COMING EVENTS
Public Observing
Sunday Dec. 02
Prairie Park Nature Center
8:00 PM
Monthly Meeting
Friday Nov. 16
7:30 PM, 2001 Malott
Voyager 1: Where Are You?
Dr. Tom P. Armstrong

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What's the Best Telescope for a Public Star Party?
Bill Pellerin, Houston Astronomical Society

If you get into a discussion about the ‘best’ telescope, prepare for controversy. The right answer, of course, is that there is no one best telescope. There are telescopes that are better for the kind of observing you are doing (deep sky, planetary, double star, etc.), but how about the right telescope for the observing conditions you’re likely to find.

Here’s my story. On October 12, 2012 I was part of a group of amateur astronomer volunteers who did a star party at the Camp for All site near Brenham, TX, about 80 miles northwest of Houston. Camp for All is designed to provide a summer camp experience for children and their families with special needs. For this event we were showing the sky to children who are cancer patients.

All public star parties are a great experience, but this one is especially rewarding for the volunteers. The weather conditions for that day were not the best, but there were some breaks in the clouds and we had hope that the sky would clear in time for observing, which was scheduled between 8:00 p.m. and 9:00 p.m. The sky didn’t cooperate – clouds came and went and while a few stars popped out from behind the clouds from time to time, there was no consistent clear sky for us.

Knowing that these were the conditions we would likely have to work with, what’s the best telescope / mount to bring? Last year, when conditions were excellent I had my computerized alt-az 8” SCT at the site. Turn it on, find two stars to set it up, and it’ll find whatever I want in the sky and track it. I didn’t have to keep nudging the telescope to keep the object in view. This telescope was a great choice last year, but it was a poor choice for this year. It didn’t work well at all,
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day of each month and often feature guest speakers, presentations by club members, and a chance to exchange amateur as-
tronomy 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
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For the month of October, we had our public education event, Webelo Astronomy night. Many, many
thanks to Rick and the club members who came out to set up scopes to serve the needs of the 200
or so kids and parents. While it looked like the clouds would close down the event after the indoor
session, luck for once was with us and the clouds dissipated to leave a clear sky by the close of ob-
serving. By contrast, the opposite happened for the public observing on Sunday. What appeared to
be a very promising night for viewing from the Lawrence Sky Clock and the weather predictions,
turned into a partially cloudy view by 9PM. Still, we did get a spectacular look at the full moon and a
1-minute view of the International Space Station. The next Sunday public observing session at the
Prairie Park Nature Center will begin at 8:00 PM, Sunday, Dec. 02.

Any suggestions for improving the club or the newsletter are always welcome.

and it wasn't because anything malfunctioned, it was because observing conditions were different. We had a 50 to 75 percent
cloudy sky at the site, with a few stars shining through (notably Vega). The SCT system requires a two star alignment, and on a
clear night it’s easy to accomplish. On a night where clouds are coming and going, alignment is virtually impossible. The ‘scope
slewed to the vicinity of Alpheratz, said ‘center Alpheratz’, Alpheratz went behind a cloud, and so on.

I never was able to get the telescope aligned. I was able to manually point the telescope to the double cluster and show this to a
few campers, but it wasn’t visible for long. The double cluster went behind a cloud. What would have been better under these
circumstances is an alt-az mounted manually pointed telescope – a Dobsonian or some other manual mount. With that kind of
telescope I could have pushed it to, say, Mizar, a nice triple star system. Or to Albireo, a lovely double star in Cygnus. (Ok… I
could have manually pointed the SCT as well, but it doesn’t lend itself to manual pointing easily.) I would, of course, have had to
nudge the manual telescope from time to time.

So… what are the characteristics of a good telescope for these circumstances? The advantage to a computerized and motor-
ized telescope is that it finds objects for you and it tracks them for you. Less fiddling is required during the observing session.
This works if the sky is clear enough for you to get a good alignment. The advantage of a manually pointed telescope is that you
can point it anywhere, easily, by hand and no alignment is necessary.

My conclusion: The best public star party telescope, especially if observing conditions are iffy, is one which can be manually
pointed if necessary but has some pointing assistance capability if the sky allows you to do an alignment. I have an alt-az tele-
scope mount with encoders and a small (deck of cards sized) push-to computer. If I can do a two star alignment, the push-to
computer will tell me which direction and how far I have to push the telescope to get the telescope pointed to an object in its
database. If I can’t do a two star alignment I can simply push it to some object I already know. I use a small wide field refractor
with a on this mount so that the number of telescope nudges is limited and the distance I have to move the telescope is limited.
This setup obliges me to select objects that show well in such an instrument, but there are plenty of those.

Look in books and magazines for “binocular objects” – these make great wide-field instrument objects. I could have showed the
kids some bright double stars (where the clouds cooperated), perhaps the Andromeda Galaxy, a bright cluster, or a planet (had
there been any in the sky on that night).

The key to public star parties is to show the public some bright objects, have a story to tell about the object (how far, what color,
the evolution of the object, etc.), and wait for questions. Be prepared to show where objects are in the sky with your green laser
pointer and teach the observers about the object.

About the Astronomy Associates of Lawrence

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Dawn Sees "Young" Surface on Giant Asteroid

Like a Hollywood starlet constantly retouching her makeup, the giant asteroid Vesta is constantly stirring its outermost layer to present a young face. Data from NASA's Dawn mission show that a form of weathering that occurs on the moon and other airless bodies we've visited in the inner solar system does not alter Vesta's outermost layer in the same way. Carbon-rich asteroids have also been splattering dark material on Vesta's surface over a long span of the body's history. The results are described in two papers released today in the journal Nature.

"Dawn's data allow us to decipher how Vesta records fundamental processes that have also affected Earth and other solar system bodies," said Carol Raymond, Dawn deputy principal investigator at NASA's Jet Propulsion Laboratory, Pasadena, Calif. "No object in our solar system is an island. Throughout solar system history, materials have exchanged and interacted."

Over time, soils on Earth's moon and asteroids such as Itokawa have undergone extensive weathering in the space environment. Scientists see this in the accumulation of tiny metallic particles containing iron, which dulls the fluffy outer layer. Dawn's visible and infrared mapping spectrometer (VIR) and framing camera detected no accumulation of such tiny particles on Vesta, and this particular protoplanet, or almost-planet, remains bright and pristine.

Nevertheless, the bright rays of the youngest features on Vesta are seen to degrade rapidly and disappear into background soil. Scientists know frequent, small impacts continually mix the fluffy outer layer of broken debris. Vesta also has unusually steep topography relative to other large bodies in the inner solar system, which leads to landslides that further mix surface material.

"Getting up close and familiar with Vesta has reset our thinking about the character of the uppermost soils of airless bodies," said Carle Pieters, one of the lead authors and a Dawn team member based at Brown University, Providence, R.I. "Vesta 'dirt' is very clean, well mixed and highly mobile."

Early pictures of Vesta showed a variety of dramatic light and dark splotches on Vesta's surface. These light and dark materials were unexpected and now show the brightness range of Vesta is among the largest observed on rocky bodies in our solar system.

Dawn scientists suspected early on that bright material is native to Vesta. One of their first hypotheses for the dark material suggested it might come from the shock of high-speed impacts melting and darkening the underlying rocks or from recent volcanic activity. An analysis of data from VIR and the framing camera has revealed, however, that the distribution of dark material is widespread and occurs both in small spots and in diffuse deposits, without correlation to any particular underlying geology. The likely source of the dark material is now shown to be the carbon-rich material in meteoroids, which are also believed to have deposited hydrated minerals from other asteroids on Vesta.

To get the amount of darkening we now see on Vesta, scientists on the Dawn team estimate about 300 dark asteroids with diameters between 0.6 to 6 miles (1 and 10 kilometers) likely hit Vesta during the last 3.5 billion years. This would have been enough to wrap Vesta in a blanket of mixed material about 3 to 7 feet (1 to 2 meters) thick.

"This perpetual contamination of Vesta with material native to elsewhere in the solar system is a dramatic example of an apparently common process that changes many solar system objects," said Tom McCord, the other lead author and a Dawn team member based at the Bear Fight Institute, Winthrop, Wash. "Earth likely got the ingredients for life—organics and water—this way."

Launched in 2007, Dawn spent more than a year investigating Vesta. It departed in September 2012 and is currently on its way to the dwarf planet Ceres.

Canuleia, about 6 miles (10 kilometers) in diameter, is distinguished by the rays of bright material that streak out from it. Image credit: NASA/JPL-Caltech/This image from NASA's Dawn spacecraft features the distinctive crater Canuleia on the giant asteroid Vesta. Canuleia, about 6 miles (10 kilometers) in diameter, is distinguished by the rays of bright material that streak out from it. There is also a more subdued unnamed crater of about the same size to the northeast. A comparison of these two craters illustrates how freshly excavated materials on Vesta appear quite different from background soils.
Vast fields of marble-sized chunks of ice and rock spun slowly in the darkness this week, and I sat in the back of a grey conference room with white plastic tables spread with papers and laptops. I was sitting in on a meeting of an international team of astronomers gathered to analyze data from the Herschel Infrared Observatory. This telescope, sometimes just called Herschel, orbits the Sun about a million miles from the Earth. The meeting began with dinner at Karl’s house. Karl charred chorizo on the backyard grill while the airplanes dribbled into Dulles airport. Our colleagues arrived, jetlagged and yawning, from Germany, Sweden, and Spain, and we sat on Karl’s couches catching up on the latest gossip. The unemployment level in Spain is about twenty percent, so research funding there is hard to come by these days. That’s not nice to hear. But it cheered us up to be with old friends.

The meeting commenced the next morning, as the vast fields of ice and rock continued to spin—shards glinting in the starlight. Or maybe they didn’t. Maybe they didn’t exist at all. You see, this team is looking at a series of images of stars taken by a device called a bolometer that is blind to ordinary starlight. Instead, the bolometer inside Herschel senses infrared light, a kind of light that we would probably refer to as heat if we could feel it. But the idea of pointing the bolometer at the stars was not to collect ordinary starlight. It was to measure heat coming from the vicinity of these stars, like an infrared security camera, in case there was something else to be found lurking nearby.

And lo and behold, for a handful of stars, the bolometer measurements were off the charts! Maybe something was orbiting these stars. From the details of the bolometer readings—which channels lit up and so on—you would guess that this stuff took the form of majestic fields or rings of icy and rocky particles. It would be a new kind of disk, a discovery worth writing home to Madrid about. There are several teams of astronomers analyzing data from the Herschel Space Telescope. They call themselves by oddly inappropriate sounding acronyms: GASPS, DUNES, DEBRIS. For the time being, the scientists on these teams are the only ones with access to the Herschel data. But in January, all the data these teams are working on will suddenly be released to the public. So they are all under pressure to finish their work by then. The team whose meeting I was sitting in on would like to publish a paper about the new disks by then.

But it’s not so simple. The stars that this team had measured were relatively nearby as stars go, less than a few hundred light years. But the universe is big, and full of galaxies of all kinds—a sea of galaxies starting from maybe a hundred thousand light years away, and stretching on and on. Maybe one of those background galaxies was lined up with each of the stars that had lit up the bolometer—fooling us into thinking they were seeing disks around these stars.

The team argued and paced, and then broke for lunch. We marched to the cafeteria through the rain. Meanwhile, vast fields of marble-sized chunks of ice and rock spun slowly in the darkness. Or maybe they didn’t.


Dr. Marc J. Kuchner is an astrophysicist at the Exoplanets and Stellar Astrophysics Laboratory at NASA’s Goddard Space Flight Center. NASA’s Astrophysics Division works on big questions about the origin and evolution of the universe, galaxies, and planetary systems. Explore more at http://www.science.nasa.gov/astrophysics/.
Present

VOYAGER 1,
Where Are You?

Dr. Tom P. Armstrong
Fundamental Technologies

FRIDAY NOV. 16, 2012
7:30 PM
2001 Malott Hall
University of Kansas
FREE & OPEN TO THE PUBLIC
NASA's WISE Colors in Unknowns on Jupiter Asteroids

Scientists using data from NASA's Wide-field Infrared Survey Explorer, or WISE, have uncovered new clues in the ongoing mystery of the Jovian Trojans -- asteroids that orbit the sun on the same path as Jupiter. Like racehorses, the asteroids travel in packs, with one group leading the way in front of the gas giant, and a second group trailing behind. The observations are the first to get a detailed look at the Trojans' colors: both the leading and trailing packs are made up of predominantly dark, reddish rocks with a matte, non-reflecting surface. What's more, the data verify the previous suspicion that the leading pack of Trojans outnumbers the trailing bunch. The new results offer clues in the puzzle of the asteroids' origins. Where did the Trojans come from? What are they made of? WISE has shown that the two packs of rocks are strikingly similar and do not harbor any "out-of-towners," or interlopers, from other parts of the solar system. The Trojans do not resemble the asteroids from the main belt between Mars and Jupiter, nor the Kuiper belt family of objects from the icy, outer regions near Pluto.

"Jupiter and Saturn are in calm, stable orbits today, but in their past, they rumbled around and disrupted any asteroids that were in orbit with these planets," said Tommy Grav, a WISE scientist from the Planetary Science Institute in Tucson, Ariz. "Later, Jupiter re-captured the Trojan asteroids, but we don't know where they came from. Our results suggest they may have been captured locally. If so, that's exciting because it means these asteroids could be made of primordial material from this particular part of the solar system, something we don't know much about." Grav is a member of the NEOWISE team, the asteroid-hunting portion of the WISE mission. The first Trojan was discovered on Feb. 22, 1906, by German astronomer Max Wolf, who found the celestial object leading ahead of Jupiter. Christened "Achilles" by the astronomer, the roughly 81-mile-wide (130-kilometer-wide) chunk of space rock was the first of many asteroids detected to be traveling in front of the gas giant. Later, asteroids were also found trailing behind Jupiter. The asteroids were collectively named Trojans after a legend, in which Greek soldiers hid inside in a giant horse statue to launch a surprise attack on the Trojan people of the city of Troy.

"The two asteroid camps even have their own 'spy,'" said Grav. "After having discovered a handful of Trojans, astronomers decided to name the asteroid in the leading camp after the Greek heroes and the ones in the trailing after the heroes of Troy. But each of the camps already had an 'enemy' in their midst, with asteroid 'Hector' in the Greek camp and 'Patroclus' in the Trojan camp. Other planets were later found to have Trojan asteroids riding along with them too, such as Mars, Neptune and even Earth, where WISE recently found the first known Earth Trojan. Before WISE, the main uncertainty defining the population of Jupiter Trojans was just how many individual chunks were in these clouds of space rock and ice leading Jupiter, and how many were trailing. It is believed that there are as many objects in these two swarms leading and trailing Jupiter as there are in the entirety of the main asteroid belt between Mars and Jupiter.

To put this and other theories to bed requires a well-coordinated, well-executed observational campaign. But there were many things in the way of accurate observations -- chiefly, Jupiter itself. The orientation of these Jovian asteroid clouds in the sky in the last few decades has been an impediment to observations. One cloud is predominantly in Earth's northern sky, while the other is in the southern, forcing ground-based optical surveys to use at least two different telescopes. The surveys generated results, but it was unclear whether a particular result was caused by the problems of having to observe the two clouds with different instruments, and at different times of the year.

Enter WISE, which roared into orbit on Dec. 14, 2009. The spacecraft's 16-inch (40-centimeter) telescope and infrared cameras scoured the entire sky looking for the glow of celestial heat sources. From January 2010 to February 2011, about 7,500 images were taken every day. The NEOWISE project used the data to catalogue more than 158,000 asteroids and comets throughout the solar system. "By obtaining accurate diameter and surface reflectivity measurements on 1,750 Jupiter Trojans, we increased by an order of magnitude what we knew about these two gatherings of asteroids," said Grav. "With this information, we were able to more accurately than ever confirm there are indeed almost 40 percent more objects in the leading cloud." Trying to understand the surface or interior of a Jovian Trojan is also difficult. The WISE suite of infrared detectors was sensitive to the thermal glow of the objects, unlike visible-light telescopes. This means WISE can provide better estimates of their surface reflectivity, or albedo, in addition to more details about their

(Continued on page 8)
Monster Galaxy May Have Been Stirred Up By Black-hole Mischief

Astronomers using NASA's Hubble Space Telescope have obtained a remarkable new view of a whopper of an elliptical galaxy that may have been puffed up by the actions of one or more black holes in its core.

Spanning a little more than one million light-years, the galaxy is about 10 times the diameter of our Milky Way galaxy. The bloated galaxy is a member of an unusual class of galaxies with a diffuse core filled with a fog of starlight where there would normally be a concentrated peak of light around a central black hole. Viewing the core is like seeing a city with no downtown, just houses sprinkled across a vast landscape.

Astronomers used Hubble's Advanced Camera for Surveys and Wide Field Camera 3 to measure the amount of starlight across the galaxy, dubbed A2261-BCG. The Hubble observations revealed that the galaxy's puffy core, measuring about 10,000 light-years, is the largest yet seen.

A galaxy's core size typically is correlated to the dimensions of its host galaxy, but in this case, the central region is much larger than astronomers would expect for the galaxy's size. In fact, the bloated core is more than three times larger than the center of other very luminous galaxies. Located three billion light-years away, the galaxy is the most massive and brightest galaxy in the Abell 2261 cluster.

Astronomers have proposed two possibilities for the puffy core. One scenario is that a pair of merging black holes gravita-
C- and P-type, which are more grey-bluish in color. More research is needed, but it's possible we are looking at the find a largely uniform population of what we call D-type asteroids, which are dark burgundy in color, with the rest being "We didn't see any ultra-red asteroids, typical of the main belt and Kuiper belt populations," said Grav. "Instead, we properly sorted according to asteroid classification schemes for the first time. The NEOWISE team has analyzed the colors of 400 Trojan asteroids so far, allowing many of these asteroids to be portion of the light spectrum, we can see more details of the asteroids' colors, or, in essence, more shades or hues.

"Seeing asteroids with WISE's many wavelengths is like the scene in 'The Wizard of Oz,' where Dorothy goes from her black-and-white world into the Technicolor land of Oz," said Amy Mainzer, the principal investigator of the NEOWISE project at NASA's Jet Propulsion Laboratory in Pasadena, Calif. "Because we can see farther into the infrared part of the light spectrum, we can see more details of the asteroids' colors, or, in essence, more shades or hues." The NEOWISE team has analyzed the colors of 400 Trojan asteroids so far, allowing many of these asteroids to be properly sorted according to asteroid classification schemes for the first time.

"We didn't see any ultra-red asteroids, typical of the main belt and Kuiper belt populations," said Grav. "Instead, we find a largely uniform population of what we call D-type asteroids, which are dark burgundy in color, with the rest being C- and P-type, which are more grey-bluish in color. More research is needed, but it's possible we are looking at the some of the oldest material known in the solar system. Scientists have proposed a future space mission to the Jupiter Trojans that will gather the data needed to determine their age and origins."
Astronomers using NASA's Spitzer Space Telescope have greatly improved the cosmic distance ladder used to measure the expansion rate of the universe, as well as its size and age. The cosmic distance ladder, symbolically shown here in this artist's concept, is a series of stars and other objects within galaxies that have known distances. By combining these distance measurements with the speeds at which objects are moving away from us, scientists can calculate the expansion rate of the universe, also known as Hubble's constant. Spitzer was able to improve upon past measurements of Hubble's constant due to its infrared vision, which sees through dust to provide better views of variable stars called Cepheids. These pulsating stars are vital "rungs" in the distance ladder. Spitzer observed ten Cepheids in our own Milky Way galaxy and 80 in a nearby neighboring galaxy called the Large Magellanic Cloud. Without the cosmic dust blocking their view at the infrared wavelengths seen by Spitzer, the research team was able to obtain more precise measurements of the stars' apparent brightness, and thus their distances. The galaxies used in this composite artwork are all infrared images from Spitzer covering wavelengths of 3.6 microns (blue), 4.5 microns (green), and 8.0 microns (red).

In addition, the findings were combined with published data from NASA's Wilkinson Microwave Anisotropy Probe (Continued on page 10)
to obtain an independent measurement of dark energy, one of the greatest mysteries of our cosmos. Dark energy is thought to be winning a battle against gravity, pulling the fabric of the universe apart. Research based on this acceleration garnered researchers the 2011 Nobel Prize in physics.

"This is a huge puzzle," said the lead author of the new study, Wendy Freedman of the Observatories of the Carnegie Institution for Science in Pasadena. "It's exciting that we were able to use Spitzer to tackle fundamental problems in cosmology: the precise rate at which the universe is expanding at the current time, as well as measuring the amount of dark energy in the universe from another angle." Freedman led the groundbreaking Hubble Space Telescope study that earlier had measured the Hubble constant. Glenn Wahlgren, Spitzer program scientist at NASA Headquarters in Washington, said infrared vision, which sees through dust to provide better views of variable stars called cepheids, enabled Spitzer to improve on past measurements of the Hubble constant using Cepheids.

"These pulsating stars are vital rungs in what astronomers call the cosmic distance ladder: a set of objects with known distances that, when combined with the speeds at which the objects are moving away from us, reveal the expansion rate of the universe," said Wahlgren. Cepheids are crucial to the calculations because their distances from Earth can be measured readily. In 1908, Henrietta Leavitt discovered these stars pulse at a rate directly related to their intrinsic brightness. To visualize why this is important, imagine someone walking away from you while carrying a candle. The farther the candle traveled, the more it would dim. Its apparent brightness would reveal the distance. The same principle applies to cepheids, standard candles in our cosmos. By measuring how bright they appear on the sky, and comparing this to their known brightness as if they were close up, astronomers can calculate their distance from Earth.

Spitzer observed 10 cepheids in our own Milky Way galaxy and 80 in a nearby neighboring galaxy called the Large Magellanic Cloud. Without the cosmic dust blocking their view, the Spitzer research team was able to obtain more precise measurements of the stars' apparent brightness, and thus their distances. These data opened the way for a new and improved estimate of our universe's expansion rate. "Just over a decade ago, using the words 'precision' and 'cosmology' in the same sentence was not possible, and the size and age of the universe was not known to better than a factor of two," said Freedman. "Now we are talking about accuracies of a few percent. It is quite extraordinary."