COMING EVENTS
Public Observing
Sunday September 30
Prairie Park Nature Center
9:00 PM
Monthly Meeting
Friday Sept. 14
7:30 PM, 2001 Malott

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Of Local Interest - HST Discovers Fifth Moon for Pluto
A team of astronomers using NASA's Hubble Space Telescope is reporting the discovery of another moon orbiting the icy dwarf planet Pluto. The moon is estimated to be irregular in shape and 6 to 15 miles across. It is in a 58,000-mile-diameter circular orbit around Pluto that is assumed to be co-planar with the other satellites in the system.

"The moons form a series of neatly nested orbits, a bit like Russian dolls," said team lead Mark Showalter of the SETI Institute in Mountain View, Calif.

The discovery increases the number of known moons orbiting Pluto to five.

The Pluto team is intrigued that such a small planet can have such a complex collection of satellites. The new discovery provides additional clues for unraveling how the Pluto system formed and evolved. The favored theory is that all the moons are relics of a collision between Pluto and another large Kuiper belt object billions of years ago.

The new detection will help scientists navigate NASA's New Horizons spacecraft through the Pluto system in 2015, when it makes an historic and long-awaited high-speed flyby of the distant world.

The team is using Hubble's powerful vision to scour the Pluto system to uncover potential hazards to the New Horizons spacecraft. Moving past the dwarf planet at a speed of 30,000 miles per hour, New Horizons could be destroyed in a collision with...
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 at the Prairie Park Nature Center. Periodic star parties are scheduled as well. For more information, please contact the club officers: president, Rick Heschmeyer at rcjbm@sbcglobal.net; webmaster, Howard Edin, at howard@howardedin.com; AlCor William Winkler, at billwink10@yahoo.com; or faculty advisor, Prof. Bruce Twarog at btwarog@ku.edu. 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://groups.ku.edu/~astronomy

Copies of the Celestial Mechanic can also be found on the web at http://groups.ku.edu/~astronomy/celestialmechanic
A Different View of the Flame Nebula

The Flame Nebula sits on the eastern hip of Orion the Hunter, a constellation most easily visible in the northern hemisphere during winter evenings. This view of the Flame nebula from WISE, NASA’s Wide-field Infrared Survey Explorer, shows an expanded view over one previously released of this enormous space cloud. The previous image was made from data WISE collected after its coolant began to run out, when only three of WISE’s infrared bands were in operation. The flame nebula is a very infrared-bright region, and the reduced sensitivity during the 3-band phase of the WISE mission worked to the advantage of astronomers interested in studying the brightest parts of this region without so much glare.

This new image includes more data collected from all of WISE’s four infrared bands. This view takes in a vast cloud of gas and dust where new stars are being born. Three familiar nebulae are visible in the central region: the Flame nebula, the Horsehead nebula, and NGC 2023. The Flame is the brightest and largest in the image. It is being lit up by a star inside it that is 20 times the mass of the sun and would be as bright to our eyes as the other stars in Orion’s belt if it weren’t for all the surrounding dust, which makes it appear 4 billion times dimmer than it really is.

NGC 2023 is the bright knot below the Flame. The famous Horsehead nebula is visible poking out of the edge of the cloud, just to the right of NGC 2023 and down a touch. It takes on a very different view in infrared compared to visible light. In visible light, the horse’s head is a silhouetted dark cloud in front of glowing gas. But here, we see the dust in that dark cloud glowing in infrared light.

Two of the three stars in Orion’s belt are visible in this image, but despite their prominence to our eyes in the night sky, they are somewhat unremarkable as seen by WISE. Alnitak, the far left star in Orion’s belt, is a multiple blue-giant star system located 736 light-years away. In this image, it is located just to the right of the central part of the Flame nebula. Alnilam, the middle star of Orion’s belt, is a variable blue supergiant, located 1,980 light-years away. Despite having a radius 24 times bigger than the sun, and luminosity 275,000 times greater than the sun, it only appears as a moderately bright star near the upper right corner of this image.

(Continued on page 8)
A Visit to the Astronomical League National Convention: July 4--7, 2012
William Winkler, AAL “ALCOR”

For the first time in many years I attended a national Astronomical League convention, this one held at the Mariott Lincolnshire Resort, 18 miles north of Chicago. On Wednesday, Thursday, and Friday, general presentations were held in the morning, beginning at 8:30. Small group specialized workshops were held in the afternoons, and business meetings were also held. These included national membership organizations such as AL, ALPO and AAVSO. In the evenings groups of people who knew each other met informally and went out to dinner. Saturday had presentations all day and an evening banquet.

Temperatures were above 100°F every afternoon.

I attended mainly for the afternoon trips. Each included air-conditioned buses, a box lunch, and a talk by someone familiar with the area as we traveled. Trips concluded after 8 PM each evening. We went to places where we would likely see more, and more conveniently, than going on our own. Three Greyhound-type coaches were filled with 150 people.

Wednesday we attended the Adler Planetarium, where they have a state-of-the-art digital astronomy projector. There were two lectures, one on the physics of Solar System formation and the other a star show with background music composed by a local. It is an open question as to which is better, the newest Zeiss or full digital technology. Outside is a spectacular working sundial sculpture. A trip to the Marshall Field Science Museum followed; there was time to examine only a portion of the many well-done exhibits. I was reminded that if you want to really see a museum, visit it alone.

Thursday we traveled to the Fermilab “proton smasher,” west of Chicago. We walked some of the underground tunnels of the recently closed Tevatron with a guide and had grand views from the 15th story of its main building. There was an excellent lecture on the physics of star formation. There was early news of the possible discovery of the Higgs Boson at Fermilab’s competitor, CERN. Then we headed to Lake Michigan for a sunset sail on the 4-masted WINDY schooner with a pizza dinner on the open decks. The sails were raised and lowered and passengers could help, but most of propulsion came from a silent engine. The Captain regaled us with sea legends and sea shanties as the nighttime skyline of Chicago loomed.

On Friday we took a long bus trip to Yerkes Observatory near the small town of Williams Bay, Wisconsin, primarily a lake resort area in summer. Knowledgeable docents guided us, some of whom are retired professional staff. We sat under the huge dome and the huge 40-inch refractor built in 1897. My understanding is that the refractor is no longer in active use and needs funding sources for maintenance, but that the two 40-inch reflectors are in operation. For people familiar with the history of astronomy, the place just drips with history, and the Hindu India-like architecture is an art treat in itself. We were shown priceless artifacts of long-ago observational research. Some serious ALPO planetary observers are hoping to make observations with the 40-inch refractor, but this will be difficult to arrange. The good news about Yerkes is that it will not be surrounded by a housing development and the area is nearly as pristine as ever. It now has an effective public outreach program supported by both the Williams Bay high school students and the University of Chicago owners, 100 miles away. It seems that the UC astronomy club is about the size of AAL. We spoke to a number of students wearing Yerkes Observatory T-shirts. Next, we headed to nearby Williams Bay High School, where faculty demonstrated hands-on science-teaching techniques for various disabilities. I enjoyed comparing this quite new but smallish building with those of LHS and Free State. Friday evening finished with an informal supper outdoors at the Ravenna Music Festival, the summer home of the Chicago Symphony, I believe. I think that it was The Emerson String Quartet that was playing in the background. We did not stay for late evening amateur telescope observing.

The convention had its bumps but was well run and well worth the time and expense of attendance. We appreciate the fine efforts of the many volunteers that made it possible. Notably all of the trip lectures were aimed at experienced amateurs.
ESO Telescopes Find Most Stellar Heavyweights Don't Live Alone

A new study using the European Southern Observatory’s (ESO) Very Large Telescope (VLT) has shown that most very bright high-mass stars, which drive the evolution of galaxies, do not live alone. Almost three-quarters of these stars are found to have a close companion star, far more than previously thought. Surprisingly most of these pairs are also experiencing disruptive interactions, such as mass transfer from one star to the other, and about one-third are even expected to ultimately merge to form a single star. The results are published in the July 27 issue of the journal Science.

The universe is a diverse place, and many stars are quite unlike the Sun. An international team has used the VLT to study what are known as O-type stars, which have very high temperature, mass, and brightness. These stars have short and violent lives and play a key role in the evolution of galaxies. They are also linked to extreme phenomena such as gamma-ray bursts and “vampire stars,” where a smaller companion star sucks matter off the surface of its larger neighbor.

“These stars are absolute behemoths,” said Hugues Sana (University of Amsterdam, The Netherlands), the lead author of the study. “They have 15 or more times the mass of our Sun and can be up to a million times brighter. These stars are so hot that they shine with a brilliant blue-white light and have surface temperatures over 54,000 degrees Fahrenheit.”

The astronomers studied a sample of 71 O-type single stars and stars in pairs (binaries) in six nearby young star clusters in the Milky Way. Most of the observations in their study were obtained using ESO telescopes, including the VLT.

By analyzing the light coming from these targets in greater detail than before, the team discovered that 75 percent of all O-type stars exist inside binary systems, a higher proportion than previously thought, and the first precise determination of this number. More importantly, though, they found that the proportion of these pairs that are close enough to interact (through stellar mergers or transfer of mass by so-called vampire stars) is far higher than anyone had thought, which has profound implications for our understanding of galaxy evolution.

O-type stars make up just a fraction of a percent of the stars in the universe, but the violent phenomena associated with them mean they have a disproportionate effect on their surroundings. The winds and shocks coming from these stars can both trigger and stop star formation, their radiation powers the glow of bright nebulae, their supernovae enrich galaxies with the heavy elements crucial for life, and they are associated with gamma-ray bursts, which are among the most energetic phenomena in the universe. O-type stars are therefore implicated in many of the mechanisms that drive the evolution of galaxies.

“The life of a star is greatly affected if it exists alongside another star,” said Selma de Mink of the Space Telescope Science Institute, in Baltimore, Md., a co-author of the study. “If two stars orbit very close to each other they may eventually merge. But even if they don't, one star will often pull matter off the surface of its neighbor.”
Spitzer Finds Possible Exoplanet Smaller than Earth

Astronomers using NASA's Spitzer Space Telescope have detected what they believe is a planet two-thirds the size of Earth. The exoplanet candidate, called UCF-1.01, is located a mere 33 light-years away, making it possibly the nearest world to our solar system that is smaller than our home planet.

Exoplanets circle stars beyond our sun. Only a handful smaller than Earth have been found so far. Spitzer has performed transit studies on known exoplanets, but UCF-1.01 is the first ever identified with the space telescope, pointing to a possible role for Spitzer in helping discover potentially habitable, terrestrial-sized worlds.

"We have found strong evidence for a very small, very hot and very near planet with the help of the Spitzer Space Telescope," said Kevin Stevenson from the University of Central Florida in Orlando. Stevenson is lead author of the paper, which has been accepted for publication in The Astrophysical Journal. "Identifying nearby small planets such as UCF-1.01 may one day lead to their characterization using future instruments."

The hot, new-planet candidate was found unexpectedly in Spitzer observations. Stevenson and his colleagues were studying the Neptune-sized exoplanet GJ 436b, already known to exist around the red-dwarf star GJ 436. In the Spitzer data, the astronomers noticed slight dips in the amount of infrared light streaming from the star, separate from the dips caused by GJ 436b. A review of Spitzer archival data showed the dips were periodic, suggesting a second planet might be orbiting the star and blocking out a small fraction of the star's light.

This technique, used by a number of observatories including NASA's Kepler space telescope, relies on transits to detect exoplanets. The duration of a transit and the small decrease in the amount of light registered reveals basic properties of an exoplanet, such as its size and distance from its star. In UCF-1.01's case, its diameter would be approximately 5,200 miles (8,400 kilometers), or two-thirds that of Earth. UCF-1.01 would revolve quite tightly around GJ 436, at about seven times the distance of Earth from the moon, with its "year" lasting only 1.4 Earth days. Given this proximity to its star, far closer than the planet Mercury is to our sun, the exoplanet's surface temperature would be more than 1,000 degrees Fahrenheit (almost 600 degrees Celsius).

If the roasted, diminutive planet candidate ever had an atmosphere, it almost surely has evaporated. UCF-1.01 might therefore resemble a cratered, mostly geologically dead world like Mercury. Paper co-author Joseph Harrington, also of the University of Central Florida and principal investigator of the research, suggested another possibility; that the extreme heat of orbiting so close to GJ 436 has melted the exoplanet's surface.

"The planet could even be covered in magma," Harrington said.
Imagine if the rings of Saturn suddenly disappeared. Astronomers have witnessed the equivalent around a young sun-like star called TYC 8241 2652. Enormous amounts of dust known to circle the star are unexpectedly nowhere to be found. "It's like the classic magician's trick: now you see it, now you don't. Only in this case we're talking about enough dust to fill an inner solar system and it really is gone!" said Carl Melis of the University of California, San Diego, who led the new study appearing in the July 5 issue of the journal Nature.

A dusty disk around TYC 8241 2652 was first seen by the NASA Infrared Astronomical Satellite (IRAS) in 1983, and continued to glow brightly for 25 years. The dust was thought to be due to collisions between forming planets, a normal part of planet formation. Like Earth, warm dust absorbs the energy of visible starlight and reradiates that energy as infrared, or heat, radiation. The first strong indication of the disk's disappearance came from images taken in January 2010 by NASA's Wide-field Infrared Survey Explorer, or WISE. An infrared image obtained at the Gemini telescope in Chile on May 1, 2012, confirmed that the dust has now been gone for two-and-a-half years.

"Nothing like this has ever been seen in the many hundreds of stars that astronomers have studied for dust rings," said co-author Ben Zuckerman of UCLA, whose research is funded by NASA. "This disappearance is remarkably fast even on a human time scale, much less an astronomical scale. The dust disappearance at TYC 8241 2652 was so bizarre and so quick, initially I figured that our observations must simply be wrong in some strange way."

The astronomers have come up with a couple of possible solutions to the mystery, but they say none are compelling. One possibility is that gas produced in the impact that released the dust helped to quickly drag the dust particles into the star and thus to their doom. In another possibility, collisions of large rocks left over from an original major impact provide a fresh infusion of dust particles into the disk, which caused the dust grains to chip apart into smaller and smaller pieces.
Cal Poly students' portable telescope may be world's largest
By Nick Wilson, The Tribune, San Luis Obispo, Calif.

Telescopes used to study the cosmos often occupy massive structures perched atop mountains, such as Palomar Observatory in Southern California. It goes without saying that they are stuck in one place. But now scientists have a powerful portable version that helps researchers move their telescopes when needed, and it was designed at Cal Poly. A team of Cal Poly architecture students, under the guidance of an astronomy research scholar in residence, Russ Genet, have constructed a 15-foot-tall telescope that weighs approximately 500 pounds and has a 60-inch diameter mirror.

"We think it's the world's largest portable telescope," Genet said. "We'd like to confirm that with the Guinness Book of World Records."

The innovative design with high-grade ApplePly plywood and aluminum panels was planned and then built over the course of a year by Cal Poly architectural engineering students Laura Rice, Mounir El-Koussa and Mike Vickery. Telescopes of similar size often weigh tons and are bolted into one location; theoretically they can be transported, but the task is extremely costly. But Cal Poly's instrument can be broken down in a matter of minutes with a group effort and then carefully loaded onto a truck. The mirror is designed to reflect light from stars onto a specialized camera that records 600 images per second. Those images then are transported to a computer for analysis.

The computerized aspects of the device are being worked out this summer by mechanical engineering major Tim Scott and electrical engineering major Lluvia Rodriguez. Those include the control system that gathers data on stars and the photometer that captures images. According to Genet, more than a million stars are under observation by researchers. The new telescope will enable Genet and his students to take on pioneering research, including gathering information on the diameters of single stars by examining photons and the distances between two stars that can appear as one in the sky -- referred to as a "double star."

"Our telescope will be teamed with another somewhat smaller portable telescope by setting them apart," Genet said. "The spacing between the two telescopes will be changed to develop a 'correlation curve' that will provide the key information on stellar diameters or double star separations."

El-Koussa, now a recent graduate, said that he took on the task as his senior project and it helped him land a job. "I took documentation of the design and analysis of the telescope to every interview I had, and I'm certain it was instrumental in me landing numerous interviews and job offers," said El-Koussa, a project engineer with Ashley & Vance Engineering in San Luis Obispo. "The telescope gave me a better understanding of the theoretical structural engineering concepts we learn in school, and it allowed me to apply those theories to a non-conventional structure."

In addition, the telescope won first place in the annual Art of ApplePly contest, which is typically awarded for furniture designs.

(Continued from page 2)

In the years following the New Horizons Pluto flyby, astronomers plan to use the infrared vision of Hubble's planned successor, NASA's James Webb Space Telescope, for follow-up observations. The Webb telescope will be able to measure the surface chemistry of Pluto, its moons, and many other bodies that lie in the distant Kuiper Belt along with Pluto.

(Continued from page 3)

Another noteworthy feature in this image is the bright red arc at the lower right. This arc surrounds the star sigma Orionis, the upper star in the sword of Orion, which hangs from his belt. It is a blue dwarf multiple star system, located 1,070 light-years away. It is moving through space at a breathtaking speed of 113,000 miles per hour (50 kilometers per second). At that speed, winds from the star system crash into the gas and dust outside the system and create a bow shock, where material in front of the speeding Sigma Orionis system is piling up. The energy from the bow shock heats up dust in the region and makes it glow in infrared.

Color in this image represents specific infrared wavelengths. Blue represents light emitted at 3.4-micron wavelengths, and cyan (blue-green) represents 4.6-microns, both of which come mainly from hot stars. Relatively cooler objects, such as the dust of the nebulae, appear green and red. Green represents 12-micron light and red represents 22-micron light.
In addition to UCF-1.01, Stevenson and his colleagues noticed hints of a third planet, dubbed UCF-1.02, orbiting GJ 436. Spitzer has observed evidence of the two new planets several times each. However, even the most sensitive instruments are unable to measure exoplanet masses as small as UCF-1.01 and UCF-1.02, which are perhaps only one-third the mass of Earth. Knowing the mass is required for confirming a discovery, so the paper authors are cautiously calling both bodies exoplanet candidates for now.

Of the approximately 1,800 stars identified by NASA’s Kepler space telescope as candidates for having planetary systems, just three are verified to contain sub-Earth-sized exoplanets. Of these, only one exoplanet is thought to be smaller than the Spitzer candidates, with a radius similar to Mars, or 57 percent that of Earth.

"I hope future observations will confirm these exciting results, which show Spitzer may be able to discover exoplanets as small as Mars,” said Michael Werner, Spitzer project scientist at NASA’s Jet Propulsion Laboratory in Pasadena, Calif. "Even after almost nine years in space, Spitzer’s observations continue to take us in new and important scientific directions."
Mergers between stars, which the team estimates will be the ultimate fate of around 20 to 30 percent of O-type stars, are violent events. But even the comparatively gentle scenario of vampire stars, which accounts for a further 40 to 50 percent of cases, has profound effects on how these stars evolve.

Until now, astronomers mostly considered that closely orbiting massive binary stars were the exception, something that was only needed to explain exotic phenomena such as X-ray binaries, double pulsars, and black hole binaries. The new study shows that to properly interpret the universe, this simplification cannot be made: these heavyweight double stars are not just common, their lives are fundamentally different from those of single stars.

For instance, in the case of vampire stars, the smaller, lower-mass star is rejuvenated as it sucks the fresh hydrogen from its companion. Its mass will increase substantially and it will outlive its companion, surviving much longer than a single star of the same mass. The victim star, meanwhile, is stripped of its envelope before it has a chance to become a luminous red supergiant. Instead, its hot, blue core is exposed. As a result, the stellar population of a distant galaxy may appear to be much younger than it really is: both the rejuvenated vampire stars, and the diminished victim stars become hotter, and bluer in color, mimicking the appearance of younger stars. Knowing the true proportion of interacting high-mass binary stars is therefore crucial to correctly characterize these faraway galaxies.

"The only information astronomers have on distant galaxies is from the light that reaches our telescopes. Without making assumptions about what is responsible for this light we cannot draw conclusions about the galaxy, such as how massive or how young it is. This study shows that the frequent assumption that most stars are single can lead to the wrong conclusions," concluded Sana.

Understanding how big these effects are, and how much this new perspective will change our view of galactic evolution, will need further work. Modeling binary stars is complicated, so it will take time before all these considerations are included in models of galaxy formation.