SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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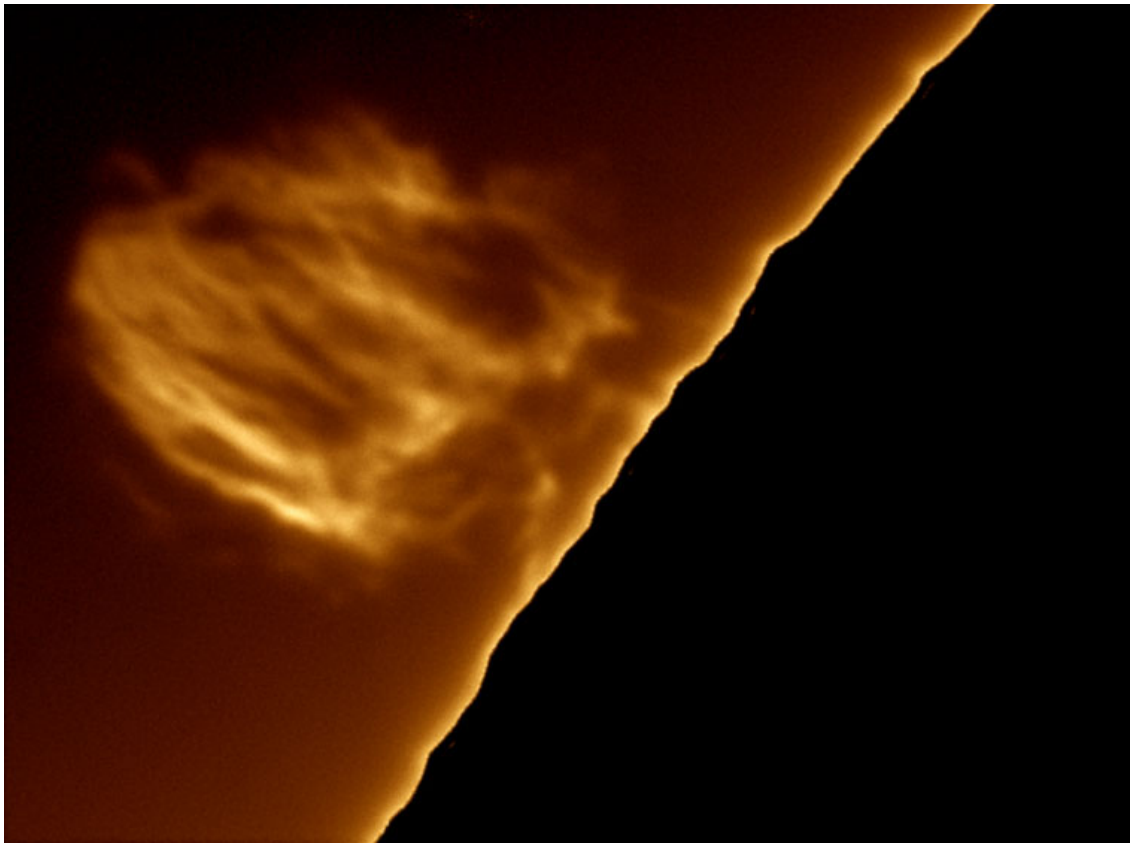
DON'T FORGET TO VOTE! BOARD ELECTION IN JANUARY!



Just the thing to help you think warm thoughts during cold observing nights: this solar prominence image was created by Pat Stoker from his observing site in Anaheim on November 6, 2008 using a Tak Sky 90 at f/35, a Solar Spectrum 0.1-angstrom test filter, and a Skynyx 2-1 imager.

OCA CLUB MEETING

The free and open club meeting will be held Friday, January 9th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. The speaker for this month is yet to be announced, so please be sure to check the website for more details!

NEXT MEETING: February 13th

STAR PARTIES

The Black Star Canyon site will be open on January 17th. The Anza site will be open on January 24th. Members are encouraged to check the website calendar, for the latest updates on star parties and other events.

Please check the website calendar for the outreach events this month! Volunteers are always welcome!

You are also reminded to check the web site frequently for updates to the calendar of events and other club news.

COMING UP

The next session of the Beginners Class will be held on Friday, January 2nd at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.

GOTO SIG: TBA (contact coordinator for details)

Astro-Imagers SIG: Jan. 20th, Feb. 17th

EOA SIG: Jan. 28th, Feb. 25th

Astrophysics SIG: Jan. 16th, Feb. 20th

Dark Sky Group: TBA (contact coordinator for details)

President's Message

By Barbara Toy

Happy New Year! By all the signs, we're in for an interesting time in 2009!

The start of the new year is traditionally a time of hope as well as good resolutions – which are probably themselves evidence of hope! – and my hope for this new year is that we will all be able to put aside our philosophical, religious and political differences enough to work together to solve the major problems facing us. That's a hope on the societal level – we in the club seem to be doing a pretty good job of that overall, I'm happy to say, which shows that it *is* possible when people are willing to focus on the interests they share instead of their differences. High-mindedness goes only so far – I'm also hoping for clear skies around new moon weekends, and that January and February won't be as cold out at Anza as December….

This also is a time of year when everyone pulls out their crystal balls (or the current equivalent) and forecasts what the year will bring. I feel reasonably safe in forecasting that the earth will continue to spin on its axis and to move on its established orbit around the sun, that we will see the same progression of constellations across the sky over the course of that orbit as we did last year and all the years before that, and that, around next December, we'll all be wondering again where the year went and how it went by so fast…and I profoundly hope we'll all be breathing a collective sigh of relief because the worst of our current economic problems are clearly behind us by then!

Elections

If you get this before the January general meeting, please be sure to vote! If you get this after the January meeting, I hope you *did* vote – thank you if you did – but I can't tell you the results yet because as I write this it is still the middle of December. After all, there could be a massive write-in campaign or some other surprise…so, stay tuned! We'll post the results on the website when they're official.

Members Night 2008

If you missed the general meeting in December, you really missed an excellent set of presentations! Our members are involved in a lot of interesting projects and have unique experiences – and it's really great to hear about them. If you've got something you're involved in, or a topic of club-related or astronomical interest you could present, please get your name in to Craig Bobchin early to be one of the Members Night presenters next December.

The presentations this year started with Lorna Pecararo, talking about her experiences with "Project Bright Sky," a program started by Frank Busutil and the Pomona Valley Amateur Astronomers to bring visual astronomy to the blind. Frank was originally one of the presenters, too, but wasn't able to make it because he had to work that night – he introduced us to Project Bright Sky over a year ago, and several OCA members, particularly Lorna, Chris Buchen, Peg Peterson and Judy Schoeffler, became actively involved. Lorna is a retired teacher, and talked about teaching astronomy to blind students at the Braille Institute in Orange County, and, in particular, about the study aids she's created using various materials she had at home or found at a local craft store, to help the students understand the concepts she presents in her classes through using things they can explore by touch.

She brought a number of examples, and they showed a lot of ingenuity – how, for instance, do you demonstrate the structure of an atom and how electrons move from level to level in a simple model that uses touch instead of sight? Her model was on a firm piece of card stock and used a plastic "jewel" for the nucleus and different types of string and ribbon to give different textures to different parts of what was shown, so what we normally see distinguished by color or different types of lines could be distinguished by touch. A set of circles of different sizes and textures bound together in a large loop of ribbon were properly scaled to allow students to compare sizes of different planets; the large planets were too large to include in that set, but she found additional items, such as a globe that was already in the classroom and a hula hoop, to show their relative size in a way that could be felt. One model of the sun she created used some circles of bridal veil material to depict the sun's corona in properly diaphanous form. As someone in the audience said at the end of her presentation, these types of tactile aids could help sighted people as well as those who can't see.

The second presentation was by Larry Adkins, and started with the celebration of the 400th anniversary of the development of the telescope in the Netherlands by the Antique Telescope Society – a nice precursor to the International Year of Astronomy, with its reminder that Galileo didn't actually invent the telescope, but he did improve it and was the first to use it to observe celestial objects. Larry's pictures of what they saw in the Netherlands when members of the ATS were there for that celebration were very interesting, and then he took matters to another level by telling us about a past club member, Bill Schaefer, known for his Schaefer mounts, which were built in his shop in Fullerton. I'd heard of the mounts many times since joining the club, but never knew much about them or the man behind them, so that was a real treat. If you want to read the information Larry has collected about him so far, please see his webpage on the subject, at http://www.cerritos.edu/ladkins/Web%20Page/Articles/Bill_Schaefer/BillBio.htm.

The next presenter was Reza AmirArjomand, who is our new website editor and also a candidate for the board, on how he met with Orange County Astronomers. It turns out that his story is the flip side of what Liam Kennedy told us about after he went on

an astronomy trip to Iran several years ago with a group led by Mike Simmonds, taking telescopes and other equipment to amateur groups there, meeting with local astronomers, participating in viewing events and lecture presentations, and so on. This was one of the trips that caused Mike to start Astronomers Without Borders. Reza was a student in Tehran at the time of that tour, heard about these visiting astronomers and managed to go to one of their presentations, where he met Liam. At the time he didn't know he would be approved for immigration to the United States, or that he would land in Orange County when he came here. And now, he's an active member in Liam's club and managing the website that Liam designed for us…and we feel very lucky to have him here!

As you can see, these talks were all very different from each other, and the last talk, by John Hoot, was different yet again. The title he gave us was "Measuring the Parallax of a Satellite," but what it was really about was solar sails as a way of propelling spacecraft. They need to test the concept before actually using one to propel a long-distance spacecraft, and, as part of the test, they need to be able to get accurate measurements of the test devices' speed and orbits. Both the Planetary Society and NASA have projects planned and, to make the most of the research dollars available, they've sought the help of amateur astronomers to gather the data to make the necessary measurements, with processing to be done with excess time on a lot of volunteers' computers similar to the process developed for the SETI project. John's one of the astronomers who responded to the call for help – and measuring the parallax of satellites is a way to practice for the real thing, when a solar sail device makes it into space (so far, terrestrial glitches have kept that from happening). For more information on the Planetary Society's Cosmos 2 project, see http://www.planetary.org/programs/projects/solar_sailing/, and for NASA's NanoSail-D project and past projects, see http://science.nasa.gov/headlines/y2008/31jul_solarsails.htm. If you're interested in getting involved in this yourself, please contact John Hoot at observatory@ssccorp.com.

Many thanks to Lorna, Larry, Reza and John – it was a great evening, and they all gave us food for thought well beyond the meeting itself!

Members Helping Members

People sometimes ask me why they should join the club, usually when I don't have a nice, well-thought-out response ready. I recently saw a good example of one of the best reasons for becoming active in the club. At a recent star party, one of our members was having problems getting her system to focus. While she and I were talking about the problem, a couple of other members in the vicinity joined in what quickly became an impromptu diagnosis session. Before long, they had figured out the probable cause and what she needed to add to her equipment to correct it. She didn't have those parts with her, but, between them, these other two members were able to supply what she was missing, so she could find out in the field whether this solution worked, and actually do most of what she had planned on doing that night.

This kind of thing happens a lot at star parties and outreach events. Someone has a problem, and other club members chip in to figure out possible solutions or at least a way of jerry-rigging something in the field to salvage the session. Often, these are learning sessions for all concerned, and I think everyone involved gets a lot of satisfaction from the experience. Certainly, if I'm able to help someone solve a problem, it makes my evening more enjoyable.

If you're at a star party and have a problem with your equipment, don't let embarrassment get in the way of asking for or accepting help. Many times if you're working on something and having obvious problems, someone passing by or set up nearby will ask what's wrong – don't turn down that implied offer of help, as often just telling someone about a problem will make you realize where you may have made a mistake or suggest a new approach, or the brief assistance of another pair of hands will get you past your impasse. If you need to seek help, it's a good idea not to ask anyone who's preoccupied at the time with setting up their own equipment or dealing with a problem of their own. If the first person you ask can't assist you, maybe he or she could direct you to someone else who can. If not, you should move on to someone else until you find someone who can help you, or it's clear that your particular problem is beyond our local ability to solve. If you don't feel comfortable asking people you don't know (yet) for help, you can look for any club official on site (that would include any officer, trustee, and people like Don Lynn, the Anza Site Coordinator, or Steve or Sandy Condrey, the Anza House Coordinators, or Steve Short, the Black Star Canyon coordinator), and they should be able to connect you with people who are likely to be able to help you if they can't help you themselves.

Winter at Anza

As I write this, we've just had a couple of arctic storms come through, bringing snow levels incredibly low (the mountains – San Gabriels, Santa Anas and San Bernardinos – were all particularly gorgeous around December 17 and 18, when I happened to be driving around where I could admire them!), and bringing temperatures at Anza down to the 20s. We also had snow at our Anza site, as shown in the picturesque view captured by the webcam in his observatory that Leon Aslan posted on the club website (see http://www.ocastronomers.org/astroimages/album.asp?ID=7429; a copy is also at the end of this article). Beautiful, but definitely chilly!

I do enjoy a good observing session, but have to admit that, when temperatures get down to the 30s and below, my enthusiasm for even the best viewing conditions tends to wane pretty quickly (especially if there's a wind-chill factor to consider). Having good cold weather gear helps postpone the moment when my body decides it's had enough of the cold and it's time to move into a warmer environment, especially if I put it on before I get really chilled. I mention this in case you're among the folks who give up on viewing or imaging activities in the winter because you think it's just too cold – having a good set of body coverings with good

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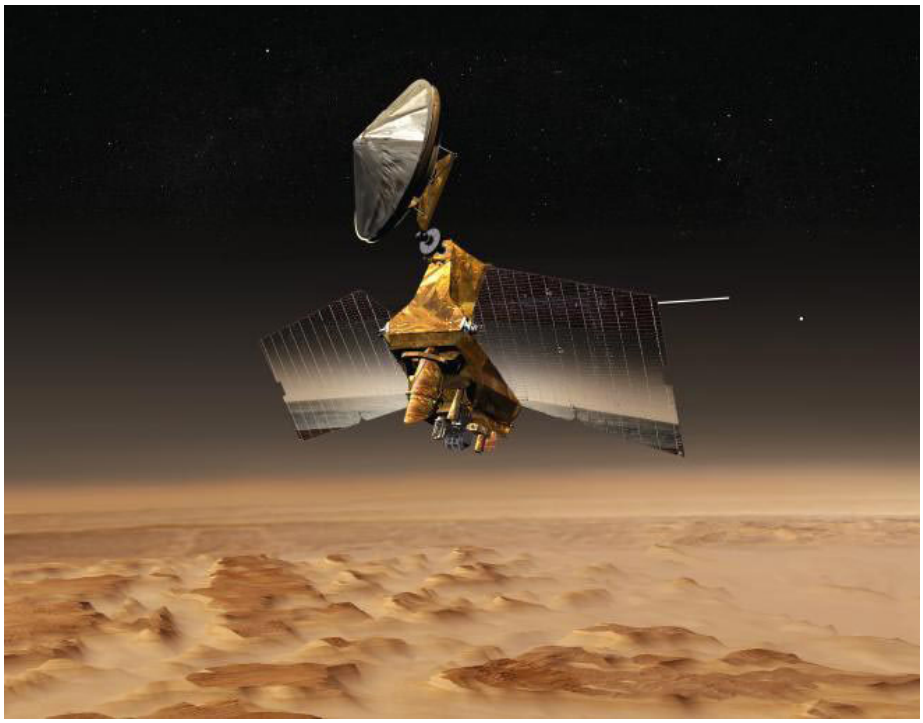
AstroSpace Update

January 2009
Gathered by Don Lynn from NASA and other sources

Mars Odyssey (orbiter) – Scientists analyzed data from Odyssey's gamma-ray spectrometer, measuring concentrations of potassium, thorium and iron in relation to suspected ancient shorelines on Mars. Their conclusion was that 2 shorelines exist, one for an ocean that covered 1/3 of the planet, and another marking a younger ocean only about half the area. Each apparently occurred billions of years ago. Shallow water within the shorelines evidently concentrated dissolved minerals that had been washed down from highlands. Mars Global Surveyor laser altimeter data were used to determine elevations, which established the boundaries of those oceans. Much of the shorelines could not be found from images because on Mars lack of tides and possibly lack of waves due to ice make the shorelines look different from those on Earth.

Mars Science Lab (MSL) (rover) has been postponed until 2011 because there is insufficient time to fix and test development problems before the planned launch in 2009. Missing a launch window for Mars requires waiting for Earth to make another orbit relative to Mars, which takes 26 months. MSL will be the first lander to be actively guided during entry to the planet's atmosphere, so can be targeted more precisely. It is far too heavy for parachute or airbag landing, so will be lowered on a tether from a hovering rocket. The rover is as large as an SUV, and is nuclear powered, so it can operate day and night, and does not have to land where sunlight is plentiful. It has a larger instrument load than previous rovers (10 times larger), and will travel many times as far, over rougher terrain. 4 landing locations have been chosen, the final decision to be made later, all 4 being places that had wet conditions in the past. In retrospect, it is not too surprising that with all the new capabilities, problems during development would arise, ultimately resulting in the delay. MSL will be worth waiting for.

Mars Reconnaissance Orbiter (MRO), using its ground-penetrating radar, detected many glaciers on Mars in mid-latitude regions (35 to 60°). It had been thought that glaciers would not last long in mid-latitudes, but apparently a thin covering of soil and rock protects these glaciers. The discovery clears up the apron mystery. Since the 1970s a large number of features have been seen on Mars that have been termed aprons, gently sloping areas containing rocky deposits at the bases of taller features. It has never been clear what the aprons are until these observations that show glaciers fill the aprons. It is believed that the mid-latitude glaciers formed in the past when the planet's climate was different, such that sufficient snow fell in the mid-latitudes to form glaciers. With the current climate, this occurs only near the poles. It is known that over millions of years the tilt of Mars' rotation axis changes drastically, which is believed to substantially change the climate. The apron-glaciers contain the most known water on Mars outside the polar areas, and might be a source of water for future exploration of the planet.



MRO also found repeating patterns in thick stacks of sedimentary rock layers, indicating that climate cycles persisted for millions of years. Rocks exposed inside craters in the Arabia Terra region show repeating dozens to hundreds of times. Bundles of a particular pattern of 10 layers repeat, probably because of the known 10-to-1 pattern of changes in the tilt of Mars' rotational axis. If axis tilt is the cause, then at least 12 million years of climate history is represented in the longest stretch of the layer patterns yet seen. The analysis was made possible by high-resolution stereo images of the layers, which allowed determining the thickness of each layer.

MRO completed it planned primary mission of 2 years and is beginning a new 2-year phase. It has returned 73 terabits of data, more than all earlier Mars missions combined. It has imaged nearly 40% of the planet with house-sized resolution, and 1% with desk-sized resolution. The mineral mapping instrument, with stadium-sized resolution, has covered almost 60% of Mars. About 700 global weather maps have been returned, as have hundreds of ground-penetrating radar observations. Many images are repeated from different angles, allowing stereo images that show the heights of features.

Mars Express – Scientists have been puzzled by the light-colored layered deposits on Mars known as LTDs (Light Toned Deposits) since their discovery in the 1970s. New observations by Mars Express suggest that the LTDs formed when large amounts of liquid groundwater burst through the surface. The observations also yield a younger age for LTDs than previously believed.

Martian atmosphere – A study of old data from Mars Global Surveyor showed that chunks of atmosphere are ripped away from the planet by the solar wind, not the smooth loss of atmospheric molecules that was expected. The smooth loss theory was having trouble explaining why there is so little air on Mars today, less than 1% the pressure found on Earth. This discovery may solve that problem. Surprisingly the loss of chunks occurs above the magnetic spots on Mars, the areas where scientists expected that the magnetic field would deflect the solar wind and prevent atmospheric loss. It appears that occasionally magnetic field lines from the magnetic spots on the planet connect with magnetic field lines from the Sun, trapping a chunk of atmosphere magnetically, that then sails off into space.

Cassini (Saturn mission) – There are 2 general theories on the source of the geysers on Enceladus: Trapped underground liquid water, or ice in cracks in the surface being exposed to space during tidal flexing. There are variations on the theories too. The recent passes of Cassini by Enceladus are gathering data to try to distinguish between these theories. The latest data tends to support a liquid water source. The leading non-liquid theory predicted that more material would be ejected at the time when tidal forces were opening the cracks, but a measurement of geyser material made during crack opening measured less than a later measurement during crack closing. Other observations, such as the speed of ejected material, seem to fit what is predicted if liquid water is nozzling into the cracks and then shooting upward. Further observations will be made, and further theoretical work will be done to explain how water gets melted under the surface.

Exoplanet has been found that orbits closest to a red giant of any one known. It is about 6 times the mass of Jupiter and orbits HD102272, a star about 1200 light-years away in Leo, as closely as Venus orbits our Sun. Red giants swell to enormous sizes, and so eventually (within 100 million years or so) it is expected that this star will expand to swallow the planet. There is a hint in the data that a second planet exists orbiting this star, and if this turns out to be true, it would be the first known multi-planet system orbiting a red giant.

Yet another exoplanet has been imaged (there were 4 reported last month), this time orbiting Beta Pictoris, a star long known to have a debris disk, and predicted to have planets. The new image was taken in infrared by the Very Large Telescope in Chile, using adaptive optics. The planet is a little closer to its star than Saturn is to our Sun, so this is the closest to a star that a planet has yet been imaged.

Exoplanet size – A new camera, which is much more sensitive to small changes in light, mounted on the 2.2 meter telescope in Hawaii, has measured the diameter of an exoplanet as it transits in front of its star. Less sensitive measurements had yielded a suspiciously large size for planet WASP-10b, but the new measurement showed it to be smaller than theory predicted, meaning the planet is one of the densest planets known. The planet is about 300 light-years away. The new camera uses an orthogonal transfer array, which is similar to a CCD, but with all-direction shift capability. It measures light level to a precision of 1 part in 2000, which is 2-3 times better than the best ground-based CCDs. This is approaching the precision needed to detect Earth-sized planets transiting in front of stars. Previous precision has been finding roughly Jupiter-sized planets.

Cosmic rays – 2 different teams, using different cosmic ray detectors, have announced that they have found sources in the sky producing excesses of cosmic rays, which are subatomic particles arriving here at tremendous speeds. Previous attempts seemed to show that the rays come from all directions. The first group showed that the excess had only certain energies, between 300 and 800 Gev (billion electron volts). The source could not be farther than a few thousand light-years, since collisions and magnetic effects would have slowed the cosmic rays down if they had traveled farther than that. Guesses as to the source include pulsars, black holes or annihilation of dark matter. The second team was able to pin down locations with excess cosmic rays, and they are a large area on each side of Orion. The locations of cosmic ray sources have eluded scientists since their discovery long ago, because the magnetic field of the Milky Way bends the paths of the particles.

Brown dwarfs – It has long been a puzzle as to whether brown dwarfs form like stars form or like planets form. Brown dwarfs are those objects larger than planets, but smaller than stars. They briefly fuse heavy hydrogen, but do not have sufficient mass to fuse normal hydrogen, the source of energy that powers normal stars for up to billions of years. Stars form when gas clouds collapse from gravity, while planets form from material swirling in a disk about a star, shortly after the star forms. New observations with the Submillimeter Array Telescope of a brown dwarf in the formation stage showed that it displayed jets spewing out like those that occur when a star forms. As expected, the jets contained much less mass than a typical forming star's jets. So at least in this one case, a brown dwarf forms like a star forms, but scaled down in size.

Nova – A team of researchers observed a nova explosion inside a planetary nebula for the first time in over a century. Many stars churn out a cloud of gas late in their lives that we call a planetary nebula, due to its shape and color resembling, for example, Neptune. A binary pair of stars, late in their lives, may have one star dump enough material on the other to start a nuclear reaction on the surface, and that reaction suddenly makes the star vastly brighter, a phenomenon known as a nova. As one might expect, a nova is a smaller explosion than a supernova, which blows apart much of the star. A nova within a planetary nebula is a fairly rare occurrence. By continuing to watch the light of the nova as it reaches and reflects off material in the nebula will show us exactly the structure of the nebula.

Supernova – New spectra of the light echoes of Tycho's supernova, observed to explode in 1572, showed that it was a typical Type Ia supernova. It was also a very asymmetric explosion. A type Ia supernova occurs when one of a pair of binary stars dumps so much material on the other that its mass exceeds what can be supported by the forces within atoms, and the atoms at the core of the star collapse with a huge explosion that blows away much of the star. Light echoes occur when the light traveled to a dust

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A Father, His Son, and the Moon

by Steve Condrey

Most of the time when I put together this newsletter I try to avoid writing content for it, or putting in my own pictures. This is mostly because I don't want to appear self-serving. And maybe some won't appreciate a piece that is admittedly sappy and sentimental, but sentiment is what makes this hobby more than just merely looking at the stars and what makes humans more than apes with a software upgrade. This photo my wife took last summer at Anza brought forth some thoughts I felt needed to be shared with all of you in the club.

I've now been a father for just over a year, and Alex has pretty much been the dominating factor in my life. He is a very bright and energetic little boy who's always making friends everywhere he goes. If he's ever proven disruptive at one of the monthly meetings, I do apologze; Sandy and I have agreed that she'll stay home with him until he's old enough to really appreciate what's going on. Still, much of my astronomy-related activity has taken a back seat to making sure my little man gets what he needs. I don't observe as much as I'd like, I haven't been to a lot of the meetings, and some months this newsletter is the only astronomy-related activity I take on.

But even so, the spirit lives on and is being handed down to a new generation. Alex is becoming quite a little astronomer in his own right! Two of his first words were 'sun' and 'moon' and Alex will gladly point out the location of the Moon for you. Let me point out that Alex found the Moon on his own, and pointed it out to us one night as we were driving home. The Moon, just a few days into the lunation, was showing a brilliant crescent just after sunset. We were driving west so we had a pretty good view. Alex was able to look out the front window of the car from where he was seated, point to the Moon, and say 'Moon is coming!'

And he loves looking through Daddy's telescope! On his second birthday in August Alex got to see the Moon through my 10-inch Newtonian. The look of astonishment on his face was priceless! I wish I'd been able to get a picture of it. Since then Alex has also learned where the planets are, and he enjoys listening to his Singing Planets CD in the car.

Anza, however, is his big adventure: he loves it out there! During the day Alex (who's also a budding geologist who will tell you all about big rocks and volcanoes) enjoys keeping the pads on the football field clear of rocks by loading up his dump truck. At night, before it gets too late or too cold, he loves his planets and the Moon.

And of course, when Daddy's away, we have a little ritual: if Alex misses Daddy, he just has to look for the Moon, and know that Daddy's looking at the same Moon. Apparently if I have to be away from him overnight, he does look for the Moon.

I don't know if Alex will develop a full-fledged interest in astronomy when he gets old enough to observe on his own. But just in case, I still have my old Celestron 4.5-inch Newtonian packed in storage for him, so we can bypass the department store telescope phase completely. And if not, I'll still love him anyway, of course. Besides, there's always the little girl I'll be adopting sometime after March...

Happy New Year, everyone. Be sure to share the skies with your family, especially your little ones. ■

NASA's Space Place

Superstar Hide and Seek
by Dr. Tony Phillips

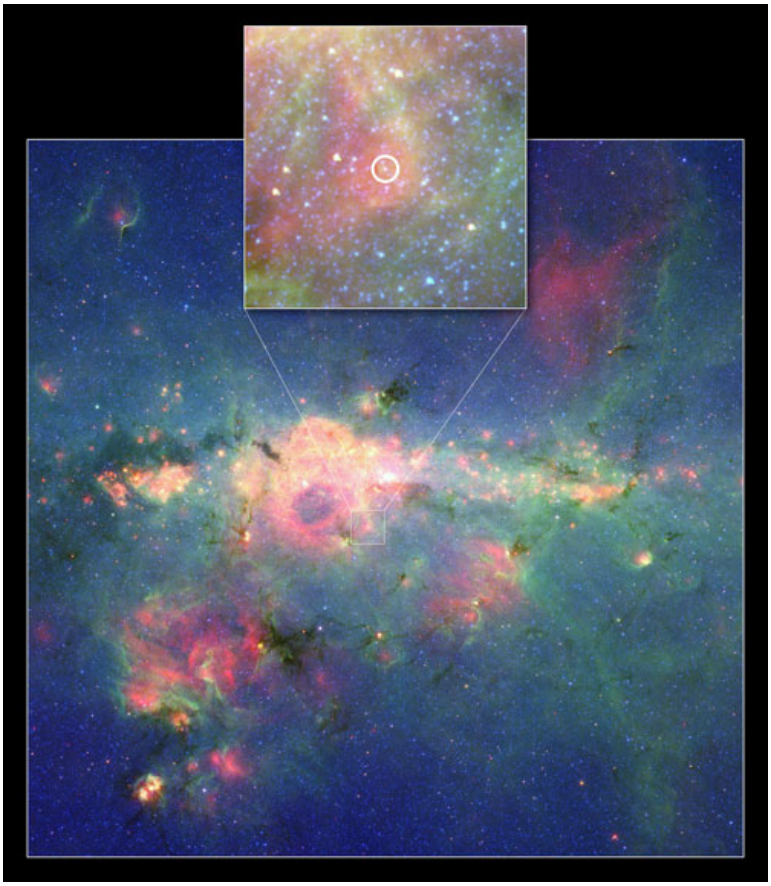
It sounds like an impossible task: Take a star a hundred times larger in diameter and millions of times more luminous than the Sun and hide it in our own galaxy where the most powerful optical telescopes on Earth cannot find it.

But it is not impossible. In fact, there could be dozens to hundreds of such stars hiding in the Milky Way right now. Furiously burning their inner stores of hydrogen, these hidden superstars are like ticking bombs poised to 'go supernova' at any moment, possibly unleashing powerful gamma-ray bursts. No wonder astronomers are hunting for them.

Earlier this year, they found one. "It's called the Peony nebula star," says Lidia Oskinova of Potsdam University in Germany. "It shines like 3.2 million suns and weighs in at about 90 solar masses."

The star lies behind a dense veil of dust near the center of the Milky Way galaxy. Starlight traveling through the dust is attenuated so much that the Peony star, at first glance, looks rather dim and ordinary. Oskinova's team set the record straight using NASA's Spitzer Space Telescope. Clouds of dust can hide a star from visible-light telescopes, but Spitzer is an infrared telescope able to penetrate the dusty gloom.

"Using data from Spitzer, along with infrared observations from the ESO's New Technology Telescope in Chile, we calculated the Peony star's true luminosity," she explains. "In the Milky Way galaxy, it is second only to another known superstar, Eta Carina, which shines like 4.7 million suns."



The "Peony Nebula" star is the second-brightest found in the Milky Way Galaxy, after Eta Carina. The Peony star blazes with the light of 3.2 million suns.

Oskinova believes this is just the tip of the iceberg. Theoretical models of star formation suggest that one Peony-type star is born in our galaxy every 10,000 years. Given that the lifetime of such a star is about one million years, there should be 100 of them in the Milky Way at any given moment.

Could that be a hundred deadly gamma-ray bursts waiting to happen? Oskinova is not worried.

"There's no threat to Earth," she believes. "Gamma-ray bursts produce tightly focused jets of radiation and we would be extremely unlucky to be in the way of one. Furthermore, there don't appear to be any supermassive stars within a thousand light years of our planet."

Nevertheless, the hunt continues. Mapping and studying supermassive stars will help researchers understand the inner workings of extreme star formation and, moreover, identify stars on the brink of supernova. One day, astronomers monitoring a Peony-type star could witness with their own eyes one of the biggest explosions since the Big Bang itself. Now *that* might be hard to hide.

Find out the latest news on discoveries using the Spitzer at www.spitzer.caltech.edu. Kids (of all ages) can read about "Lucy's Planet Hunt" using the Spitzer Space Telescope at spaceplace.nasa.gov/en/kids/spitzer/lucy.

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

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cloud many light years away from the supernova, and then get reflected to Earth, arriving for our observation as much as centuries later than the original flash. A similar analysis was done on the light echoes from the Cassiopeia A supernova remnant in 2007.

Red spirals – It has long been known that spiral galaxies tend to be blue, due to recent formation of hot blue stars, and elliptical galaxies tend to be red, due to containing older cooler stars. But recent surveys have turned up a few red spiral galaxies. They tend to be on the outskirts of crowded clusters of galaxies. The best theory explaining these is that star formation in them is being stifled by cutting off the supply of gas with which to form stars. It is thought that when a galaxy is drawn by gravity into a galaxy cluster, as it reaches the outskirts some process removes the gas from the galaxy. There are a few guesses for the gas removal process, but further observation will be needed to distinguish them. It is thought that falling farther into a galaxy cluster will eventually disrupt the spiral arms, turning the galaxy elliptical. Thus the red spirals are a transitional stage.

Hanny's Voorwerp – When we last updated this story, Hanny van Arkel, a Dutch schoolteacher, had volunteered (along with thousands of others) to classify galaxies for the Galaxy Zoo project. In the process she found a unique object near the galaxy IC2497, which became known as the Voorwerp (means "object"). Astronomers now think they have explained what it is. The super massive black hole at the center of the nearby galaxy is shooting a jet of highly energetic particles, which has heated (to over 27,000° F.) and ionized a part of a huge cloud of hydrogen gas. The glowing part of the gas cloud is the Voorwerp. Why was there a huge gas cloud next to the galaxy? The characteristics of the gas cloud seem to match that seen when galaxies pass close to each other, which causes tidal forces that throw outward a stream of gas. There is a group of galaxies in the direction of the gas stream, and they may have passed by IC2497 hundreds of millions of years ago. Further observations are planned.

Hubble Space Telescope (HST) has solved the puzzle of a starburst galaxy (NGC1569) that had no apparent cause for the bursts of new stars in it. A study of red giant stars in nearby galaxies failed to find the expected numbers of them in this galaxy. Further observation showed that the red giants were there, but dimmer than expected. Since certain red giants make passable "standard candles" for judging distances, this was done to determine the distance to the galaxy. It was found to be about 11 million light-years away, while former measurements made with ground-based telescopes had come up with about 7. This explained why the stars being studied were too dim, and what triggered the starburst. The new distance places it within a group of 10 galaxies that must be interacting gravitationally with it, causing much new star formation.

HST has detected carbon dioxide and carbon monoxide in the atmosphere of an exoplanet, the first time these compounds have been found on an exoplanet. The technique used was to subtract the spectrum of the star alone (in near infrared) from that of the combined star and transiting planet, to get the spectrum of the planet. Previous observations of the same planet by HST and the Spitzer infrared space telescope have found water vapor and methane. The star, HD189733, is 63 light-years away. The Webb space telescope, scheduled for launch in a few years, should be able to make much more sensitive measurements of exoplanet atmospheres.

International Space Station (ISS) – The joints that swivel the station solar panels to follow the Sun were repaired and relubricated in a series of spacewalks, in spite of the incident where 2 grease guns and a few other tools floated away because their container was not properly tethered. A number of amateur astronomers have spotted and even photographed the wandering tool bag as it orbits overhead. The other goals of the Shuttle mission were also accomplished, moving toward completion of facilities to house 6 aboard the station by May. Current station capacity is 3. The waste water recycling device appears to be working, after a few false starts and subsequent repairs. No water will be consumed from it until about February, after the output water is tested as safe several times.

Dawn (asteroid mission) has turned off its ion propulsion system now that it has gained sufficient speed for a flyby at Mars in February. That will gravity slingshot the spacecraft out to the asteroid belt. There in June the ion engines will be fired up again until it is on track to reach the asteroid Vesta in 2011. Over the lifetime of the spacecraft, its 3 ion engines will fire cumulatively for 50,000 hours, a record for spacecraft.

Juno (Jupiter mission) has been approved by NASA for launch in 2011, arriving at the giant planet 5 years later. The spacecraft will use a highly elliptical orbit over the poles, swooping down as close as 3000 miles from the cloud tops. 32 orbits are planned over 1 year. It will be the first solar powered mission to Jupiter. It will be a very efficient spacecraft to survive on the available sunlight there, only 1/27 the strength of light that Earth receives. Juno will study the hidden world beneath the clouds using instruments and techniques that penetrate them. The magnetic field, clouds, aurora and core will be the focus of observations.

Jupiter has a rocky core that is more than twice as large a previously thought, according to a new computer simulation of conditions inside the giant planet. The new result has the rocky core being 14 to 18 times the mass of the Earth. The core is made of layers of metals (chiefly iron and nickel), rocks, surrounded by ices of methane, ammonia and water. This supports the theory that the gas giant planets formed with the collision of rocky objects to form the core first, followed by capture of lighter materials. The computer simulation matched observations of the cloud surface of Jupiter only if the internal rotation is in the form of concentric cylinders rotating at somewhat different speeds. This is believed to be the way the Sun rotates also.

Comets – A long-term study of the abundances of 5 molecules in about 150 comets has shown that there are 2 general classes of comets, and one comet (Machholz 1) that doesn't fit either. The odd comet is quite deficient in the molecule cyanogen. The 2

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thermal properties, including hat and gloves, can make the cold of winter a manageable problem for a significant chunk of all but the coldest nights. And there are additional aids to give a bit of warmth where needed – those little chemical heat packs you can tuck in your boots, gloves, or elsewhere, for instance, can really boost the comfort level.

The point of this is that you shouldn't give up on viewing for the winter just because it's cold – if you do, you'll miss out on all those wonderful winter objects (is a year of viewing really complete without admiring Orion high up in a cold, clear winter sky?). There are a lot of options for what you can get, clothing-wise, to help ward off the cold (some suggestions I've heard – freezer suits, duck-hunting gear from the Cabela's or other similar sporting goods places, etc., or just good thermals, thinsulite pants and coat, and fleece layers in between, which is what I normally go with) and, if you're at Anza, there's the very civilized option of going to Anza House for a while to warm up if you get cold in spite of your precautions.

Here's hoping we have clear, dark skies so you can use that great cold weather gear to good advantage – and I hope to see all of you out at Anza this winter! ■

From left to right: Venus, Jupiter, and the Moon as imaged by Michael Mirjahangir from Huntington Beach, CA on November 30, 2008. Michael used a Canon Digital Rebel XTi with a 100mm lens (f/6.8, 800 speed, 2-second exposure) on a tripod to capture this image.

FOR SALE: brand-new items - 8'F/6 Discovery Optics 1.5" Pyrex Mirror cell; 8"University Optics Alum Mirror Cell; Vega-HP1-1.25"Focuser (Japan Made); Vega-3 Low Profile Helical 2" Focuser; 48 Rini2 Eyepiece in Bolt Case (this item not new but seems to be in good condition. Will sell these items separately for lowest price or as a package for $200 o/b/o. Contact Doug 562-598-6103

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classes were identified in the 1990s: "typical", and "carbon-chain depleted" (having low abundances of C2 and C3 molecules). It is thought that forming at different distances from the Sun caused the differences in these classes. Theories to explain why the odd comet does not fit these classes are: 1) the comet formed in another planetary system, 2) it formed farther from the Sun than the other comets studied, 3) the comet formed in the second class, but was heated later to deplete the cyanogen.

Comets in X-rays – It was a big surprise when X-rays emitted by a comet were first detected in 1996: the orbiting X-ray telescope ROSAT detected Comet Hyakutake. It took some time for theorists to explain how interaction of the solar wind with the material in the head of a comet creates X-rays. The Swift gamma-ray burst satellite has now seen 6 comets in X-rays, though it was not designed to observe comets.

Supermassive black hole – Scientists using telescopes in Chile, the Very Large Telescope (in infrared) and the APEX telescope (in submillimeter wavelengths, between radio and infrared), have observed simultaneously in different wavelengths as material falls into the supermassive black hole at the center of our Milky Way galaxy. For the first time the stretching of the material as it spirals in was observed. Flares in submillimeter waves were seen to occur about 1.5 hours later than in infrared. The delay is probably due to size or temperature changes as the material falls in. Friction in the material falling into a black hole heats it until it emits various wavelengths of light, shortly before it reaches the event horizon, where it disappears due to the immense gravity of the black hole sucking in even light.

Milky Way's black hole – A 16-year study in infrared of the stars near the center of our Milky Way galaxy provides the best evidence yet that a black hole with a mass of 4 million Suns exists there. One star was seen to make a complete orbit about the mass, yielding the most precise mass yet calculated for the black hole. The distance to the center of the galaxy was also calculated, again with the most precision ever, as 27,000 light-years. The mass and the size containing it provide the strongest evidence yet that the object at the center of the galaxy must be a black hole. The study found that the stars within 1 light-month of the black hole orbited in random planes, but stars farther away orbit in a single plane. This study confirms and adds more precision to another study of stars in that region announced recently by another team.

Instant AstroSpace Updates

Infrared images taken of Betelgeuse show that its motion of 19 miles per second through the surrounding interstellar gas is creating a **bow shock** 3 light-years across, where its stellar wind pushes the gas away. A bow shock is similar to the wave ahead of a boat traveling across a lake.

The new record holder for **dimmest star** (obviously including brown dwarfs) is a tie by a pair of essentially identical orbiting brown dwarfs, each of which shines with 1 millionth the light of our Sun (1 billionth, if only visible light is counted). They are 17 light-years away in the constellation Antlia and each has 30-40 times Jupiter's mass.

Meteorite fragments have been recovered from the fireball seen widely in the Calgary, Canada area on November 20. Most were pebble size and smaller, though the original object was estimated at 10 tons.

NASA and the European Space Agency have agreed to jointly build and run all future **missions to Mars**. This should allow a robotic sample-return mission (though not until after 2020), which was judged too expensive for either agency alone to execute.

The final plan for replacing the data unit that recently failed in the **Hubble Space Telescope** (HST) has determined that the delayed Space Shuttle mission to repair HST will be ready to launch May 12. The 11-day flight will include 5 spacewalks and should add many years to the life of HST.

Mars Express has over the past 4 years observed 9 aurora events with its ultraviolet instruments. Each event has occurred over one of the magnetic spots on the surface of Mars.

3 undergraduate college students in the Netherlands doing a project to analyze data from the OGLE project (which monitors huge numbers of stars for gravitational lensing) found evidence in the data for a **planet** transiting in front of a star. It is now the hottest star with a known planet, and the first planet found orbiting a fast rotating star.

A student group from Cambridge England launched 4 **teddy bears** in space suits into near space (about 20 miles) on a balloon flight, in order to test various materials and designs for space suits.

The first report from the **spider experiment** on the latest Space Shuttle mission was that they became disoriented by zero gravity and produced aimless random webs. Apparently they adapted, because a few days later they scrapped the webs and produced new flat circular ordinary webs.

The British government has approved the **MoonLITE** mission, which will orbit the Moon and send 4 penetrators into the surface, containing drills, sensors, accelerometers, seismometers and mass spectrometers. If the mission passes a review at the end of 2009, it will be launched in 2014.

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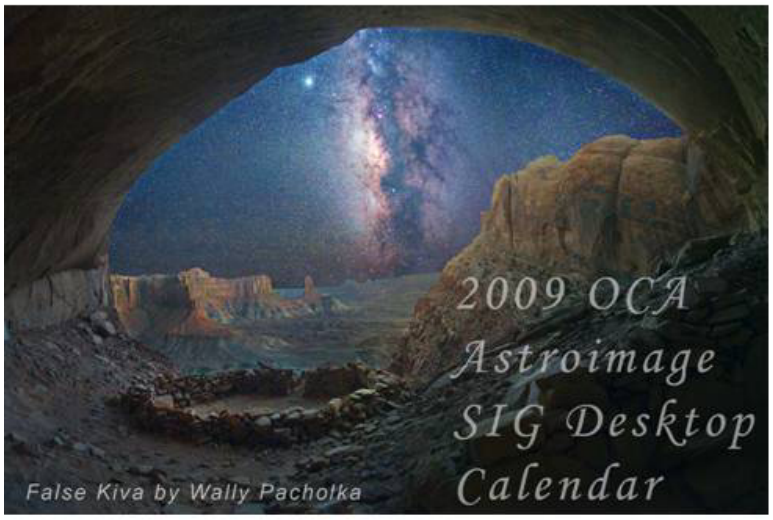

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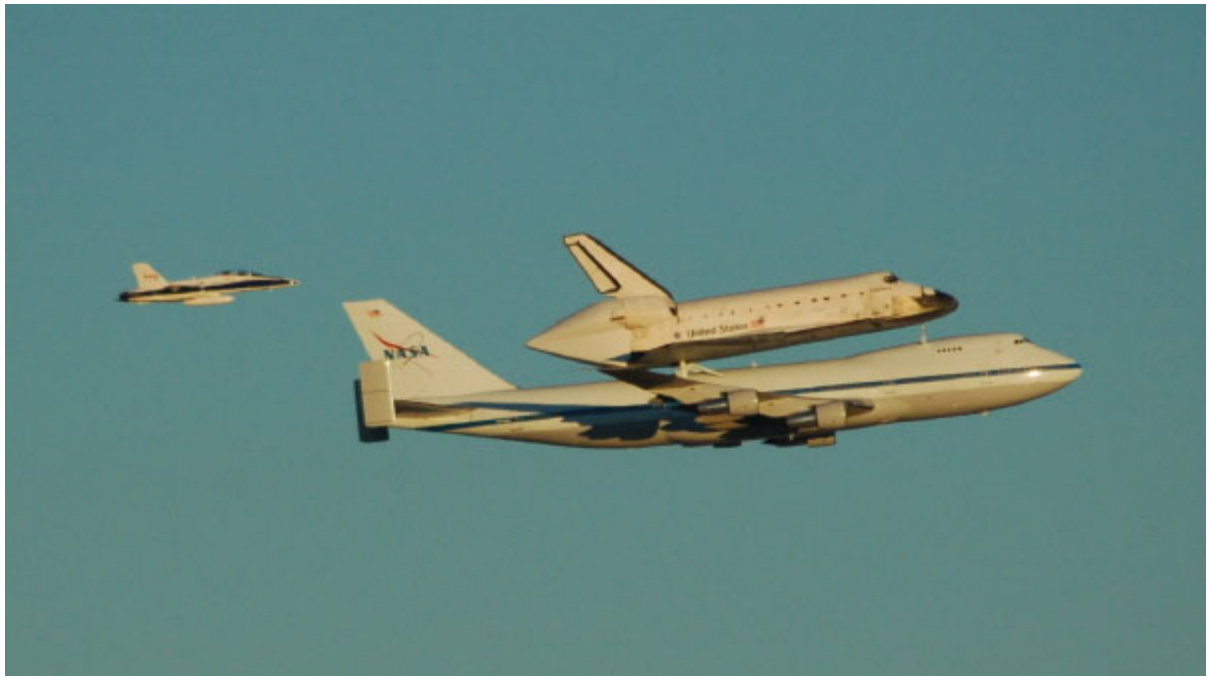

Space Shuttle *Endeavour* being ferried from Edwards AFB, December 10, 2008 (Jorge Rubino)

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