COMING EVENTS

Post Band Concert Observing

**Tuesday July 03**

**Wednesday July 18**

**South Park, West of Massachusetts St.**

9:00 PM

**President**

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**Volume 38 Number 07**

**July 2012**

**Report from the Officers:**

The big event of the month was, of course, the transit of Venus on June 5. While a positive response to the event was expected, no one predicted the crowds of hundreds who stopped by over the few hours before sunset for this now once-in-a-lifetime event. The crowd was undoubtedly helped by the promotion of the event by NPR/KPR/KANU. The KU station picked up the announcement about the setup at the Lied and encouraged anyone and everyone to attend. The array of equipment and technology was impressive. To the club members who found the time to come out and set up a scope, many thanks. The Club probably interacted with more of the public in this single event than it has cumulatively in all our events combined over the last few years. For more on the transit and its value from an observational standpoint, take a look at Bill Pellerin's article below. The Journal-World article on the event can been read at [http://www2.ljworld.com/news/2012/jun/05/observers-look-sky-get-rare-glimpse-venus-transit/](http://www2.ljworld.com/news/2012/jun/05/observers-look-sky-get-rare-glimpse-venus-transit/)

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**Venus Transit – Time for the Replay!**

By Bill Pellerin, Houston Astronomical Society, GuideStar Editor

Did you see it? Did you see it?

After reading a couple of books about the history of the Venus transit I was very eager to see the one on June 5, 2012, and I did. The most recent book I read was The Transits of Venus by William Sheehan and John Westfall. This book tells the history of Venus transits since the first one known to have been observed by Jeremiah Horrocks and William Crabtree in December of 1639. It's a remarkable story of determination by those observers who timed the next pair of transits in 1761 and 1769 on the recommendation of Edmund Halley. Halley died before either of these transits. The goal was to determine the distance between the Earth and the Sun, which they did but without the hoped-for accuracy.

I began to wonder about the mechanics of the event. How were Venus and the Sun arranged in the sky, and how were they moving during the transit? Did the movement of the Sun or of Venus contribute more to the relative movement that I saw?

We’ve learned that these events are rare because the orbital planes of the Earth and of Venus are not the same. Only when the planes cross each other while Venus is at inferior conjunction does a transit occur. An inferior conjunction is when the orbit of an ‘inferior’ (closer to the Sun) planet is between the superior planet and the Sun. The next inferior conjunction will be on January 10, 2014, but Venus will miss the Sun by about 5 degrees, and there will be no transit. The next transit is in 2117.

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Summer observing continues despite the oppressive weather. Our last attempt in June was clouded out, but the next session will be on TUESDAY, July 3, after the Band Concert in South Park at ~ 9:15 PM. The weather for this session look promising, with no rain in sight for the entire week. Please check the phone message at 864-3166 if you aren’t sure about whether or not the South Park observing is on.

As noted last issue, the MSRAL Convention at UMKC was a grand success. For those interested in more details about the event and the talks, there are a number of items at the meeting site, http://www.msral.org/. One of the speakers at the convention was Jim Small discussing the Night Sky Network (see http://nightsky.jpl.nasa.gov/index.cfm). The organization is a nationwide coalition of amateur astronomy clubs bringing the science, technology, and inspiration of NASA's missions to the general public. It costs nothing for a club to join and it can supply resources and ideas that have the potential to strengthen astronomy clubs while expanding their public profile. The current plan is to investigate the option to take part and, if it looks promising and we can get one or two members to volunteer as liaisons with the national organization, we will move ahead with membership. More next month.

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

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Let's do a replay of the June 5, 2012 event to understand what was going on. Observationally, we saw Venus attack the northeastern edge of the Sun and then move slowly westward across the face of the Sun. For the purposes of this article, the movements are considered from the point of view of an observer on the Earth.

When Venus is at inferior conjunction the apparent motion of the planet is to the west with some motion to the north or south. I simulated all eight transits back to May 23, 1526. For every May or June transit, Venus' apparent motion was to the southwest, and for every December transit Venus' apparent motion was to the northwest.

What was the Sun doing? The Sun is reliably moving east in the sky (compared to the background stars) year-around with some additional movement to the north or south because of the tilt of the Earth’s axis. You only have to know about the motion of the Sun during the four seasons to understand the motion of the Sun during a transit. In spring, the Sun is moving to the north and it continues to do so until the summer (northern hemisphere) solstice (the first day of summer – June 20, this year).

So, while the Sun was moving mostly east, it was also moving a bit north during the most recent transit and the position angle of the Sun’s motion was 82 degrees, just north of due east. Remember that north is 0 degrees, east is 90 degrees, south is 180 degrees and west is 270 degrees. The Sun moved 15° 50.86” east and 2° 13.6” north during the time of the transit the total motion of the Sun was 16° 2”.

Until about May 13, 2012, Venus was moving mostly to the east in the sky. Between that date and about June 26, 2012 Venus was moving to the southwest at a position angle of about 244 degrees. After June 26, Venus continued its eastward trek in the sky. During the transit Venus moved 10° 06” west and 4° 56” south, the total Venus movement was 11° 14.3”.

The movement of the Sun and Venus were in more-or-less opposite directions, but not exactly. If you do the vector math the combined movement is 26° 55”.

So, if you want to see the replay, and you have software on your computer that simulates the positions of Venus and the Sun
An international team of astronomers using data from NASA's Hubble Space Telescope has made an unparalleled observation, detecting significant changes in the atmosphere of a planet located beyond our solar system.

The scientists conclude the atmospheric variations occurred in response to a powerful eruption on the planet's host star, an event observed by NASA's Swift satellite.

"The multiwavelength coverage by Hubble and Swift has given us an unprecedented view of the interaction between a flare on an active star and the atmosphere of a giant planet," said lead researcher Alain Lecavelier des Etangs at the Paris Institute of Astrophysics (IAP), part of the French National Scientific Research Center located at Pierre and Marie Curie University in Paris.

The exoplanet is HD 189733b, a gas giant similar to Jupiter, but about 14 percent larger and more massive. The planet circles its star at a distance of only 3 million miles, or about 30 times closer than Earth's distance from the Sun, and completes an orbit every 2.2 days. Its star, named HD 189733A, is about 80 percent the size and mass of our Sun.

Astronomers classify the planet as a "hot Jupiter." Previous Hubble observations show that the planet's deep atmosphere reaches a temperature of about 1,900 degrees Fahrenheit (1,030 degrees Celsius).

HD 189733b periodically passes across, or transits, its parent star, and these events give astronomers an opportunity to probe its atmosphere and environment. In a previous study, a group led by

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How Many Discoveries Can You Make in a Month?

By Dr. Tony Phillips

This year NASA has announced the discovery of 11 planetary systems hosting 26 planets; a gigantic cluster of galaxies known as “El Gordo;” a star exploding 9 billion light years away; alien matter stealing into the solar system; massive bullets of plasma racing out of the galactic center; and hundreds of unknown objects emitting high-energy photons at the edge of the electromagnetic spectrum.

That was just January.

Within NASA’s Science Mission Directorate, the Astrophysics Division produces such a list nearly every month. Indeed, at this very moment, data is pouring in from dozens of spacecraft and orbiting observatories. “The Hubble, Spitzer, Chandra, and Fermi space telescopes continue to make groundbreaking discoveries on an almost daily basis,” says NASA Administrator Charlie Bolden. NASA astrophysicists and their colleagues conduct an ambitious research program stretching from the edge of the solar system to the edge of the observable Universe. Their work is guided in large part by the National Research Council’s Decadal Survey of Astronomy and Astrophysics, which identified the following priorities: Finding new planets—and possibly new life—around other stars; Discovering the nature of dark energy and dark matter; Understanding how stars and galaxies have evolved since the Big Bang; Studying exotic physics in extreme places like black holes.

Observing time on Hubble and the other “Great Observatories” is allocated accordingly. Smaller missions are important, too: The Kepler spacecraft, which is only “medium-sized” by NASA standards, has single-handedly identified more than 2300 planet candidates. Recent finds include planets with double suns, massive “super-Earths” and “hot Jupiters,” and a miniature solar system. It seems to be only a matter of time before Kepler locates an Earth-sized world in the Goldilocks zone of its parent star, just right for life.

A future astrophysics mission, the James Webb Space Telescope, will be able to study the atmospheres of many of the worlds Kepler is discovering now. The telescope’s spectrometers can reveal the chemistry of distant exoplanets, offering clues to their climate, cloud cover, and possibilities for life. That’s not the telescope’s prime mission, though. With a primary mirror almost 3 times as wide as Hubble’s, and a special sensitivity to penetrating infrared radiation, Webb is designed to look into the most distant recesses of the universe to see how the first stars and galaxies formed after the Big Bang. It is, in short, a Genesis Machine.

Says Bolden, “We’re on track in the construction of the James Webb Space Telescope, the most sophisticated science telescope ever constructed to help us reveal the mysteries of the cosmos in ways never before possible.” Liftoff is currently scheduled for 2018. How long will the list of discoveries be in January of that year? Stay tuned for Astrophysics.

For more on NASA’s astrophysics missions, check out http://science.nasa.gov/astrophysics/. Kids can get some of their mind-boggling astrophysics questions answered by resident Space Place astrophysicist “Dr. Marc” at http://spaceplace.nasa.gov/dr-marc-space. This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.
NASA's Spitzer Finds First Objects Burned Furiously

The faint, lumpy glow given off by the very first objects in the universe may have been detected with the best precision yet, using NASA's Spitzer Space Telescope. These faint objects might be wildly massive stars or voracious black holes. They are too far away to be seen individually, but Spitzer has captured new, convincing evidence of what appears to be the collective pattern of their infrared light.

The observations help confirm the first objects were numerous in quantity and furiously burned cosmic fuel.

"These objects would have been tremendously bright," said Alexander "Sasha" Kashlinsky of NASA's Goddard Space Flight Center in Greenbelt, Md., lead author of a new paper appearing in The Astrophysical Journal. "We can't yet directly rule out mysterious sources for this light that could be coming from our nearby universe, but it is now becoming increasingly likely that we are catching a glimpse of an ancient epoch. Spitzer is laying down a roadmap for NASA's upcoming James Webb Telescope, which will tell us exactly what and where these first objects were."

Spitzer first caught hints of this remote pattern of light, known as the cosmic infrared background, in 2005, and again with more precision in 2007. Now, Spitzer is in the extended phase of its mission, during which it performs more in-depth studies on specific patches of the sky. Kashlinsky and his colleagues used Spitzer to look at two patches of sky for more than 400 hours each.

The team then carefully subtracted all the known stars and galaxies in the images. Rather than being left with a black, empty patch of sky, they found faint patterns of light with several telltale characteristics of the cosmic infrared background. The lumps in the pattern observed are consistent with the way the very distant objects are thought to be clustered together.

Kashlinsky likens the observations to looking for Fourth of July fireworks in New York City from Los Angeles. First, you would have to remove all the foreground lights between the two cities, as well as the blazing lights of New York City itself. You ultimately would be left with a fuzzy map of how the fireworks are distributed, but they would still be too distant to make out individually.

"We can gather clues from the light of the universe's first fireworks," said Kashlinsky. "This is teaching us that the sources, or the "sparks," are intensely burning their nuclear fuel."

The universe formed roughly 13.7 billion years ago in a fiery, explosive Big Bang. With time, it cooled and, by around 500 million years later, the first stars, galaxies and black holes began to take shape. Astronomers say some of that "first light" might have traveled billions of years to reach the Spitzer Space Telescope. The light would have originated at visible or even ultraviolet wavelengths and then, because of the expansion of the universe, stretched (Continued on page 10)
NASA's Hubble Space Telescope shows a rare view of a pair of overlapping galaxies, called NGC 3314. The two galaxies look as if they are colliding, but they are actually separated by tens of millions of light-years, or about ten times the distance between our Milky Way and the neighboring Andromeda galaxy. The chance alignment of the two galaxies, as seen from Earth, gives a unique look at the silhouetted spiral arms in the closer face-on spiral, NGC 3314A.

The motion of the two galaxies indicates that they are both relatively undisturbed and that they are moving in markedly different directions. This indicates they are not on any collision course. NGC 3314A's warped shape is likely due to an encounter with another nearby galaxy, perhaps the large spiral galaxy NGC 3312 (located outside the Hubble image).

Because of the alignment, NGC 3314B's dust lanes appear lighter than those of NGC 3314A. This is not because that galaxy lacks dust, but rather because its dust lanes are lightened by the bright fog of stars in the foreground. NGC 3314A's dust, in contrast, is backlit by the stars of NGC 3314B, silhouetting them against the bright background.

The color composite was produced from exposures taken in blue and red light with Hubble's Advanced Camera for Surveys. The pair of galaxies lie roughly 140 million light-years from Earth, in the direction of the southern hemisphere constellation Hydra.
WISE Finds Few Brown Dwarfs Close to Home

Astronomers are getting to know the neighbors better. Our sun resides within a spiral arm of our Milky Way galaxy about two-thirds of the way out from the center. It lives in a fairly calm, suburb-like area with an average number of stellar residents. Recently, NASA’s Wide-field Infrared Survey Explorer, or WISE, has been turning up a new crowd of stars close to home: the coldest of the brown dwarf family of "failed" stars. Now, just as scientists are "meeting and greeting" the new neighbors, WISE has a surprise in store: there are far fewer brown dwarfs around us than predicted.

"This is a really illuminating result," said Davy Kirkpatrick of the WISE science team at NASA’s Infrared Processing and Analysis Center at the California Institute of Technology in Pasadena. "Now that we're finally seeing the solar neighborhood with keener, infrared vision, the little guys aren't as prevalent as we once thought." Previous estimates had predicted as many brown dwarfs as typical stars, but the new initial tally from WISE shows just one brown dwarf for every six stars. It’s the cosmic equivalent to finally being able to see down a mysterious, gated block and finding only a few homes. Nonetheless, the observations are providing crucial information about how these exotic worlds form, and hinting at what their population densities might be like in our galaxy and beyond.

"WISE is finding new, cold worlds that are ripe for exploration in their own right," said Kirkpatrick. "We think they can form by several different mechanisms, including having their growth stunted by a variety of factors that prevent them from becoming full-blown stars. Still, we don’t know exactly how this process works." WISE was launched in 2009 and surveyed the entire sky in infrared light in 2010. One of the mission's main science goals was to survey the sky for the elusive brown dwarfs. These small bodies start their lives like stars, but lack the bulk required to burn nuclear fuel. With time, they cool and fade, making them difficult to find. Improvements in WISE’s infrared vision over past missions have allowed it to pick up the faint glow of many of these hidden objects. In August 2011, the mission announced the discovery of the coolest brown dwarfs spotted yet, a new class of stars called Y dwarfs. One of the Y dwarfs is less than 80 degrees Fahrenheit (25 degrees Celsius), or about room temperature, making it the coldest star-like body known. Since then, the WISE science team has surveyed the entire landscape around our sun and discovered 200 brown dwarfs, including 13 Y dwarfs.

This image shows our own back yard, astronomically speaking, from a vantage point about 30 light-years away from the sun. It highlights the population of tiny brown dwarfs recently discovered by NASA’s Wide-field Infrared Survey Explorer, or WISE (red circles). The image simulates actual positions of stars. Image credit: NASA/JPL-Caltech

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Determining the distances to these objects is a key factor in knowing their population density in our solar neighborhood. After carefully measuring the distance to several of the coldest brown dwarfs via a method called parallax, the scientists were able to estimate the distances to all the newfound brown dwarfs. They concluded that about 33 brown dwarfs reside within 26 light-years of the Sun. There are 211 stars within this same volume of space, so that means there are about six stars for every brown dwarf.

"Astronomers have been debating the details of atmospheric evaporation for years, and studying HD 189733b is our best opportunity for understanding the process," said Vincent Bourrier, a doctoral student at IAP and a team member on the new study. When HD 189733b transits its star, some of the star's light passes through the planet's atmosphere. This interaction imprints information on the composition and motion of the planet's atmosphere into the star's light.

In April 2010, the researchers observed a single transit using Hubble's Space Telescope Imaging Spectrograph (STIS), but they detected no trace of the planet's atmosphere. Follow-up STIS observations in September 2011 showed a surprising reversal, with striking evidence that a plume of gas was streaming away from the exoplanet.

The researchers determined that at least 1,000 tons of gas was leaving the planet's atmosphere every second. The hydrogen atoms were racing away at speeds greater than 300,000 miles per hour. The findings will appear in an upcoming issue of the journal Astronomy & Astrophysics.

Because X-rays and extreme ultraviolet starlight heat the planet's atmosphere and likely drive its escape, the team also monitored the star with Swift's X-ray Telescope (XRT). On Sept. 7, 2011, just eight hours before Hubble was scheduled to observe the transit, Swift was monitoring the star when it unleashed a powerful flare. It brightened by 3.6 times in X-rays, a spike occurring atop emission levels that already were greater than the Sun's.

"The planet's close proximity to the star means it was struck by a blast of X-rays tens of thousands of times stronger than the Earth suffers even during an X-class solar flare, the strongest category," said co-author Peter Wheatley, a physicist at the University of Warwick in England.

After accounting for the planet's enormous size, the team notes that HD 189733b encountered about 3 million times as many X-rays as Earth receives from a solar flare at the threshold of the X class.
Most Quasars Live on Snacks, Not Large Meals

Black holes in the early universe needed a few snacks rather than one giant meal to fuel their quasars and help them grow, according to observations from NASA's Spitzer and Hubble space telescopes.

Quasars are the brilliant beacons of light that are powered by black holes feasting on captured material, and in the process, heating some of the matter to millions of degrees. The brightest quasars reside in galaxies distorted by collisions with other galaxies. These encounters send lots of gas and dust into the gravitational whirlpool of hungry black holes.

Now, however, astronomers are uncovering an underlying population of fainter quasars that thrive in normal-looking spiral galaxies. They are triggered by black holes snacking on such tasty treats as a batch of gas or the occasional small satellite galaxy.

A census of 30 quasar host galaxies conducted with two of NASA's premier observatories, Hubble and Spitzer, has found that 26 of the host galaxies bear no telltale signs of collisions with neighbors, such as distorted shapes. Only one galaxy in the sample shows evidence of an interaction with another galaxy. The galaxies existed roughly 8 billion to 12 billion years ago, during a peak epoch of black-hole growth. The study, led by Kevin Schawinski of Yale University, New Haven, Conn., bolsters evidence that the growth of most massive black holes in the early universe was fueled by small, long-term events rather than dramatic short-term major mergers.

"Quasars that are products of galaxy collisions are very bright," Schawinski said. "The objects we looked at in this study are the more typical quasars. They're a lot less luminous. The brilliant quasars born of galaxy mergers get all the attention because they are so bright and their host galaxies are so messed up. But the typical bread-and-butter quasars are actually where most of the black-hole growth is happening. They are the norm, and they don't need the drama of a collision to shine."

For his analysis, Schawinski analyzed galaxies observed by the Spitzer and Hubble telescopes in the Cosmic Assembly Near-infrared Deep Extragalactic Legacy Survey. He chose 30 dust-enshrouded galaxies that appeared extremely bright in infrared images taken by the Spitzer telescope, a sign that their resident black holes are feasting on surrounding material. The dust is blocking the quasar's light at visible wavelengths. But infrared light pierces the dust, allowing Schawinski to study the galaxies' detailed structure. The masses of those galaxies are comparable to that of our Milky Way.

Schawinski then studied the galaxies in near-infrared images taken by Hubble's Wide Field Camera 3. Hubble's sharp images allowed careful analysis of galaxy shapes, which would be significantly distorted if major galaxy mergers had taken place and were disrupting the structure. Instead, in all but one instance, the galaxies show no such disruption. Whatever process is stoking the quasars, it's below the detection capability of even Hubble. "I think it's a combination of processes, such as random stirring of gas, supernovae blasts, swallowing of small bodies, and streams of gas and stars feeding material into the nucleus," Schawinski said.

A black hole doesn't need much gas to satisfy its hunger and turn on a quasar. "There's more than enough gas within a few light-years from the center of our Milky Way to turn it into a quasar," Schawinski explained. "It just doesn't happen. But it could happen if one of those small clouds of gas ran into the black hole. Random motions and stirrings inside the galaxy would channel gas into the black hole. Ten billion years ago, those random motions were more common and there was more gas to go around. Small galaxies also were more abundant and were swallowed up by larger galaxies."

The galaxies in Schawinski's study are prime targets for NASA's upcoming James Webb Space Telescope, a large infrared observatory scheduled to launch later this decade. "To get to the heart of what kinds of events are powering the quasars in these galaxies, we need the Webb telescope. Hubble and Spitzer have been the trailblazers for finding them."
out to the longer, infrared wavelengths observed by Spitzer.

The new study improves on previous observations by measuring this cosmic infrared background out to scales equivalent to two full moons -- significantly larger than what was detected before. Imagine trying to find a pattern in the noise in an old-fashioned television set by looking at just a small piece of the screen. It would be hard to know for certain if a suspected pattern was real. By observing a larger section of the screen, you would be able to resolve both small- and large-scale patterns, further confirming your initial suspicion.

Likewise, astronomers using Spitzer have increased the amount of sky examined to obtain more definitive evidence of the cosmic infrared background. The researchers plan to explore more patches of sky in the future to gather more clues hidden in the light of this ancient era.

"This is one of the reasons we are building the James Webb Space Telescope," said Glenn Wahlgren, Spitzer program scientist at NASA Headquarters in Washington. "Spitzer is giving us tantalizing clues, but James Webb will tell us what really lies at the era where stars first ignited."

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accurately, you can set this scenario up and watch it play out. We've been told that we won't see another Venus transit in our lifetime. That's true, but we can watch the replay of the event on our computers as many times as we want. Johannes Kepler, Edmond Halley, and their contemporaries would have been astonished by this capability.

After the 2012 transit ended, I thought about the observers who will see the next transit in 2117 and I wondered what tools they will have at that time. Surely it will be an amazing time, and some of those observers will be thinking about the observers of the previous transit in June of 2012 and wondering what the event was like for them.

Thanks to fellow Houston Astronomical Society member Bill Flanagan who contributed calculations to this article. (Any mistakes are mine.)

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