makes up 30% of what we can't see! There will be the usual refreshments and hopefully lots to talk about, so come by and bring a friend.

For observing, our 2nd Sunday public session was a bust. Due to the heavy thunderstorms and the poor sky conditions, the decision was made at 6 PM to cancel the observing due to poor weather. Unfortunately, as occasionally happens in KS, the weather improved dramatically in about 1 hour and, by 8:30, sky conditions were clear, though the seeing was wretched. To those of your who planned to attend, our apologies. Sometimes we guess wrong. Fortunately, we have a chance to make up for our mistake with the next session, scheduled for Sunday, October 28 from 8:00 PM to 9:30 PM. So, please make a note of the date and, if you have the time and desire, plan on joining us either as an observer or a participant running a telescope. Having 3-4 people available is a real plus for crowd control.

Long term, the meeting for the evening of Friday, Nov. 16 has been set aside for the annual Cub Scout Astronomy night—an event that requires a serious amount of help and volunteers to handle the sheer number of scouts who take part (please contact Rick for more details), and Prof. Steve Shawl will close out the year with a presentation on Friday, Dec. 07 at our annual holiday meeting with refreshments and door prizes. 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 at the meeting in two weeks and/or observing on Memorial Stadium later this month**.** ALL for now.

(Continued from page 1)

The Great World Wide Star Count

Join us this coming October for an exciting new citizen science campaign — the Great World Wide Star Count (www.starcount.org). This international event encourages everyone to go outside, look skywards after dark, count the stars they see in certain constellations, and report what they see online.

This inaugural Windows After Dark event is designed to raise awareness about light pollution and the night sky as well as encourage learning in astronomy. All the information needed to participate is available on the Star Count Web site. The Star Count uses a simple protocol and an easy data entry form. At the conclusion of the event, the submitted data will be analyzed and a map will be generated highlighting the results of this new citizen science campaign.

Mark your calendars and plan on joining thousands of other students, families, and citizen scientists counting stars this October! The Great World Wide Star Count will be held from October 1st through October 15, 2007.

Please help us get the word out to all interested star counters! Download our flyer at fwww.starcount.org/GWWSC2007_flyer.pdf For more information visit www.starcount.org or contact starcount_info@ucar.edu.

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 lcvargas@ku.edu, Gary Webber at gwebber@ku.edu, our faculty advisor, Prof. Bruce Twarog at btwarog@ku.edu. 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

Adding an Extra Room for the Skyl

by Kate Murphy, NY Times

In the quaint seaside community of Gloucester, Mass., on Cape Ann, one gray clapboard house stands out from the rest. It has a big white dome rising from the top, with a sliding shutter that opens to the sky and a powerful telescope inside. “My wife got an ocean view and I got a view of the sky,” said Dr. Mario Motta, 55, a cardiologist and astronomy enthusiast, of the house they built three years ago. At a time when amateur astronomy is becoming increasingly popular — thanks in part to the availability of high-tech equipment like digital cameras that filter out light pollution — Dr. Motta and his wife, Joyce, are among a growing number of Americans incorporating observatories into new or existing homes. Manufacturers of observatory domes report increasing sales to homeowners, and new residential communities are being developed with observatories as options in house plans.

“As the baby boomers and wealthy tech types retire, they want challenging hobbies like astronomy, and have enough cash stashed away to afford to build their own observatories,” said Richard Olson, president of the Ash Manufacturing Company in Plainfield, Ill., which makes steel domes for observatories. His customers used to be limited to academic and research institutions, but within the last five years, he said, homeowners have begun making requests, to the point where 25 percent of his sales are to people like Steve Cullen, a 41-year-old retired senior vice president of the Symantec Corporation, who is building a home and observatory on 190 acres in Rodeo, N.M. Mr. Cullen said he chose the location because it has “some of the darkest skies and clearest weather for space photography in the U.S.” (Most sophisticated telescopes now allow for the addition of digital cameras.) He expects the total cost of his observatory, which is still under construction, to be close to $340,000, including a $225,000 telescope, but his is a high-end project.

Most home observatories have between $10,000 and $40,000 in equipment, including telescopes, computers, refractors, filters and tracking mechanisms, according to astronomy equipment retailers. The total budget for an observatory can range from $50,000 to more than $500,000, depending on how technologically advanced the equipment and the size and complexity of the structure. Dr. Motta also photographs deep space from his home’s observatory, posting his images of distant galaxies online and publishing them in astronomy magazines and journals. His telescope, which he constructed himself, weighs well over a hundred pounds, and would be cumbersome to move outdoors if he didn’t have an observatory. And like most sophisticated telescopes, it would also require at least an hour of careful recalibration if relocated.

“The reason why people don’t use their telescopes is they are such a pain to haul out and set up,” said John Spack, 50, a certified public accountant who had a domed observatory built on top of an addition to his house in Chicago last year. “Now, if I want to get up at 3 a.m. and look at something, I just open the shutter.” Like observatories at research facilities and museums, most home observatories now have computers that rotate the dome so the telescope is oriented toward precisely what the user wants to see. Once fixed on a point in space, the dome continues to slowly rotate to compensate for the earth’s rotation, so whatever is in view doesn’t move out of range.

Mr. Spack's house in Chicago

“It’s all fully automated, real high-tech,” said Mr. Spack, who estimated that he spent at least $100,000 to build and equip his observatory. Many home observatories also allow remote real-time views through the telescope from any computer with an Internet connection. Roy and Elise Furman, who own a software company, view the cosmos through the telescope in their vacation house observatory in Portal, Ariz., both when they are there and when they are at home, in Philadelphia.

“Philadelphia skies are so light polluted, we got depressed trying to do astronomy,” said Ms. Furman, 48. So the couple bought the Portal property, which is about 10 miles from Rodeo and part of a community called Arizona Sky Village, founded in 2003. Half of the 15 adobe-style homes there have matching domed observatories, and five more observatory homes are under construction. “We are a bunch of astronomy buffs looking through our telescopes out in the middle of nowhere,” said Mr. Furman, 57.

A Missile in Your Eye

by Patrick L. Barry

Satellite technology designed to catch ballistic missile launches may soon help doctors monitor the health of people's eyes.

For the last 15 years, Greg Bearman and his colleagues at JPL have been working on a novel design for a spectrometer, a special kind of camera often used on satellites and spacecraft. Rather than snapping a simple picture, spectrometers measure the spectrum of wavelengths in the light coming from a scene. From that information, scientists can learn things about the physical properties of objects in the photo, be they stars or distant planets or vegetation on Earth's surface.

In this case, however, the challenge was to capture snapshots of short-lived events—like missile launches! The team of JPL scientists designed the new spectrometer, called a computed tomographic imaging spectrometer (CTIS), in collaboration with the Ballistic Missile Defense Organization as a way to detect missiles by the spectral signatures of their exhaust.

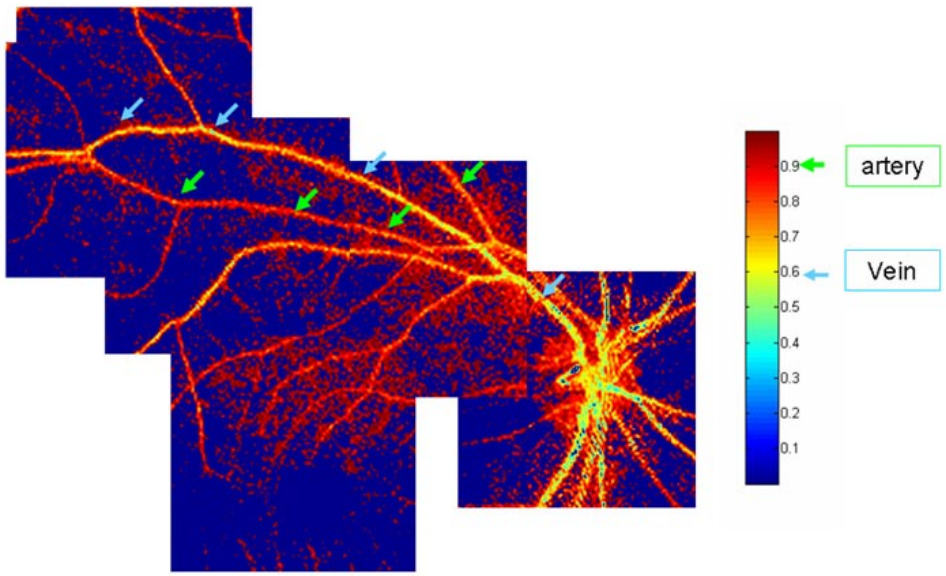
But now the scientists are pointing CTIS at another fast-moving scene: the retina of an eye.

Blood flowing through the retina has a different spectral signature when it is rich in oxygen than when it is oxygen deprived. So eye doctors can use a spectrometer to look for low oxygen in the retina—an indicator of disease. However, because the eye is constantly moving, images produced by conventional spectrometers would have motion blurring that is difficult to correct.

The spectrometer that Bearman helped to develop is different: It can capture the whole retina and its spectral information in a single snapshot as quick as 3 milliseconds. "We needed something fast," says Bearman, and this spectrometer is "missile-quick."

CTIS is even relatively cheap to build, consisting of standard camera lenses and a custom, etched, transparent sheet called a grating. “With the exception of the grating, we bought everything on Amazon,” he says.

The grating was custom-designed at JPL. It has a pattern of microscopic steps on its surface that split incoming light into 25 separate images arranged in a 5 by 5 grid. The center image in the grid shows the scene undistorted, but colors in the surrounding images are slightly “smeared” apart, as if the light had passed through a prism. This separation of colors reveals the light's spectrum for each pixel in the image.



This three-color composite image from the computed tomographic imaging spectrometer shows the oxygenation of the blood in the arteries and veins of a human retina. (Arteries appear red, veins appear yellow.)

”We're conducting clinical trials now,” says Bearman. If all goes well, anti-missile technology may soon be catching eye problems before they have a chance to get off the ground.

Information about other NASA-developed technologies with spin-off applications can be found at http://www.sti.nasa.gov/tto .

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

The Astronomy Associates of Lawrence present

SEEING THROUGH the DARK

Dr. BruceTwarog

Professor of Physics & Astronomy

FRIDAY, OCTOBER 19, 2007

7:30 PM, 1001 Malott Hall

University of Kansas

FREE & OPEN TO THE PUBLIC

Astronomers See Second Earth in the Making

By Ker Than, Space.com

Astronomers have spotted evidence of a second Earth being built around a distant star 424 light-years away. Using NASA's Spitzer Space Telescope, astronomers have spotted a huge belt of warm dust swirling around a young star called HD 113766 that is just slightly larger than our sun. The dust belt, which scientists suspect is clumping together to form planets, is located in the middle of the star system's terrestrial habitable zone where temperatures are moderate enough to sustain liquid water. Scientists estimate there is enough material in the belt to form a Mars-sized world or larger.

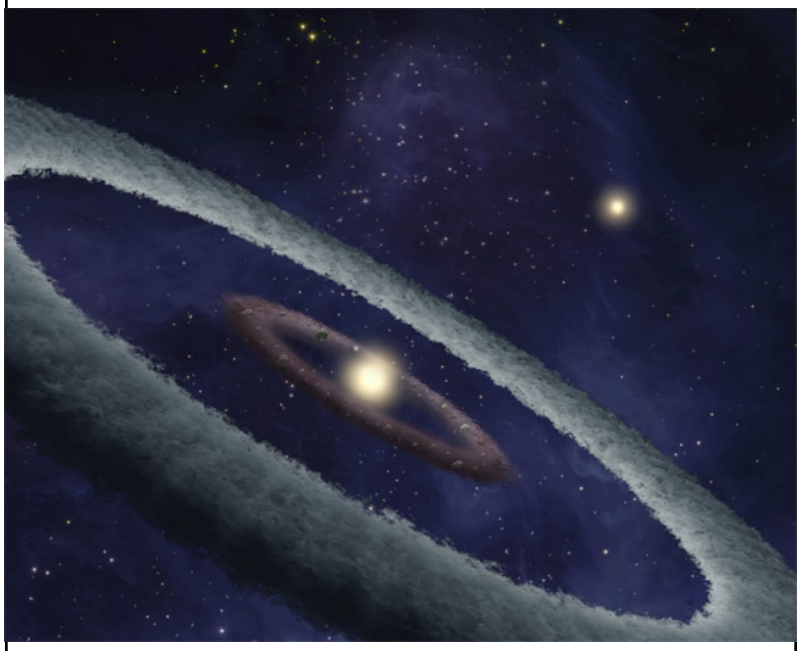
At approximately 10 million years old, the star is just the right age for forming rocky planets, the researchers say. Their finding will be detailed in an upcoming issue of *Astrophysical Journal.* "The timing for this system to be building an Earth is very good," said study team member Carey Lisse of the Johns Hopkins University Applied Physics Laboratory in Baltimore, Md.

If the star system were too young, the planet-forming disk would be full of gas, and it would be making gas-giant planets like Jupiter instead. If it were too old, Spitzer would have spotted rocky planets that had long ago formed. The star system also has the right mix of dusty materials in its disk to form an Earth-like planet, Lisse said.

Using Spitzer's infrared spectrometer instrument, the team determined that the material around HD 113766 is more processed than the snowball-like stuff that makes up infant solar systems and comets, which are considered cosmic "refrigerators" because they contain pristine ingredients from the solar system's formative period. But it is also not as processed as the stuff found in mature planets and asteroids.

"The material mix in this belt is most reminiscent of the stuff found in lava flows on Earth," Lisse said. "I thought of Mauna Kea [in Hawaii] material when I first saw the dust composition in this system – it contains raw rock and it's abundant in iron sulfides, which are similar to fool's gold."

Earlier this year, scientists announced they had found evidence for one, and possibly two, already formed Earth-like planets around Gliese 581, a dim red star located only 20.5 light-years away. The possible planets, called Gliese 581c and Gliese 581d, are located at about the right distance from their star to support liquid water and life as we know it, but many more observations are needed to confirm this.



This artist's conception shows a binary system, called HD 113766, where astronomers suspect a rocky Earth-like planet is forming around one of the stars. Credit: NASA/JPL-Caltech/JHUAPL

To date, planet hunters have discovered more than 250 extrasolar planets, or "exoplanets." Most of the distant worlds, however, are giant gas planets several times the size of Jupiter.

While life is known to exist only on our planet, the range of exoplanet types found so far has astronomers increasingly confident that many worlds in our galaxy could be habitable. Finding Earth-like worlds in habitable zones is a first step toward the technically challenging task of discovering biology outside our solar system.

Extreme Star Cluster Bursts Into Life

HST Press Release — The NASA/ESA Hubble Space Telescope has captured a spectacular image of NGC 3603, a giant nebula hosting one of the most prominent massive young clusters in the Milky Way, thus supplying a prime template for star formation studies

NGC 3603 is a prominent star-forming region located in the Carina spiral arm of the Milky Way, about 20,000 light-years away from our Solar System. This latest image from the NASA/ESA Hubble Space Telescope shows a young star cluster surrounded by a vast region of dust and gas. Most of the bright stars in the image are hot blue stars whose ultraviolet radiation and violent winds have blown out an enormous cavity in the gas and dust enveloping the cluster. The new Hubble image provides a snapshot in time of many stars with differing masses but similar ages inside the young cluster. This allows for detailed analysis of several types of stars at varying stages in their lives. Astronomers can then compare clusters of different ages with one another and determine which properties (such as temperature and brightness) change as the stars get older.

According to astronomer Dr. Jesús Maíz Apellániz from Instituto de Astrofísica de Andalucía, Spain, who is leading the Hubble investigation, the massive star cluster in NGC 3603 appears to gather the most massive stars at its core. He and his team have discovered that the distribution of different types of stars at the centre of this very dense cluster is similar to that of other young star clusters in the Milky Way. The team has also found that the three brightest stars in the centre are apparently misleading us into believing that they are more massive objects than theoretical limits allow. These heavyweight stars may actually consist of two or maybe more individual massive stars whose light has blended together. Even with the resolution of Hubble it is not possible to separate the individual stars in each of the three systems.

This finding agrees with a recent discovery by Dr. Anthony Moffat from the Université de Montréal, Canada, who used ESO's Very Large Telescope and Hubble's infrared NICMOS camera to measure the movements of the individual stars in two of the three systems. Dr. Moffat measured the largest individual mass to be roughly 115 solar masses, which is within the acceptable limits for conventional theory. The swirling nebula of NGC 3603 contains around 400,000 solar masses of gas. Lurking within this vast cloud are a few Bok globules (seen at the top right corner of the image), named after Bart Bok who first observed them in the 1940s. These are dark clouds of dense dust and gas with masses of about ten to fifty times larger than that of the Sun. They resemble insect cocoons and are undergoing gravitational collapse on their way to form new stars. Bok globules appear to be some of the coldest objects in the Universe.

NGC 3603 was first discovered by Sir John Herschel in 1834. It is known to harbour a blue supergiant star called Sher 25 that can be spotted above and left of the densest part of the cluster. This star is believed to be near the point of exploding as a supernova and is often denoted as the Milky Way counterpart of the predecessor of the now famous supernova SN 1987A.

The NASA/ESA Hubble Space Telescope has captured a spectacular image of NGC 3603, a giant nebula hosting one of the most prominent massive young clusters in the Milky Way. (Credit: NASA, ESA and the Hubble Heritage (STScI/AURA)-ESA/Hubble Collaboration)

Scientists 'Weigh' Tiny Galaxy Halfway Across Universe

Science Daily — A tiny galaxy, nearly halfway across the universe, the smallest in size and mass known to exist at that distance, has been identified by an international team of scientists led by two from the University of California, Santa Barbara. The scientists used data collected by NASA's Hubble Space Telescope and the W. M. Keck Observatory in Hawaii. This galaxy is about half the size, and approximately one-tenth the "weight" of the smallest distant galaxies typically observed, and it is 100 times lighter than our own Milky Way.

"Even though this galaxy is more than six billion light years away, the reconstructed image is as sharp as the ordinary ground-based images of the nearest structure of galaxies, the Virgo cluster, which is 100 times closer to us," said lead author Phil Marshall, a postdoctoral fellow at UC Santa Barbara.

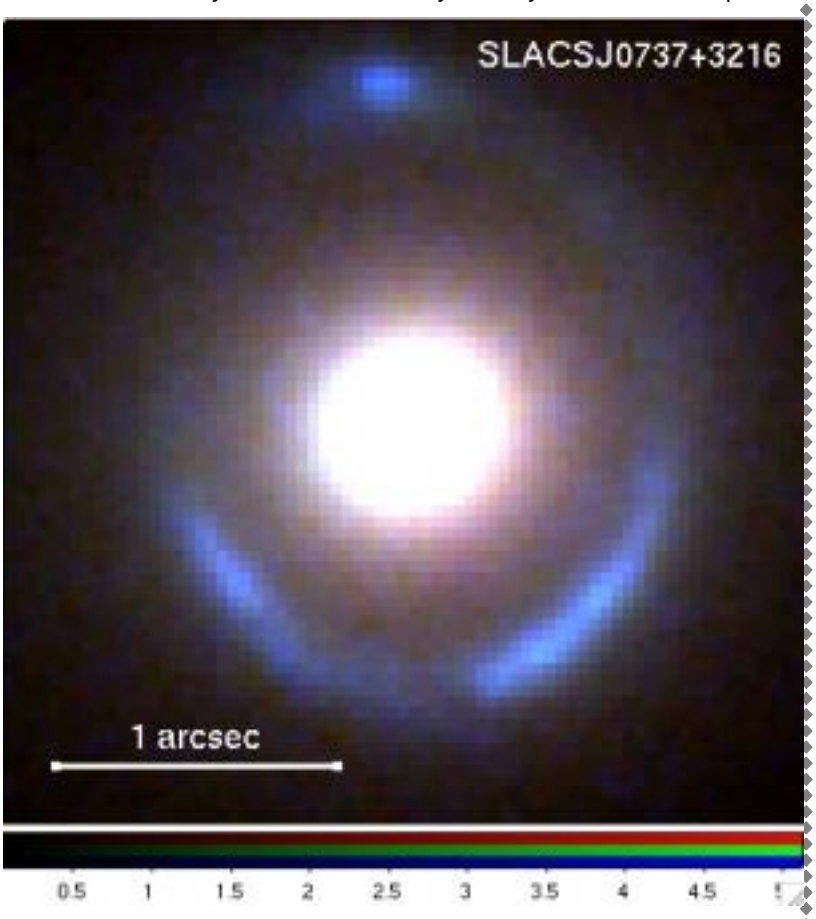
Second author Tommaso Treu, assistant professor of physics at UCSB, explained that the imaging is made possible by the fact that the newly discovered galaxy is positioned behind a massive galaxy, creating an "Einstein ring." The matter distribution in the foreground bends the light rays in much the same way a magnifying glass does. By focusing the light rays, this gravitational lensing effect increases the apparent brightness and size of the background galaxy by more than a factor of 10.

Treu and his colleagues in the Sloan Lens ACS Survey (SLACS) collaboration are at the forefront of the study of Einstein ring gravitational lenses. With gravitational lensing, light from distant galaxies is deflected on its way to Earth by the gravitational field of any massive object that lies in the way. Because the light bends, the galaxy is distorted into an arc or multiple separate images. When both galaxies are exactly lined up, the light forms a bull's-eye pattern, called an Einstein ring, around the foreground galaxy.

The mass estimate for the galaxy, and the inference that many of its stars have only recently formed, is made possible by the combination of optical and near infrared images from the Hubble Space Telescope with longer wavelength images obtained with the Keck Telescope. "If the galaxy is representative of a larger population, it could be one of the building blocks of today's spiral galaxies, or perhaps a progenitor of modern dwarf galaxies," said Treu. "It does look remarkably similar to the smallest galaxies in the Virgo cluster, but is almost half the way across the universe."

Another key aspect of the research is the use of "laser guide star adaptive optics." Adaptive optics systems use bright stars in the field of view to measure the Earth's atmospheric blurring and correct for it in real time. This technique relies on having a bright star in the image as well, so it is limited to a small fraction of the night sky.

The laser guide star adaptive optics system in place at the Keck Telescope uses a powerful laser to illuminate the layer of sodium atoms that exist in the Earth's atmosphere, explained Jason Melbourne, a team member from the Center for Adaptive Optics at the University of California, Santa Cruz. The laser image acts as an artificial star, bright enough to perform adaptive optics correction at an arbitrary position in the sky, thus enabling much sharper imaging over most of the sky.



Color composite image of the gravitational lens system, made from Hubble (blue and green) and Keck (red) data. The blue ring is the tiny background galaxy, stretched by the gravitational pull of the foreground lens galaxy at the center of the image. (Credit: Marshall & Treu (UCSB))

Muddying the Water? Orbiter drains confidence from fluid story of Mars

Ron Cowen, Science News

Evidence for liquid water on some parts of Mars—now or in the past—looks leakier than researchers had supposed, according to an analysis of the sharpest images ever taken of the Red Planet from orbit. But in other places, the new images bolster the case that water once flowed.

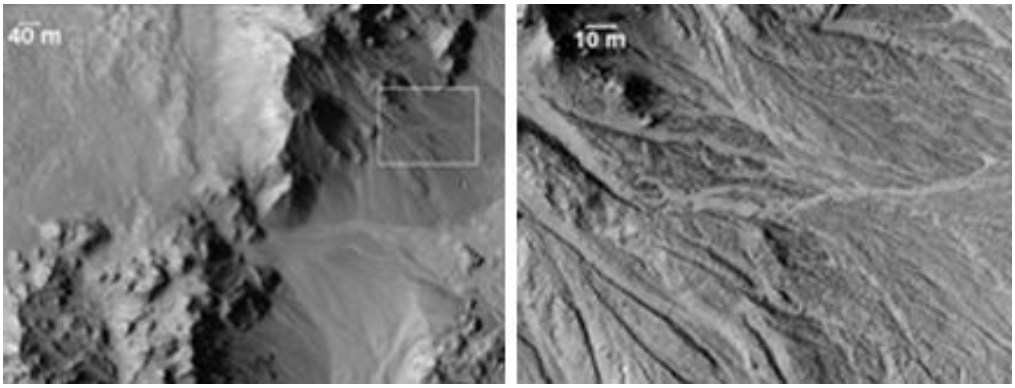
High-resolution pictures and infrared spectra recorded by NASA's Mars Reconnaissance Orbiter (MRO) indicate that fresh, bright streaks on two steep gullies don't signify a recent flow of water, as scientists suggested just a year ago. MRO's instruments neither detected minerals that might have been left behind as salty groundwater evaporated from those regions nor found changes in the shapes of the deposits since the gullies were last imaged 15 months ago. Such changes could have occurred if the bright deposits were frost created by an underground supply of water rushing to the frigid surface in recent years or months.

Instead, the deposits on the steep gullies could just as easily have been formed by landslides of dry, sandy material, assert Alfred McEwen of the University of Arizona in Tucson and his colleagues in one of five reports of MRO findings in the Sept. 21 *Science*. Other gullies, however, whose slopes are too shallow to permit landslides, do offer clear evidence of watery flows. These flows might have occurred several million years ago, when the Martian climate was warmer.

McEwen, Windy Jaeger of the U.S. Geological Survey in Flagstaff, Ariz., and their collaborators reexamined a 300-kilometer-long system of channels called Athabasca Valles, which in lower-resolution images taken by previous spacecraft showed some resemblance to a frozen sea. Although not ruling out water might have carved the system, the new images suggest that the structure is more likely a remnant of a "once-swollen river of lava," the researchers say in another of the five reports.

Theorists have invoked the presence of liquid water for "nearly every imaginable time and place on Mars," notes McEwen. But the interpretation of planetary features "can completely change with better observations," he adds.

Although the MRO images cover only 0.2 percent of the Martian surface, they reveal features as small as 50 centimeters across, about 10 times the resolution of previous satellite images. MRO reached Mars last year and is now recording a terabyte of data a week—more than many missions do during their entire lives.



WATERING HOLE? Photo of Mars' 60-kilometer-wide Mojave crater (left) shows pale, fan-shaped streaks and channels (detailed at right). The features suggest that water flowed in the region after an impactor struck an icy crust. NASA

Elsewhere on the Red Planet, McEwen notes, water might have played a more important role than had been indicated. The MRO camera reveals branched channels and fan-like deposits adjacent to several large craters. The channels and deposits suggest the flow of water, perhaps when meteoroids slammed into an ice-rich crust, McEwen suggests.

As well as excavating craters, the impacts would have created transient, wet microenvironments in which liquid water sculpted the channels and left behind the deposits, he says. Images of the features support the hypothesis that ancient Mars had sporadic episodes of warm, wet weather at specific sites but not a warm, planetwide climate for long periods. Some scientists in the past may have been too quick to jump on the bandwagon for a wet Mars, comments Philip Christensen of Arizona State University in Tempe. The new findings add to the evidence that the planet had liquid water "only for brief periods" during an otherwise cold and dry history, he says.

Celestial Mechanic OCTOBER 2007

AAL

Astronomy Associates of Lawrence

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