SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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GET YOUR APPETITE READY! ANNUAL STARBECUE ON JULY 18TH!

John Kerns and Don Lynn created this image of the Dumbbell Nebula (M27) on June 19th from Anza using an AP 152mm refractor with a Canon 50DA. The image consists of five 5-minute exposures composited together.

OCA CLUB MEETING

The free and open club meeting will be held Friday, July 10th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month, Dr. Rachel Kuzio de Naray of UC Irvine will discuss 'Dark Matter: The Invisible Mass of Galaxies'.

NEXT MEETING: August 14th

STAR PARTIES

The Black Star Canyon site will be open on July 25th. The Anza site will be open on July 18th. 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, July 3rd at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.
GOTO SIG: TBA
Astro-Imagers SIG: July 21st, Aug. 18th
Remote Telescopes SIG: July 22nd, Aug. 26th
Astrophysics SIG: July 17th, Aug. 21st
Dark Sky Group: TBA

July 2009 President's Message

By Barbara Toy

It always amazes me just how far north the sun seems to get each year as the days get shorter. Now that we're past the solstice, it's slowly starting its southward movement, though the period of full darkness is still far too short, and full darkness comes much too late for those of us who like to get in a decent amount of good observing and still have some time for sleep. Alas, that's the price we pay for more comfortable viewing conditions – and I do hope you're taking advantage of our temperate summer nights out at Anza or Black Star Canyon!

Southern California Astronomy Expo — Help Needed

As mentioned last month, the Southern California Astronomy Expo is returning to OPT. The first Saturday, July 11, includes a swap meet where clubs and vendors can sell things. I expected to help with the OCA booth that day, but will have to be in class all day in Los Angeles and so won't be able to make it. We need help manning the booth, so if you can donate a few hours to the cause, we would really appreciate it. We also need help the following weekend, when those in the booth will be there to give information about the club and publicize its existence and activities rather than selling things. If you can help out, please contact me at btoy@cox.net.

For the swap meet session, if you have astronomical equipment or other items you would like to donate to the club to sell there, please contact me so we can arrange to pick it up or to otherwise take delivery; anything you donate would be tax deductible. We could also sell equipment or other items for members on a commission basis, as individuals won't be able to sell things themselves at the swap meet. If you have something that you would like to sell this way, please let me know in advance, bring it to SCAE on July 11 and deliver it to the OCA booth. We will need your contact information and also your price range for selling the item, then we will do our best to sell it for you. The club would take a 20% commission on any sale and you would get 80%.

RTMC Astronomy Expo Revisited

Weather-wise, we never know quite what to expect at the annual RTMC Astronomy Expo. Most years, the days are hot and dusty and it cools down fast after sunset, becoming quite cold if you don't move around. Every few years, it's stormy over Memorial Day weekend, and that was our experience last year, when temperatures stayed in the 30s and 40s during the day, there was snow on the ground, and people experienced rain, sleet and hail as well as snow. Bad weather makes for good stories, but it does cut down on attendance. This year, we were back to the more usual pattern of warm days (fortunately, not as hot as some years), and chilly nights, but with very clear skies. Sadly, the infamous RTMC dust was very much in evidence this year – one of the advantages of the bad weather last year was that dust was not a problem.

Our May star party fell on Memorial Day weekend this year, and there was an obvious conflict between the two events. Some of us went to RTMC instead of the star party, some went to RTMC for part of Saturday and then headed over to Anza for the star party, and others skipped RTMC entirely (some took advantage of the holiday weekend to spend several nights at Anza). I'm told that conditions there were excellent on Friday and Saturday nights; I was there Sunday and though, as usual when I've missed the previous nights, I was told that night was not as good as the night before, viewing seemed excellent to me.

For me, the highlight of RTMC this year was the Club Officers Forum, with a panel of officers from the Riverside, San Diego, Pomona Valley, Los Angeles, San Bernardino and Antelope Valley clubs as well as ours (I may have missed or misidentified any – if I have, I apologize to anyone affected). It was a very diverse group, and there was a lot talk about the different approaches clubs have taken in many areas. We all have a lot of the same concerns, such as finding good speakers for our meetings, getting material for our newsletters and deciding how best to distribute them, dealing with insurance and potential liability problems, and dark site issues. There were a lot of people in the audience who would have been excellent additions to the panel, who asked some challenging questions and provided interesting comments afterwards. I think everyone on the panel found the experience enlightening – I know I did.

Another major highlight of the weekend was running into the first serious amateur astronomer I ever knew, Bill Hornaday, who was my family's neighbor in Fullerton for many years. Not only was he on the JPL team that built the Hubble Space Telescope, he was first person I knew who had his own observatory, built his own telescope and planned his vacation around a full solar eclipse. I have a much greater appreciation for that now than I did back then; we lost contact with him when he moved out of the area and he had no idea that I'd become a serious amateur astronomer myself. He's back in Southern California, still has his observatory, and I'm hoping to see it myself one of these days.

OCA at RTMC
In the past, the OCA booth at RTMC has also served as a fundraiser for our library. This has meant a lot of work for the last several years for Karen Schnabel, our current librarian, and also for our prior librarian, Cathy Weinberger and her husband Roy. Due to changing tastes and costs, it has become less effective as a fundraiser over the years, and Karen finally decided this year that it was not a cost-effective use of her time, particularly as she had other commitments over the holiday. We really appreciate all the time and energy she's put into the booth in the past, as well as her ongoing efforts to keep the library solvent and stocked with current materials.

We still want the club to have a presence at RTMC, since we are a major player in amateur astronomy in Southern California, and we want to show support for the event as well as publicize our club, so we are continuing to have a booth there. As he has for several years now, Bob Buchheim brought the canopy and a table for the booth this year, along with some donated items so the booth would have something to sell. Alan Smallbone kindly edited the AstroImage calendar to give us an RTMC special edition, running from June 1 through July 31, 2010, as another sale item in the booth. Ron Zukowski did an excellent job of running the booth on Friday and a good part of Saturday; fortunately, Craig Bobchin and I were able to cover the booth for part of Saturday, so he had an opportunity to enjoy other aspects of RTMC and didn't have to spend all of his time in the booth. Besides participating in the Club Officers' Forum and helping with the booth, Craig took the annual club picture at the booth, and Ron took several auxiliary pictures, as additional people showed up after the group photos were taken. We owe them all a hearty vote of gratitude for helping to make our presence at RTMC a success this year.

Every year, there are certain vignettes that stand out in my memory of that year's RTMC. This year, they include James Thorpe celebrating his return to health after some life-threatening medical experiences and then winning the new Lightswitch ETX from Meade in the RTMC raffle Saturday night, which they said was the first one they had actually delivered to a consumer. I certainly hope that we will see him using his new telescope at Anza one of these days now that the weather is warmer and he's feeling better.

Changes at RTMC
Times are challenging for all kinds of events, including RTMC. It started out as the Riverside Telescope Makers Conference, with its primary emphasis on telescope making. Since then, the range of good telescopes at decent prices has continually expanded, and people that might have made their own in the past to save money now often find it cheaper as well as easier to buy one instead. The interests of people involved in amateur astronomy have also changed over time – I haven't done any definitive study, but in just the 10 years that I've been active in the community, it seems that the availability of more consumer friendly equipment has brought more "ordinary" people into the hobby, making it much more of a populist hobby than the exclusive realm of dedicated star hoppers and the technologically savvy. Those who can star hop their way around the heavens to find what they want to observe without computer assistance may consider those who rely exclusively on various types of "go to" systems as less serious than amateurs of the past, but it's certainly made the hobby much more accessible to more people. All of these changes mean that time honored events such as RTMC have to change as well to remain meaningful to the amateur community and to attract enough attendance to stay in business.

Well, RTMC has announced some changes of its own that they hope will bring in more people next year. The most significant aspect is that it won't be on Memorial Day weekend, but will be scheduled on the closest new moon weekend in May. They have also convinced SAS to move its meeting so that it will still be in the week before RTMC. In addition, although there will be no formal events planned then, the RTMC folks have access to the YMCA Camp Oakes site for several days before the formal proceedings start, and people will be allowed to camp and star gaze there for a couple days before the main event, and possibly afterwards, too.

Unfortunately, this means that RTMC would conflict with the various club star parties every year instead of every few years, which means that those who have strong ties to their home observing sites will have to have very strong reasons to choose to attend RTMC instead of their local star parties. Since I enjoy both and certainly want to see RTMC remain viable, this is a definite concern.

If you have any opinions regarding this change, whether pro or con, or if you have any suggestions for how the RTMC experience might be improved, I suggest you share them with the Powers That Be at RTMC. Unfortunately, they don't have a central contact address, but some email addresses that appear on their website are: registrar@rtmcastronomyexpo.org (for registration) and gmalcolm@charter.net (for sponsors); if you ask for your comments to be forwarded to the appropriate people, they should be willing to do that.

Whether this change remains permanent or not, and regardless of what other changes they might decide to make, I certainly hope that RTMC will be around for many, many years to come, bringing people together in the interest of astronomy.

(continued on page 9)

This month's theme of the International Year of Astronomy is "Black Holes"

Shedding Light on Black Holes

July, 2009

By Tom Koonce

Antelope Valley Astronomy Club

Lancaster, California

Black Holes... Just their name sounds like something out of science fiction. Maybe this is one reason why they have been the focus of misconceptions and misguided theories. This month, the theme of the International Year of Astronomy is centered on the objects that weigh heavily (pun intended) on the minds of theoretical physicists and leading astronomers… Black Holes.

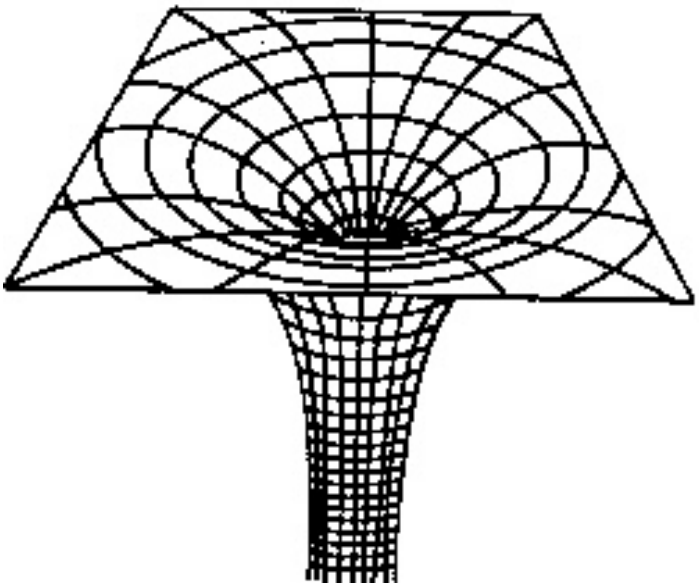
First a bit of background on the subject.

The gravitational force exhibited by a celestial body is directly related to its mass and inversely proportional to the square of the distance which the object is away from that mass. So how does a black hole generate its enormous gravity even though its mass is reduced to an infinitesimal point?

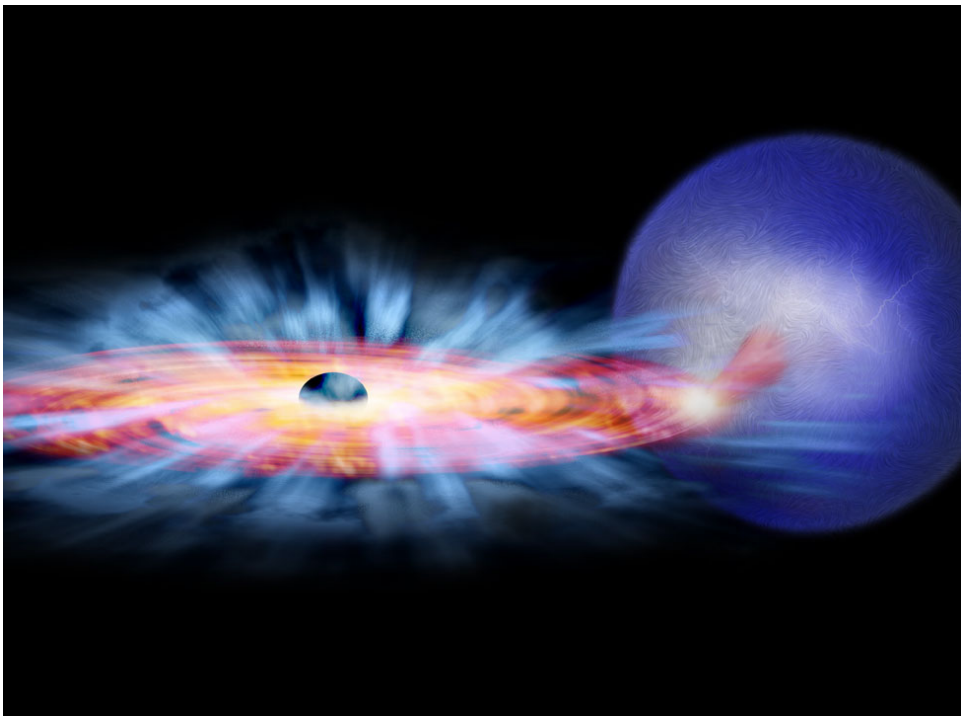
Consider a star with the mass and radius of the red supergiant Betelgeuse. Under normal circumstances, an object could orbit the star at a distance outside of Betelgeuse's stellar atmosphere. But if the entire mass of Betelgeuse was compressed down to become a black hole and in the absence of Betelgeuse's stellar atmosphere, the object could pass much closer to the black hole's center of mass… so close, in fact, that the gravitational force it could experience would be incredibly high.

Another concept to realize is that if the Sun were to suddenly be replaced with a black hole of equal mass, the Earth would continue to orbit it in the exact same manner as it does today, except that the lack of sunlight would render the Earth incapable of sustaining life.

A common question that comes up during casual conversation about this subject is, "If I went through a black hole, where would I go?" The straight-forward blunt answer? "To your death!" You literally would be torn to pieces by the gravitational tidal forces during your approach to the event horizon and then, with unerring certainty, what gelatinous mess remained would be squashed much, much flatter than a pancake as your remains fell deeper into the gravity well. Black holes are not a mode of transportation to another universe, but they are efficient "matter compactors," sweeping up all mass that passes too near. Of course they can't draw in matter from light years away, but as matter falls into a black hole it becomes (perhaps) infinitely compressed by its overwhelming gravitational force.



Imagine what a black hole looks like and you probably picture the graphic popularized by the media; a two dimensional plane with a funnel-shaped hole descending towards the black hole's singularity. This stylized perception of the three dimensional nature of the object has misled many people to think of a black hole as a hole in space, like a hole in the backyard, or perhaps a tunnel in space-time leading to other parts of our own universe. The event horizon is a spherical region around the black hole, inside of which the black hole's gravity is so strong that nothing can achieve escape velocity - nothing, not even light. Because light can't escape, space artists have envisioned the object as a black blob against a field of distant stars. This black blob is surrounded by a fairly bright disk of material caught in the gravitational field. Why is it bright? As all of the dust and matter spirals in closer to the black hole it is rubbing against other matter, heating it up by friction until it gets to millions of degrees. It is this dust outside of the event horizon that is radiating light.



This is an artist's representation of GRO J1655-40, a binary star system observed in April 2005 by Chandra. This binary consists of a black hole and a normal star shown in blue. Gas is being pulled away from the star and falling onto a red disk spinning around the black hole. Some of this gas spirals in towards the black hole, generating copious amounts of light along the way. (Credit: NASA)

What would a glimpse below the event horizon look like? How important would it be to you to find out? It would be a one-way trip to find out. Nothing, not even light, can escape from below the event horizon… but photons of light could orbit the black hole. Since there is an equivalent mass for the energy of a photon ($E = mc^2$), light is affected by gravitational forces. Photons can orbit a black hole if conditions are right. Since there are photons continuously falling into black holes, many must get trapped in this manner. We can't see the photons because they are orbiting and not radiating outward and striking our retinas. If we were somehow able to glimpse just below the event horizon, on that one way trip into gravitational flatness, I believe you would see bright light surrounding you; you would see photons instead of blackness. Your final view would be of all of the light shed upon the black hole.

(continued from page 3)

Observatories at Anza

One of the sad consequences of the current economic downturn has been that a number of people who were hoping to build observatories at Anza if and when sites became available have had to postpone those plans indefinitely. However, in spite of this, as of this writing five people on the Observatory Interest List have committed to building in the immediate future and have selected sites out of the six building sites that Gary Schones was able to clear in the three areas below the Member Observatory level, and the sixth site may be taken soon, as well, which means that you should be seeing some significant building activity out there before too long.

Another area where you will be seeing some significant building activity is the unfinished concrete block observatory near Mars Hill. John Castillo and Tom Kucharski are the new licensees for the observatory, their plans for renovating and completing it have been approved by the Board, and they plan to finish the project by Thanksgiving. John managed to come up with plans for a low roll-off roof that will have minimal impact on the sightlines for the surrounding areas but meets Code requirements and will have enough clearance that they can open it without problems. They plan to use or remove the old building materials that have been stacked around the observatory for years, clean the calcium deposits off the walls and refinish them, and otherwise improve the looks and safety of that part of the Anza site immensely.

If you are not currently on either the Pad or Observatory Interest List but are interested in building a pad or observatory at Anza in the future, or would like your name available in case one of the current licensees for a pad or observatory wants to find a buyer for their interest, please e-mail me and ask to be put on the appropriate list. I maintain separate lists for pads and observatories, and add names in the order in which I receive notice of interest. Priority on the list doesn't necessarily mean priority in obtaining a site or in selection of a site, as are other factors that come into play, such as who is actually ready to move forward with plans when sites become available, whether there are special needs associated with a particular proposed observatory and whether a particular observatory proposal would be appropriate for the proposed building site, but it is a factor

(continued on page 10)

AstroSpace Update

July 2009
Gathered by Don Lynn from NASA and other sources

New standard candle – Type Ia supernovas are the most reliable standard candle used for determining larger distances in the Universe. Since we know how bright these are, and we measure how bright one appears, we can calculate how far it must be in order to appear that bright. Since Type Ia's are not exactly the same brightness, the color and the timing of its rise and fall in brightness must be measured to determine exact intrinsic brightness. The resulting distance is still good only to about 8-10%. A new way of sorting out exact brightness of a Type Ia has been found which is simpler than watching the rise and fall for weeks, and is a little more accurate (about 6% in distance). A study of 2500 spectra taken of 58 different Ia supernovas has determined that the intrinsic brightness can be calculated from the ratio of the brightness of two lines in the spectrum (642 and 443 nm). This is independent of when the spectrum is taken, of the level of heavy elements, and how much dust is blocking our view, all problems that have to be dealt with performing the classical distance determination.

Another new standard candle – For shorter distances in the Universe, Cepheid variable stars are the most reliable standard candle. Measuring the period of the brightness pulsations tells us how bright the Cepheid is. However, only standard Cepheids have been calibrated for this purpose. Ultra long period (ULP) Cepheids have now been calibrated as standard candles also. The advantage of ULP Cepheids is that they are much brighter and can therefore be seen out to about 3 times the distance that a standard Cepheid can. The study that calibrated the ULPs also found evidence that theory of how such stars evolve is not correct. It was known that standard Cepheids pass through their pulsating phase several times, as the temperature of the star rises above then drops below the temperature range at which pulsations can take place. It was thought that ULPs go through the pulsating phase only once, when their temperature falls through the critical temperature. However one of the ULPs in the study was found to be going through the pulsating phase as its temperature rose, so ULPs may go through the pulsating phase more than once.

Yet another – A method of measuring distances to galaxies, which was developed 10 years ago, has been extended to a galaxy (UGC 3789) 160 million light-years distant, about as far away as the Cepheid method is useful. The new method involves measuring both the linear size and the apparent (angular) size of a disk of material orbiting the galaxy's central black hole. Three radiotelescopes, including the Very Long Baseline Array, were used to observe the water molecule maser in the disk. The linear size is calculated from the rotational structure of the disk. A maser is similar to a laser, but working at radio wavelengths. Masers occur naturally in some interstellar matter. Other galaxies have been found with suitably bright masers, some about twice as distant, and observations are underway to determine their distances with this new method.

Mars rover Spirit is still sitting in the same spot where it was when controllers decided to stop commanding driving until a plan is developed to get it out of the soft soil into which it sunk up to its hubs. The rover has successfully traversed slopes as steep as the present one, and soil as soft, but not at the same time. The project team has built a replica at JPL of the soft soil area and is trying methods of escape with test rovers. A diagnostic test performed on the real rover showed that its left middle wheel is neither broken nor jammed, despite an engineering status that indicated it might be. Also the rover moved slightly the last time that all wheels (except the broken right front) were turned. Both of these are good signs. The Martian winds have blown dust off the solar panels 4 times in the past month, resulting in over 800 watt hours of power being generated daily, nearly as good as when new. This has allowed additional science and communications to be performed, and is sufficient to maintain the rover until Martian fall without further movement to optimize sun angle. So the team has plenty of time to develop an escape plan. Pictures were taken of the bottom of Spirit with the microscope, the only camera on the end of the movable instrument arm. Though out of focus (as expected), it showed enough about the rocks and soil underneath to help build the replica at JPL. It is not clear (due to the focus issue) whether the rover is quite touching the rocky high point under it.

Mars rover Opportunity – Major science results were released from the observations made by Opportunity during its trip down into Victoria Crater from late 2006 to August 2008. Water repeatedly came and left billions of years ago. Wind persisted much longer, heaping sand into dunes between the water episodes. Steep cliffs and gentler alcoves alternate around Victoria, as a result of wind erosion that gradually widened the crater from its size immediately after an impact created it. Distinctive patterns in the cliffs indicate the rocks formed from shifting dunes that later hardened into sandstone. The small iron-rich spheres, called spherules or blueberries, formed from the interaction with water penetrating the rocks. The spherules in rocks deeper in the crater are larger than those in higher layers, suggesting the action of groundwater was more intense at greater depth. The spherules formed before the impact created the crater. Lower layers of rock showed less sulfur and iron, but more aluminum and silicon than higher layers. The sulfate salts found in the soil were produced by interaction of volcanic rock with acidic water. Much of the geological history found in Victoria Crater matched that found earlier when Opportunity visited two shallower craters, indicating that the findings probably apply generally to the whole region. The impact craters allow examining the layers of rock beneath the surface to determine the geological history that created those layers. Opportunity found rocks near Victoria containing minerals such as kamacite and troilite, which are common in meteorites. It is possible that these are fragments of the rock that impacted to form the crater. The rover has, since leaving Victoria, made it about 20% of the way to its next major target, a yet larger crater, named Endeavour.

Messenger (Mercury mission) – Mercury is known to have a very thin atmosphere that appears to be constantly replenished by particles sputtering off the surface when it is hit by solar wind particles. The problem with this is that the planet's magnetic field should be deflecting solar wind particles and preventing enough of them from reaching the surface. On Earth a little of the solar

(continued on page 8)

NASA's Space Place

The Cool Chemistry of Alien Life

Alien life on distant worlds. What would it be like? For millennia people could only wonder, but now NASA's Spitzer Space Telescope is producing some hard data. It turns out that life around certain kinds of stars would likely be very different from life as we know it.

Using Spitzer, astronomers have discovered the organic chemical acetylene in the planet-forming discs surrounding 17 M-dwarf stars. It's the first time any chemical has been detected around one of these small, cool stars. However, scientists are more intrigued by what was *not* there: a chemical called hydrogen cyanide (HCN), an important building block for life as we know it.

"The fact that we do not detect hydrogen cyanide around cool stars suggests that that prebiotic chemistry may unfold differently on planets orbiting cool stars," says Ilaria Pascucci, lead scientist for the Spitzer observations and an astrophysicist at Johns Hopkins University in Baltimore, Maryland. That's because HCN is the basic component for making adenine, one of the four information-carrying chemicals in DNA. All known life on Earth is based on DNA, but without adenine available, life in a dwarf-star solar system would have to make do without it. "You cannot make adenine in another way," Pascucci explains. "You need hydrogen cyanide."

Do alien planets around other stars have the right ingredients for a pre-biotic soup?

M-dwarf and brown dwarf stars emit far less ultraviolet light than larger, hotter stars such as our sun. Pascucci thinks this difference could explain the lack of HCN around dwarf stars. For HCN to form, molecules of nitrogen must first be split into individual nitrogen atoms. But the triple bond holding molecular nitrogen together is very strong. High-energy ultraviolet photons can break this bond, but the lower-energy photons from M-dwarf stars cannot. "Other nitrogen-bearing molecules are going to be affected by this same chemistry," Pascucci says, possibly including the precursors to amino acids and thus proteins.

To search for HCN, Pascucci's team looked at data from Spitzer, which observes the universe at infrared wavelengths. Planet-forming discs around M-dwarf stars have very faint infrared emissions, but Spitzer is sensitive enough to detect them.

HCN's distinctive 14-micron emission band was absent in the infrared spectra of the M-dwarf stars, but Spitzer did detect HCN in the spectra of 44 hotter, sun-like stars.

Infrared astronomy will be a powerful tool for studying other prebiotic chemicals in planet-forming discs, says Pascucci, and the Spitzer Space Telescope is at the forefront of the field. Spitzer can't yet draw us a picture of alien life forms, but it's beginning to tell us what they could—and could not—be made of. "That's pretty wonderful, too," says Pascucci.

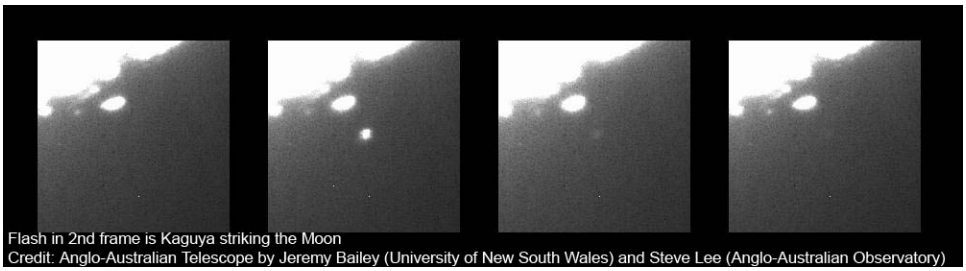
For news of other discoveries based on Spitzer data, visit www.spitzer.caltech.edu. Kids can learn Spitzer astronomy words and concepts by playing the Spitzer "Sign Here!" game at spaceplace.nasa.gov/en/kids/spitzer/signs.

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

(continued from page 6)

wind penetrates our magnetic field through magnetic tornados that occasionally form when the Earth's magnetic field lines reconnect with solar magnetic field and twist up. Messenger found that this process occurs 10 times more frequently on Mercury, allowing enough solar wind to leak through the magnetic tornados and hit the surface.

Cassini (Saturn mission) has been observing clouds forming on Titan for more than 3 years. An analysis shows they form much like clouds on Earth, but more slowly, and they last much longer into the fall season. The differences are probably due to receiving about 100 times less sunlight than Earth, due to Titan's greater distance from the Sun. Titan is the only moon in our solar system with a substantial atmosphere.



Flash in 2nd frame is Kaguya striking the Moon
Credit: Anglo-Australian Telescope by Jeremy Bailey (University of New South Wales) and Steve Lee (Anglo-Australian Observatory)

Kaguya (Japanese lunar mission) has completed its 2 years of observations of the Moon, and when its fuel supply was nearly out in early June, it was intentionally crashed. The spacecraft struck at an angle of just 1° from horizontally at a speed of about 4,000 mph. The impact was observed by an Australian telescope.

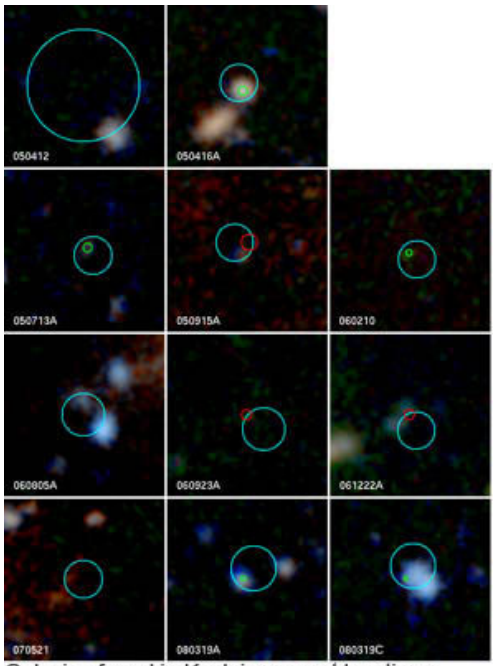
A supernova was found in nearby galaxy M82 in radiotelescope images taken in April, and then it was found in archived images up to a year earlier. This is the nearest supernova in the last 5 years, and should have been easily visible in amateur telescopes. Yet it was not seen in any other wavelengths than radio. Apparently it occurred in thick gas and dust, which hid it. Radio waves penetrate such obstacles. A ring was found (again in radio) expanding from the supernova site, and tracing it backwards yielded a date of January or February 2008 when the explosion occurred. The ring is moving at 4% the speed of light, typical for a supernova, and is somewhat asymmetric. The event was not visible in ordinary light, ultraviolet, or even X-rays. M82 harbors a vigorous starburst in its inner few hundred light-years, and so should be producing supernovas every few years. Yet one had not been seen for about a quarter century. Maybe there have been supernovas there every few years, but were missed due to the obscuring gas and dust.

Possible supernova – An explosion that was observed in February 2006 may finally have been explained. Its light curve was too symmetric, that is took as long to rise to peak brightness as to drop again, it had the wrong spectrum, had no visible surrounding galaxy, and was too bright in X-rays to be a supernova. A new analysis claims that it was a supernova occurring in the midst of a thick carbon cloud, such as is found around Wolf-Rayet stars, about 2 billion light-years away. The strange spectrum is then a carbon spectrum, but redshifted due to the great distance. That distance is also what makes the surrounding galaxy too dim to see. The cloud would also enhance the X-ray emission and change the rise and fall time of peak brightness. Other theories still have their proponents, and it is hoped that the all-sky surveys such as Panstarrs, which just started operation, will find more objects like this to definitively settle what it was.

Fermi (orbiting gamma-ray telescope) has found a new class of active galaxies that emit gamma rays. Blazars and radio galaxies were already known to give off gamma rays. Now a Seyfert galaxy (called PMN J0948+0022) has been seen by Fermi. The particular Seyfert has been a subject of controversy, since radio observations of it indicated the galaxy has jets, but spectra of it indicated no jets. The gamma rays detected indicate jets, so that should solve the controversy. This Seyfert is now being observed in many wavelengths, from radio to gamma rays, to see why it does not seem to follow the rules. Fermi also observed NGC 1275, a radio galaxy, which is also known as Perseus A. It is easily visible in high-energy gamma rays, and should have been seen in high-energy gamma rays by Fermi's predecessor, the Compton gamma-ray telescope, but was not. Such a change in just a few years means that the source is small (less than a few light-years across) and variable.

Swift (orbiting gamma-ray burst telescope) has observed many so-called "dark" gamma-ray bursts, that is, ones that have little or no visible light even though they are bright in gamma rays and X-rays. Follow up observations with the Keck I Telescope in Hawaii have found that there is almost always a normal galaxy at the location of each of the dark bursts. The 2 leading theories on dark bursts are that they occur in extremely dusty galaxies or extremely distant galaxies. The Keck observations showed they were not in extremely distant galaxies. So the leading theory is now dust hiding the visible light from these bursts.

M87 halo – Using the Very Large Telescope in Chile, astronomers have measured the size of the halo of giant galaxy M87. A galaxy halo is a sphere about the galaxy sparsely populated by stars. The scarcity of stars makes a halo hard to measure. The results were surprising because the stars suddenly stop at a diameter of about a million light-years, smaller than expected. The observations actually tracked planetary nebulas, which are easier to find in very sparse areas, but are distributed similarly to



Galaxies found in Keck images at locations (indicated by circles) of "dark" gamma-ray bursts
Credit: Daniel Perley, Joshua Bloom/UC Berkeley

stars. Several theories have been proposed to explain the smaller halo, including collapse of dark matter or a past close encounter with M84 stripping the outer halo.

M87 black hole – A new computer simulation that takes into account dark matter surrounding galaxies has been run for the giant galaxy M87. The result is that the supermassive black hole at its center is about twice as massive (6 billion solar masses) as previous methods have calculated. This result suggests that the black holes in many other galaxies have been similarly estimated smaller than they actually are. The astronomers involved have made observations with the Gemini and Very Large telescopes, which will be published soon, that support the larger mass for the M87 black hole. This may solve the quasar mass paradox. Masses calculated for quasars, which are active supermassive black holes, were up to 10 billion solar masses, while no galaxies were known to have that large of a black hole mass. The much larger mass for the M87 black hole substantially reduces this difference.

The **Very Large Telescope**, using adaptive optics, has obtained one of the sharpest views ever of the Arches Cluster, a very dense cluster of young stars near the supermassive black hole at the heart of the Milky Way. Despite the extreme conditions there, astronomers found the same proportions of low- and high-mass stars as are found in more tranquil locations. It was already known that the cluster was extremely dense, having about a million times the density of stars as found in the Sun's neighborhood. The new observations put the mass of the cluster around 30,000 times the Sun's mass, much more than previously thought.

Spitzer (infrared space telescope) has observed for the first time newborn stars near the center of our Milky Way galaxy. Although the presence of clusters of adolescent stars implied that stars can form in this chaotic region, no newborn stars had been observed there until now. The dust blocking our view of the center of the galaxy makes such observations difficult. However some wavelengths of infrared penetrate the dust well enough for Spitzer to see. The search started with Spitzer's recent mosaic of the entire galactic center, which contains about a million stars. From this about 100 candidates for newborn stars were found, then spectra were taken to confirm their age. Only 3 newborn stars (those less than 1 million years old) have been found so far by this method, but more are expected.

Submillimeter Array (radiotelescope) has observed a disk of material of the type that forms planets surrounding a close double star (V4046 Sagittarii). It has long been the subject of disagreement whether double stars would disrupt the formation of such a disk, and therefore prevent planet formation. This is proof that a disk can form about a double star, at least in the case of close pairs. The stars are about 12 million years old, and it is very unusual for such disks to last so long after the birth of the associated star. The newly discovered disk is 240 light-years from us, quite close for this type of object.

Shrinking star – Astronomers using the infrared interferometer on Mt. Wilson have been measuring the diameter of Betelgeuse repeatedly and found that it has shrunk by 15% in the last 15 years. Measurements by the AAVSO have shown no significant changes in its brightness, however. Theories on why it appears to be shrinking include changes in the star's convection cells, but further observations are needed to get a definitive answer. Betelgeuse is one of only a handful of stars that appear large enough that the Hubble Space Telescope sees them as larger than a dot, but it still takes an interferometer to get any accuracy in measuring the star.

Ultracool subdwarfs are a class of stars recognized only since 2003. They are distinguished by their low temperatures and low concentrations of elements heavier than helium. Only a few dozen are known. Studying their motions shows that they have orbits about the galaxy that are very eccentric, very fast-moving (over 1 million mph) and often tilted to move above and below the galaxy plane, in contrast to most stars. One ultracool subdwarf has been found to have an orbit that takes it outside the galaxy. It is possible that it originated in another galaxy.

Millisecond pulsar – It has long been believed that millisecond pulsars, those that spin hundreds of times per second, and therefore throw a pulse our way every few milliseconds, were spun up to their incredible speeds by matter from a surrounding disk swirling onto the pulsar. The surrounding disk is fed by material pulled off a companion star orbiting the pulsar. But astronomers have not caught a pulsar in the act, until now. A millisecond pulsar, called J1023, discovered in 2007 by the Byrd Green Bank radiotelescope in West Virginia was then found to be in archived observations from the Very Large Array and the Sloan Digital Sky Survey. In 1998 and 1999, it did not have a surrounding disk, in 2000 it did, and in 2002 the disk was gone again. Further observations show that the pulsar indeed has a companion star, less than half the mass of our Sun, orbiting very close, once every 4 hours 45 minutes. So material was pulled off the companion star to form the disk seen in 2000, then the material fell out of the disk and onto the pulsar by 2002.

Age of millisecond pulsar – The age of a millisecond pulsar has in the past been determined using the current period and the rate at which it is changing. This is known to yield unreliable results, especially for the fastest spinners. A new method has been developed that takes into account constraints on the spin-up process and maximum spin. The new method indicates that the old method can vastly over- or under-estimate the age in different cases.

Black hole – New observations by XMM-Newton (orbiting X-ray telescope) have seen matter closer than ever before to a supermassive black hole lying at the core of a distant galaxy. The observation was made using a very long exposure, about 8 days. Matter swirling into a black hole gives off X-rays before it reaches the edge of the black hole, where all light is sucked in. Examining the distortions in spectral lines (of iron) allows calculating how close the matter was to the black hole when it gave off the X-rays. X-rays were seen to echo off the other side of the disk of matter swirling into the black hole. This helped determine the size and mass of the black

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(continued from page 4)

that could be significant in the event there was a dispute between two members who both wanted to build on a particular site at the same time – the ultimate decision in case of a dispute of that type, though, would be made by the Board.

Regarding the Policies and Procedures for member observatories, I have made some additions and revisions based on feedback I received from the version that was originally posted on the website and circulated. The revised version should be posted on the website by the time you see this for review, with the revisions in bold italics, to make it easier to identify them. The Board hopes to adopt a finalized version of the Policies and Procedures at the next Board meeting, which is on July 26th. If you have any comments you would like the Board to consider, or believe there should be further changes or additions made, please e-mail them to me at btoy@cox.net as soon as possible. ■

(continued from page 9)

hole (3-5 million times the mass of our Sun). The black hole was found to be spinning rapidly and consuming matter at nearly the theoretical maximum rate, which is about 2 Earths of mass per hour for a black hole this size.

Exoplanet discovery – Astrometry, that is measuring the location of a star very precisely, has been tried as a method of finding exoplanets, those orbiting stars other than the Sun, for about 50 years. But the accuracy was simply not there in order to see a star move due to the gravitational pull of its planet. All claims for astrometry discovering planets have found to be in error, until now. A team that has been measuring the positions of 30 stars for the past 12 years using the Palomar 200-inch (5-meter) telescope have at last found an exoplanet by astrometry. It is about 20 light-years away in Aquila. It is a gas giant with 6 times the mass of Jupiter, orbiting a small star with only 1/12 the mass of our Sun. The star, known as VB 10, was for awhile the least massive star known, but smaller ones have since been found. Even though the planet is as close to its star as Mercury is to our Sun, the new planet is not classed as a "hot Jupiter" type of planet, because the star shines so dimly that it does not heat the planet much.

Extreme exoplanet – Using the gravitational microlensing technique, astronomers have found a planet in the Andromeda Galaxy, the first known planet outside the Milky Way. Microlensing detects the bending of light caused by a massive object passing in front of any light source, according to General Relativity principals. The mass of the planet is about 6 times that of Jupiter.

International Space Station (ISS) – As I write this, the Space Shuttle Endeavour is scheduled to liftoff June 17 on one of the most complex space station assembly missions yet, a 16-day flight to attach a Japanese experiment platform, deliver spare parts, replace massive solar array batteries and swap out a station crew member. Assembly work requires 3 robot arms and 5 spacewalks. A porch-like external experiment platform is being attached to the Japanese Kibo laboratory, which has its own airlock and its own robot arm to move experiments out to and back from the platform. Six 375-lb batteries are being replaced, as they are on the oldest solar arrays, and have been in use almost 9 years. Preparations are being made to receive the first Japanese cargo spacecraft, scheduled for September arrival. With 7 shuttle crew members and 6 ISS astronauts, this is the largest crowd yet at the station. Four of the shuttle crew are entering space for the first time, and are becoming the 499th through 502nd persons to orbit the Earth. Based on seat position, Christopher Cassidy is credited with being the landmark 500th.

Instant AstroSpace Updates

apparent liquid drops on Phoenix lander leg
NASA/JPL

A new study of the properties of brines (salt solutions) using the types of salts recently found on **Mars** has concluded that they have much lower freezing points than plain water and could remain **liquid** on the surface even with the low temperatures and pressures on that planet. This vindicates the scientists who believed they saw drops of liquid on the Phoenix lander.

The Mars Science Laboratory, the rover the size of an SUV to be launched in 2011, has been named **Curiosity**, the winning entry in the naming contest, submitted by a 12-year-old in Kansas. Her prize was a trip to JPL and permission to sign her name on Curiosity.

Since the new cycle of **sunspots** has not shown up on time according to either of the competing solar prediction groups, they got together and issued a revised prediction: It should peak in May 2013, and have much fewer sunspots (max of 90) than average.

Astronomers using the Subaru Telescope in Hawaii have taken very long images of about a dozen well-known **colliding galaxies**, including the Antennae galaxies, to locate all tidal tails and debris resulting from the collisions. They are using these to recreate the paths of the galaxies during the collisions.

A team of researchers have watched a dust cloud collapsing into a massive star, and have concluded that this process is most influenced by the magnetic field there, more so than by gravity. This implies that **star formation** from clouds of all sizes should behave the same, since mass is not the most influencing factor.

As I write this, **LCROSS** and **LRO**, 2 NASA missions to the Moon, are scheduled to launch June 18. LRO will make the best yet lunar map, and LCROSS will crash into a polar crater to look for ice.

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