Calendar of Events

LOCAL PUBLIC OBSERVING
Prairie Park Nature Center

Spring Schedule
Sunday January 31
8:00 PM—9:30 PM
Sunday February 28
8:00 PM—9:30 PM
Sunday March 28
8:30 PM—10:00 PM
Sunday April 25
8:30 PM—10:00 PM

President:
Rick Heschmeyer
rcjbm@sbcglobal.net
Treasurer:
Dr. Steve Shawl
Shawl@ku.edu
University Advisor:
Dr. Bruce Twarog
btwarog@ku.edu
Webmaster:
Gary Webber
gwebber@ku.edu
Observing Clubs
Doug Fay
dfay@ku.edu

Report from the Officers:
The December meeting went well with an entertaining presentation by Dr. Anthony-Twarog about the twenty-year history of the Great Observatories program of NASA, as well as a number of smaller but equally important specialized missions, including the recently launched WISE mission. The December celebration included distribution of ten door prizes including two HST calendars and eight astronomically-related books. Our next public event is the first observing session of the new year, scheduled for Sunday, Jan. 31. Hopefully the weather will warm up a little by then and the skies will clear.

Please look over the tentative schedule for the Spring semester and try to help out if you can. There are occasionally new telescope owners after the holidays who could use a little help figuring out how their equipment works and the public sessions in the Spring offer a good chance to get some expert advice.

From the Astronomical League (all AAL members are members): The Astronomical League is very pleased to sponsor a new website, http://ya.astroleague.org.
The website is managed and edited by a very competent team of a half

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Experiment detects particles of dark matter, maybe
Science News

Analyzing results of an experiment in a northern Minnesota mine, physicists report the possible detection of particles of dark matter — the proposed invisible material believed to account for about 80 percent of the mass of the universe. The physicists caution, however, that there’s about a one in four chance that ordinary subatomic particles, rather than dark matter, could account for the signals.

The experiment, called the Cryogenic Dark Matter Search, relies on 30 detectors made of germanium and silicon crystals cooled to just above absolute zero. The detectors record tiny vibrations imparted by a proposed type of dark matter called weakly interacting massive particles, or WIMPs. WIMPs streaming in from space would very rarely jostle the germanium nuclei, some 800 meters underground in the Soudan mine, generating a tiny amount of heat and slightly altering the charge on the detectors in a characteristic pattern.

(Continued on page 2)
dozen teenage amateur astronomers. The idea is that these young astro editors will be able decide the variety of articles that will be of interest to those of their own demographic. We are confident that they will succeed in sparking an interest in astronomy and science in many younger people.

The Astronomy Associates of Lawrence now has a page on Facebook. Simply search facebook (http://www.facebook.com) for "astronomy associates". Watch the page for announcements, invitations for upcoming events, and weather updates. Finally, your dues notice should be in the mail soon. As you know, we collect it once per year. If you don’t receive the notice, it means that you are paid up for 2010.

If anyone has any ideas, suggestions, or input on how we can make the club better, please contact Rick (rcjbm@sbcglobal.net).

In new analyses of data recorded in 2007 and 2008, researchers identified two events that might be attributed to WIMPs. Two members of the team, Jodi Cooley of Southern Methodist University in Dallas and Lauren Hsu of the Fermi National Accelerator Laboratory in Batavia, Ill., reported the findings December 17 during separate presentations. Cooley spoke at the SLAC National Accelerator Laboratory in Menlo Park, Calif., while Hsu spoke at Fermilab.

The detection is far from definitive, because radioactive decay of ordinary material in the mine could be responsible for about 0.8 events, on average, during the same time period, the CDMS physicists calculate. Because of statistical fluctuations in the estimated rate of background events, there is a 23 percent chance that ordinary particles could have been responsible for both events attributed to WIMPs, Hsu says. Physicists typically require a much lower chance that a signal is spurious before regarding a result as conclusive.

“aration cannot be interpreted as evidence for WIMP interactions but we also cannot reject on an individual basis either of these events as [a real dark matter] signal,” Hsu said during her talk.

But even now, the findings are “potentially very exciting,” says theorist Craig Hogan of the University of Chicago and Fermilab, who is not on the CDMS team. He adds that he is impressed with how precisely the CDMS researchers have calibrated the expected background of ordinary particles in the experiment.

Three or four more WIMP-like interactions recorded over the next few years by the experiment, now being upgraded with detectors containing three times as much germanium, would constitute proof of dark matter, Hogan says.

“That would be a huge transformation in how we do science,” he notes. “We would have a new form of matter to study.”

The late astronomer Fritz Zwicky first proposed the existence of dark matter in the 1930s when he calculated that the amount of ordinary matter in the Coma cluster of galaxies wasn’t enough to keep the cluster from flying apart. Additional, unseen material could provide the extra gravitational tug, he suggested. Since the 1970s astronomers have accumulated further evidence that the Milky Way and other galaxies are bathed in dark matter.

“We’ve seen evidence from many parts of the universe that dark matter is out there,” Hsu said.

Depending on the exact nature of dark matter, it could unify the subatomic world with the cosmic canvas. While astronomers need dark matter to explain the growth and motions of galaxies, particle physicists who subscribe to a theory called supersym-
Keck Telescopes Gaze Into Young Star's 'Life Zone'

Science Daily

The inner regions of young planet-forming disks offer information about how worlds like Earth form, but not a single telescope in the world can see them. Yet, for the first time, astronomers using the W. M. Keck Observatory in Hawaii have measured the properties of a young solar system at distances closer to the star than Venus is from our sun.

"When it comes to building rocky planets like our own, the innermost part of the disk is where the action is," said team member William Danchi at NASA's Goddard Space Flight Center in Greenbelt, Md. Planets forming in a star's inner disk may orbit within its "habitable zone," where conditions could potentially support the development of life.

To achieve the feat, the team used the Keck Interferometer to combine infrared light gathered by both of the observatory's twin 10-meter telescopes, which are separated by 85 meters. The double-barreled approach gives astronomers the effective resolution of a single 85-meter telescope -- several times larger than any now planned.

"Nothing else in the world provides us with the types of measurements the Keck Interferometer does," said Wesley Traub at Caltech's Jet Propulsion Laboratory in Pasadena, Calif. "In effect, it's a zoom lens for the Keck telescopes."

In August 2008, the team -- led by Sam Ragland of Keck Observatory and including astronomers from the California Institute of Technology and the National Optical Astronomical Observatory -- observed a Young Stellar Object (YSO) known as MWC 419. The blue, B-type star has several times the sun's mass and lies about 2,100 light-years away in the constellation Cassiopeia. With an age less than ten million years, MWC 419 ranks as a stellar kindergartener.

The team also employed a new near-infrared camera designed to image wavelengths in the so-called L band from 3.5 to 4.1 micrometers. "This unique infrared capability adds a new dimension to the Keck Interferometer in probing the density and temperature of planet-forming regions around YSO disks. This wavelength region is relatively unexplored," Ragland explained. "Basically, anything we see through this camera is brand new information."

The increased ability to observe fine detail, coupled with the new camera, let the team measure temperatures in the planet-forming disk to within about 50 million miles of the star. "That's about half of Earth's distance from the sun, and well within the orbit of Venus," Danchi said.

The team reported temperature measurements of dust at various regions throughout MWC 419's inner disk in the Sept. 20 issue of The Astrophysical Journal. Temperature differences help shed light on the inner disk's detailed structure and may indicate that its dust has different chemical compositions and physical properties, factors that may play a role in the types of planets that form. For example, conditions in our solar system favored the formation of rocky worlds from Mars sunward, whereas gas giants and icy moons assembled farther out.

In turn, the astronomers note, the size of the young star might affect the composition and physical characteristics of its dust disk. The team is continuing to use the Keck Interferometer in a larger program to observe planet-forming disks around sun-like stars.

The Keck Interferometer was developed by the Jet Propulsion Laboratory and the W.M. Keck Observatory. It is managed by the W.M. Keck Observatory, which operates two 10-meter optical/infrared telescopes on the summit of Mauna Kea on the island of Hawaii and is a scientific partnership of the California Institute of Technology, the University of California and NASA. NASA's Exoplanet Science Institute manages time allocation on the telescope for NASA.
In December 2006, an enormous solar flare erupted on the Sun's surface. The blast hurled a billion-ton cloud of gas (a coronal mass ejection, or CME) toward Earth and sparked days of intense geomagnetic activity with Northern Lights appearing across much of the United States. While sky watchers enjoyed the show from Earth's surface, something ironic was happening in Earth orbit.

At the onset of the storm, the solar flare unleashed an intense pulse of X-rays. The flash blinded the Solar X-Ray Imager (SXI) on NOAA's GOES-13 satellite, damaging several rows of pixels. SXI was designed to monitor solar flares, but it must also be able to protect itself in extreme cases. That's why NASA engineers gave the newest Geostationary Operational Environmental Satellite a new set of sophisticated "sunglasses." The new GOES-14 launched June 27 and reached geosynchronous orbit July 8. Its "sunglasses" are a new flight-software package that will enable the SXI sensor to observe even intense solar flares safely. Radiation from these largest flares can endanger military and civilian communications satellites, threaten astronauts in orbit, and even knock out cities' power grids. SXI serves as an early warning system for these flares and helps scientists better understand what causes them.

"We wanted to protect the sensor from overexposure, but we didn’t want to shield it so much that it couldn’t gather data when a flare is occurring,” says Cynthia Tanner, SXI instrument systems manager for the GOES-NOP series at NASA’s Goddard Space Flight Center in Greenbelt, Maryland. (GOES-14 was called GOES-O before achieving orbit).

Shielding the sensor from X-rays also reduces the amount of data it can gather about the flare. It’s like stargazing with dark sunglasses on. So NASA engineers must strike a balance between protecting the sensor and gathering useful data. When a dangerous flare occurs, the new SXI sensor can protect itself with five levels of gradually “darker” sunglasses. Each level is a combination of filters and exposure times carefully calibrated to control the sensor’s exposure to harmful high-energy X-rays.

As the blast of X-rays from a major solar flare swells, GOES-14 can step up the protection for SXI through these five levels. The damaged sensor on GOES-13 had only two levels of protection—low and high. Rather than gradually increasing the amount of protection, the older sensor would remain at the low level of protection, switching to the high level only when the X-ray dose was very high.

“You can collect more science while you’re going up through the levels of protection,” Tanner says. “We’ve really fine-tuned it.” Forecasters anticipate a new solar maximum in 2012-2013, with plenty of sunspots and even more solar flares. “GOES-14 is ready,” says Tanner.

For a great kid-level explanation of solar "indigestion" and space weather, check out spaceplace.nasa.gov/en/kids/goes/spaceweather.
Mark your calendar NOW!
June 4 - 6, 2010
Mid States Region Meeting
hosted by the Prairie Astronomy Club
in Lincoln, NE

Watch our website for more details
priarieastronomyclub.org
or visit us on Facebook
Prairie Astronomy Club
P.O. Box 5585
Lincoln, NE 68505-5585

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**NASA Flight Tests Unique Jumbo Jet; Plane’s Airborne Telescope Will Be Used to Unlock Secrets of the Cosmos**

NASA PRESS RELEASE

A NASA jumbo jet that will help scientists unlock the origins of the universe with infrared observations reached a milestone Friday when doors covering the plane’s telescope were fully opened in flight.

The Stratospheric Observatory for Infrared Astronomy, a modified 747 jet known as SOFIA, flew for one hour and 19 minutes, which included two minutes with the telescope’s doors fully opened. The goal was to allow engineers to understand how air flows in and around the telescope. It was the first time outside air has interacted with the part of the plane that carries the 98-inch infrared telescope.

"Today we opened the telescope cavity door, the first time we have fully exposed the telescope and the largest cavity ever flown while in flight," said Bob Meyer, SOFIA program manager at NASA’s Dryden Flight Research Center in Edwards, Calif. "This is a significant step toward certifying NASA’s next great observatory for future study of the universe."

Besides these test flights of the airplane, two flights to operate and verify the scientific capabilities of the telescope assembly are planned for spring 2010. Telescope systems such as the vibration isolation system, the inertial stabilization system and the pointing control system will be tested during daytime flights.

These flights will prepare the telescope assembly for the first flight with the telescope operating. That first flight will be the initial opportunity scientists have to use the telescope and begin the process of quantifying its performance to prepare for SOFIA’s planned 20-year science program.

SOFIA is a joint venture of NASA and the German Aerospace Center. NASA supplied the aircraft. The telescope was built in Germany.
At a very early age, children learn how to classify objects according to their shape. Now, new research suggests studying the shape of the aftermath of supernovas may allow astronomers to do the same.

A new study of images from NASA's Chandra X-ray Observatory on supernova remnants - the debris from exploded stars - shows that the symmetry of the remnants, or lack thereof, reveals how the star exploded. This is an important discovery because it shows that the remnants retain information about how the star exploded even though hundreds or thousands of years have passed.

"It's almost like the supernova remnants have a 'memory' of the original explosion," said Laura Lopez of the University of California at Santa Cruz, who led the study. "This is the first time anyone has systematically compared the shape of these remnants in X-rays in this way."

Astronomers sort supernovas into several categories, or "types", based on properties observed days after the explosion and which reflect very different physical mechanisms that cause stars to explode. But, since observed remnants of supernovas are leftover from explosions that occurred long ago, other methods are needed to accurately classify the original supernovas.

Lopez and colleagues focused on the relatively young supernova remnants that exhibited strong X-ray emission from silicon ejected by the explosion so as to rule out the effects of interstellar matter surrounding the explosion. Their analysis showed that the X-ray images of the ejecta can be used to identify the way the star exploded. The team studied 17 supernova remnants both in the Milky Way galaxy and a neighboring galaxy, the Large Magellanic Cloud.

For each of these remnants there is independent information about the type of supernova involved, based not on the shape of the remnant but, for example, on the elements observed in it. The researchers found that one type of supernova explosion - the so-called Type Ia - left behind relatively symmetric, circular remnants. This type of supernova is thought to be caused by a thermonuclear explosion of a white dwarf, and is often used by astronomers as "standard candles" for measuring cosmic distances. On the other hand, the remnants tied to the "core-collapse" supernova explosions were distinctly more asymmetric. This type of supernova occurs when a very massive, young star collapses onto itself and then explodes.

"If we can link supernova remnants with the type of explosion", said co-author Enrico Ramirez-Ruiz, also of University of California, Santa Cruz, "then we can use that information in theoretical models to really help us nail down the details of how the supernovas went off." Models of core-collapse supernovas must include a way to reproduce the asymmetries measured in this work and models of Type Ia supernovas must produce the symmetric, circular remnants that have been observed.

These two supernova remnants are part of a new study from NASA's Chandra X-ray Observatory that shows how the shape of the remnant is connected to the way the progenitor star exploded.
Fermi Sees Brightest-Ever Blazar Flare—Fermi Press Release

A galaxy located billions of light-years away is commanding the attention of NASA's Fermi Gamma-ray Space Telescope and astronomers around the globe. Thanks to a series of flares that began September 15, the galaxy is now the brightest source in the gamma-ray sky -- more than ten times brighter than it was in the summer.

Astronomers identify the object as 3C 454.3, an active galaxy located 7.2 billion light-years away in the constellation Pegasus. But even among active galaxies, it's exceptional.

"We're looking right down the barrel of a particle jet powered by the galaxy's supermassive black hole," said Gino Tosti at the National Institute of Nuclear Physics in Perugia, Italy. "Some change within that jet -- we don't know what -- is likely responsible for these flares."

Blazars, like many active galaxies, emit oppositely directed jets of particles traveling near the speed of light when matter falls toward their central supermassive black holes. What makes a blazar so bright in gamma rays is its orientation: One of the jets happens to be aimed straight at us.

Most of the time, the brightest persistent source in the gamma-ray sky is the Vela pulsar, which at a distance of about 1,000 light-years lies practically next door.

"3C 454.3 is millions of times farther away, yet the current flare makes it twice as bright as Vela," said Lise Escande at the Center for Nuclear Studies in Gradignan, near Bordeaux, France. "That represents an incredible energy release, and one the source can't sustain for very long."

According to Massimo Villata at Italy's Torino Observatory, 3C 454.3 also is flaring at radio and visible wavelengths, if less dramatically. "In red light, the blazar brightened by more than two and a half times to magnitude 13.7, and it is also very bright at high radio frequencies."

The Fermi team is alerting astronomers to monitor the event over as broad a range of wavelengths as possible. "That's our best bet for understanding what's going on inside that jet," Tosti said.
Hubble’s Festive View of a Grand Star-Forming Region

Just in time for the holidays: a Hubble Space Telescope picture postcard of hundreds of brilliant blue stars wreathed by warm, glowing clouds. The festive portrait is the most detailed view of the largest stellar nursery in our local galactic neighborhood. The massive, young stellar grouping, called R136, is only a few million years old and resides in the 30 Doradus Nebula, a turbulent star-birth region in the Large Magellanic Cloud (LMC), a satellite galaxy of our Milky Way. There is no known star-forming region in our galaxy as large or as prolific as 30 Doradus. Many of the diamond-like icy blue stars are among the most massive stars known. Several of them are over 100 times more massive than our Sun. These hefty stars are destined to pop off, like a string of firecrackers, as supernovas in a few million years.

The image, taken in ultraviolet, visible, and red light by Hubble’s Wide Field Camera 3, spans about 100 light-years. The nebula is close enough to Earth that Hubble can resolve individual stars, giving astronomers important information about the birth and evolution of stars in the universe. The Hubble observations were taken Oct. 20-27, 2009. The blue color is light from the hottest, most massive stars; the green from the glow of oxygen; and the red from fluorescing hydrogen.
Hubble Finds Smallest Kuiper Belt Object Ever Seen

NASA's Hubble Space Telescope has discovered the smallest object ever seen in visible light in the Kuiper Belt, a vast ring of icy debris that is encircling the outer rim of the solar system just beyond Neptune.

The needle-in-a-haystack object found by Hubble is only 3,200 feet across and a whopping 4.2 billion miles away. The smallest Kuiper Belt Object (KBO) seen previously in reflected light is roughly 30 miles across, or 50 times larger.

This is the first observational evidence for a population of comet-sized bodies in the Kuiper Belt that are being ground down through collisions. The Kuiper Belt is therefore collisionally evolving, meaning that the region's icy content has been modified over the past 4.5 billion years.

The object detected by Hubble is so faint — at 35th magnitude — it is 100 times dimmer than what Hubble can see directly.

So then how did the space telescope uncover such a small body?

In a paper published in the December 17th issue of the journal Nature, Hilke Schlichting of the California Institute of Technology in Pasadena, Calif., and her collaborators are reporting that the telltale signature of the small vagabond was extracted from Hubble's pointing data, not by direct imaging.

Hubble has three optical instruments called Fine Guidance Sensors (FGS). The FGSs provide high-precision navigational information to the space observatory's attitude control systems by looking at select guide stars for pointing. The sensors exploit the wavelike nature of light to make precise measurement of the location of stars.

Schlichting and her co-investigators determined that the FGS instruments are so good that they can see the effects of a small object passing in front of a star. This would cause a brief occultation and diffraction signature in the FGS data as the light from the background guide star was bent around the intervening foreground KBO.

They selected 4.5 years of FGS observations for analysis. Hubble spent a total of 12,000 hours during this period looking along a strip of sky within 20 degrees of the solar system's ecliptic plane, where the majority of KBOs should dwell. The team analyzed the FGS observations of 50,000 guide stars in total.

Scouring the huge database, Schlichting and her team found a single 0.3-second-long occultation event. This was only possible because the FGS instruments sample changes in starlight 40 times a second. The duration of the occultation was short largely because of the Earth's orbital motion around the Sun.

They assumed the KBO was in a circular orbit and inclined 14 degrees to the ecliptic. The KBO's distance was estimated from the duration of the occultation, and the amount of dimming was used to calculate the size of the object. "I was very thrilled to find this in the data," says Schlichting.

Hubble observations of nearby stars show that a number of them have Kuiper Belt–like disks of icy debris encircling them. These disks are the remnants of planetary formation. The prediction is that over billions of years the debris should collide, grinding the KBO-type objects down to ever smaller pieces that were not part of the original Kuiper Belt population.

The finding is a powerful illustration of the capability of archived Hubble data to produce important new discoveries. In an effort to uncover additional small KBOs, the team plans to analyze the remaining FGS data for nearly the full duration of Hubble operations since its launch in 1990.
Finding compelling evidence for the dark stuff, Hogan says, is other technologies to look for dark matter continue to blossom. “I think we’ll see more such announcements of possible dark matter detections in the next few years,” says Hogan.

Other dark matter experiments, such as the Chicago-based Observatories for Underground Particle Physics, which uses evidence for dark matter particles.

In addition, several orbiting telescopes, including the Fermi Gamma-ray Space Telescope, are indirectly searching for dark matter by examining regions, such as the center of the Milky Way, where the invisible material is suspected to be densest. An excess number of gamma-rays or of pairs of particles and antiparticles in such regions might be produced when two WIMP’s collide and annihilate each other.