SIRIUS ASTRONOMER

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The Newsletter of the Orange County Astronomers

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M13, the famous globular cluster in Hercules, was imaged on May 25, 2006 from Anza by Bob Bryant using a 10-inch f/6.3 LX200. Though normally associated with summer viewing, M13 is visible along with all of the other Messier objects in the evening sky near the vernal equinox. Our 2008 Messier Marathon is scheduled for March 8th, the nearest Anza star party to the vernal equinox this year. Come on out and try your hand at observing the whole list!

OCA CLUB MEETING

The free and open club meeting will be held Friday, March 14th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. The featured speaker this month is Dr. Gary Petersen, discussing 'The Cryogenic World of Triton'

STAR PARTIES

The Black Star Canyon site will be open on March 1st. The Anza site will be open on March 8th. 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, March 7th at the Centennial Heritage Museum at 3101 West Harvard Street in Santa Ana.
GOTO SIG: TBA (contact coordinator for details)
Astro-Imagers SIG: Mar. 18th, Apr. 15th
EOA SIG: Mar. 26th, Apr. 23rd
Astrophysics SIG: Mar. 21st, Apr. 18th
Dark Sky Group: TBA (contact coordinator for details)

President's Message

By Barbara Toy

Amazingly enough, spring is on its way – after a much wetter winter than we've had for the last couple years. That's good news on the drought and wildflower fronts, but, judging by the growth we could already see in February, the bad news is that we'll have a bumper crop of weeds out at Anza this year. For those with pads and observatories – please keep your areas clear! And for everyone who uses the Anza site – please help keep the common areas clear of weeds and gopher/rabbit/other critter holes!

Two Pad Licenses Available

Two generous members have donated their pad licenses to the club – one was Harry Miller, who long-time members remember for his many contributions to the club in its early years and who bequeathed his pad license to the club when he passed away several years ago. The other was the recent donation by Roland Borey, who has moved out of the area. After the major expenses of replacing the moving roof on the observatory and the roof over both halves of Anza House, the club needs money, and so the Board decided to make these licenses available for $2500 each, which is less than what we expect it will cost to build a pad in the new area when we are finally able to start construction there.

The licenses are for Pad UP-7 (in the Upper Pad area) and LP-8 (in the Lower Pad area). Word has already been sent out to people on the current Pad Interest List, so it is possible that the licenses will already have been purchased by the time you see this. If you are interested in either of them, please contact Charlie Oostdyk (charlie@cccd.edu or 714-751-5381), for the latest information on their status and/or to buy the rights to one of the licenses.

If you want to be on the Pad Interest List or Observatory Interest List but aren't yet, please email me at btoy@cox.net, and I'll be happy to add you to either or both. Besides opportunities like this one, we'll be letting people on those lists know first when we're finally able to move ahead with construction in the Northwest Territory – so, if you're interested at all in building a pad or observatory in that area, please be sure you're on either or both of the interest lists!

Messier Marathon

The Spring Equinox is March 20, when the sun crosses the celestial equator and night and day are of equal length. Of even greater interest to at least the amateur astronomical community is the fact that around the equinox it's possible to see all 110 Messier objects in one night, which is why March is when we do the Messier Marathon. Unfortunately, the equinox this year is just one day before the full moon, and our March Anza star party is at the beginning of the month (March 8, to be precise, the night that Daylight Savings Time now starts). Even though it may be a bit early for ideal conditions, the March Anza star party will be the club's official Messier Marathon night, with the April star party as a backup in case the weather's bad on March 8. By April the nights will be shorter, and it will be a lot more challenging to find the beginning and ending objects in the twilight of sunset and sunrise – but at least the dimmer objects won't be blotted out by the moon!

For those who might not have run into this particular event, the objective is to view all 110 Messier Objects in one night, which for most of us means an all-nighter (some optimistic souls take a nap in the gap before new objects rise that occurs for most people around 2:00 – and many of the nappers fail to wake up in time to finish the objects that come into view in the last couple hours before sunrise). Marathoners generally use lists of objects in a recommended order for viewing, and note down on the list when each one was seen (some just check each one off). Even if weather or a too-short night make it impossible to truly see all of the objects (that is, genuinely making the object out instead of assuming it must be there because your goto system or computer says it is – a real temptation as sunrise approaches!), it's a lot of fun to find all of the objects you can, and a great way to visit Messier objects that are often overlooked in favor of more spectacular or popular objects.

Right after sunset and right before sunrise tend to be very busy times in the Marathon – sunset because you're trying to get the first objects in the brief period between the time they become visible in the darkening sky and the time they set, and dawn because you're trying to get the last objects between the time they rise and the time they're lost in the glare of the rising sun. In the long hours between those two races against earth's motion, take some time to really look at the objects you don't normally view, to get a sense of what makes them unique. In the open clusters, you can look for blue and red giants as indicators of their ages, and see how they fit in the galactic plane, along with nebulas of different types. Globular clusters are generally much older, and circle in the halo of our galaxy – their compact symmetry contrasts well with the looseness of the open clusters. Visually, the galaxies in the Virgo cluster tend to be dim smudges in the eyepiece, but it's possible to note which ones are spirals and how they are oriented toward us, which makes them more interesting. Although it takes a lengthy exposure to bring out much detail in most galaxies, you can train your eye to see a surprising amount of detail with practice.

We plan to have forms for the Marathon available in the club Observatory and at Anza house for both the March and April star parties, and you should also be able to download one from the club website. You don't need to be at Anza to do the Marathon, or stay up all night – a partial Marathon is also fun and challenging, and could inspire you to try a full Marathon next year. Unfortunately, we can't offer the Black Star Canyon star party as an option for doing the full Marathon, as we only have the site until around midnight, but you could certainly do the first part there. Wherever you are when you do it, the challenge is to do it all in one night – you can try it again another night, but you're not doing the real thing if you do part on one night and part on another and try to count it as a single Marathon. Wherever you do it, please be sure to put your name and contact information on your Marathon form, indicate where you did the Marathon and when, and turn a copy in to me or send it to me at the club's post office box, so we can give you an official Messier Marathon certificate.

Some Great Astronomy Classes – For Free!

We have our own Beginners Astronomy Class, which is presented by club volunteers and has always been offered to the general public for free, but I've recently discovered a different kind of free astronomy course – podcasts of college-level courses that are now posted by a number of different universities. They're generally unedited recordings of class lectures, mainly intended as a study aid for students in the classes, but anyone can download them free of charge – a real boon to public education!

Don't Miss The Messier Marathon March 8th!!!!

One of the first professors to experiment with using podcasts in his astronomy classes was Richard Pogge, Professor of Astronomy at the University of Ohio. I was given a copy of the first set of lectures he recorded and posted, which were for the second half of their two-course sequence on basic astronomy for non-science majors, and discovered that they were a great way to help me get through such things as traffic, housework and exercise – he's got a lively style and a way of presenting the material that held my interest and taught me a lot. That set of lectures started with stars – how they form, their structures and how they work at different stages in their life cycles, the different paths followed by stars of different sizes, and what happens when they die. He went on from there to talk about collections of stars, different types of galaxies, the universe as a whole, the Big Bang and scenarios for the end of the Universe, taking in Relativity and its implications along the way. It was great, and I was really sorry to reach the end. Then I found he recorded his lectures for the first course in that sequence for the Fall term of 2007, on the solar system and history of astronomy, and I'm listening to that now.

If you're interested in these particular lectures, you can find them at http://www.astronomy.ohio-state.edu/~pogge/Ast161/Audio/ and http://www.astronomy.ohio-state.edu/~pogge/Ast162/Audio/. You can also get them through iTunes. The webpages with some of the diagrams, notes and other information for these lectures can be found at http://www.astronomy.ohio-state.edu/~pogge/Ast162/ and http://www.astronomy.ohio-state.edu/~pogge/Ast161/.

Another set of free courses I haven't had a chance to try out for myself yet but hope to in the future is from MIT. They are posting a wide range of class lectures for free as part of what they call their "OpenCourseWare" or "OCW" program, specifically intended for access by the general public. An article was posted about it on Astromart at http://www.astromart.com/news/news.asp?news_id=771. While looking for Dr. Pogge's lectures on iTunes, I found another set of lectures posted by a professor at Stanford (on "Stanford at iTunes U," http://itunes.stanford.edu/) – it seems that iTunes is making it easy for different universities and colleges to post podcasts on "iTunes U," and they have quite a list of universities that are taking advantage of it for a wide range to topics, not just astronomy. Some don't seem to leave them up for long, unfortunately – I found several of the podcasts listed on the Yale website, for instance, were no longer available. These podcasts are a great and growing resource – one that can give us all a lot of pleasure and learning!

On Night Friendly/Efficient Outside Lighting

If you look at the club "Contacts" list, you might note that I'm listed as our "Dark Sky Coordinator." That is an area I'd really like to see our club more active in – both in attempting to improve lighting conditions in Orange County and in protecting the darker skies in the area of our Anza site. Unfortunately, I haven't had as much time to devote to that as I'd hoped when I started in that position (if there's anyone out there who would like to take that on – please email me about it!). We do have an email list for dark sky issues (ocadarksky@yahoogroups.com) and I hope you'll join it if you have any interest in dark sky issues and aren't

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AstroSpace Update

March 2008
Gathered by Don Lynn from NASA and other sources

Messenger (Mercury mission) – First results are in from the spacecraft's first flyby of Mercury in January, at a distance of only 124 miles. Only the edge of the Caloris Basin was seen by the only other Mercury spacecraft (Mariner 10 in the 1970s), but this flyby got good resolution pictures of the entire basin. It is one of the largest impact craters in the entire solar system. In fact it was found to be larger (at 960 miles) than the estimates made from Mariner images. Unlike most large impact basins on the Moon, which are filled with darker lava, Caloris is filled with lighter colored material. More lobate scarps (huge cliffs snaking hundreds of miles across the surface) were discovered, which since Mariner have been ascribed to shrinkage of Mercury's core in the distant past, wrinkling the surface. "Telephone" crater was discovered, so nicknamed because it is shaped like a handset. One crater was found with huge numbers of secondary craters, those formed by material thrown out by the initial impact falling back down around the crater. A feature dubbed "The Spider", unique in the solar system, was discovered. It consists of more than 100 narrow, flat-floored troughs radiating from a center. There is an impact crater at the center, but it is not known if the crater was formed when the Spider was. It is located inside the Caloris Basin. The first guess is that the area swelled up, possibly from volcanic activity, splitting open the surface.

Messenger found the magnetosphere has changed since Mariner, now being quieter in terms of particles. Mercury does not have Van Allen belts of radiation its magnetosphere like the Earth does. The Mercurian magnetic field was very little changed in intensity or tilt (10 degrees from the rotation axis). Of the 4 terrestrial planets, only Earth and Mercury have substantial magnetic fields. Earth's is formed by electrical currents in the liquid metallic core. It is a mystery why Mercury's core would not have cooled and solidified, shutting down the magnetic field. Ultraviolet emissions were detected from sodium, calcium and hydrogen in Mercury's exosphere (an extremely thin atmosphere resulting from surface material being thrown off by atomic particle impact). The sodium-rich tail of the exosphere extending more than 25,000 miles was measured, and a previously unknown hydrogen tail was found. Both tails were found to have a strong north-south asymmetry. Spectra of the surface under the flyby path were taken, but analysis to determine the minerals present has just begun. The altimeter took elevation measurements under the flyby path, and precise tracking of the spacecraft path is expected to provide gravity data.

Cassini (Saturn mission) – 2 of Saturn's rings have been found to contain orderly lines of densely grouped, boulder-size icy particles that extend outward across the rings like ripples. The spacing between the groups is about 300 to 800 feet, depending on location within the ring. The structures are found only in areas where particles are densely packed: the B ring and the innermost part of the A ring. The pattern was detected by measuring various frequencies of radio signal from Cassini as it passed through the ring on its way to Earth.

Scientists have been running computer simulations of icy geysers to try to match the geyser action observed by Cassini at Saturn's moon **Enceladus**. The best match is that a pool of liquid water about at the freezing point (32º F) lies not far below the surface. When cracks in the crust open, water vapor blows out at up to 1100 mph, cooling from expansion and forming ice grains. The ice particles ricochet up through the crooked cracks, and slow. Only about 10% of the material remains above the escape velocity of Enceladus (536 mph), with the rest falling back to the moon, making snowy deposits. The escaping material spreads out to form the E ring about Saturn.

New observations by Cassini show that the outer part of the **A ring** (the outermost one easily visible from Earth) is sopping up charged atomic particles that are carried inward by the magnetic field from the tenuous larger E ring. The material in the E-ring is known to come from the geysers on Enceladus. Sunlight breaks up the ice or vapor from the geysers into atoms and ionizes (electrically charges) them to become plasma. It is thought that the absorption of the plasma by the A ring is the reason that Saturn's vicinity is far more nearly free of charged atomic particles compared to Jupiter's high radiation levels. Cassini measurements found a bit of the plasma leaking through the Cassini Division, the nearly clear space between the A ring and the B ring.

Scientists have estimated the depth of hydrocarbon lakes on Saturn's moon **Titan** by comparison with Earth's lakes and their surrounding mountains, to calculate the volumes of liquid hydrocarbons. The result is that several dozen of the largest of the hundreds of lakes found there each contain more than the Earth's known oil and gas deposits. The dunes of solidified hydrocarbons were calculated to be hundreds of times the Earth's known coal. The calculations were made to understand the lake-vapor-rain cycle on Titan, and to try to explain why the methane has not escaped to space.

Jupiter disturbance – Observers of the planet have seen 2 giant storms erupt in the middle northern latitudes, in the area where jet stream winds are strongest (370 mph). Similar phenomena occurred in 1975 and 1990, but this time better resolution images were taken with the Hubble Space Telescope (HST) and various ground-based instruments. At the beginning of the eruption last March, HST happened to be taking images of Jupiter to support the flyby of that planet by the New Horizons spacecraft. The disturbance grew from 250 miles across to 5 times that size in a single day. 2 bright plumes were seen that were later determined to be storm systems from deep in the atmosphere that vigorously moved upward, injecting ammonia ice and water to a height of 20 miles above the top cloud deck. Comparison with the 2 previous similar events showed: the plumes arise in the peak jet stream, and they occur at 15 to 17 year intervals.

Mars Express has measured high wispy Martian clouds made of carbon dioxide (dry ice) and found that they are more substantial than thought, actually casting shadows on the surface and reducing sunlight up to 40%. They are higher than thought also, at

about 50 miles. The ice particles were measured to be larger than expected at more than a micron (1/25000 inch). The clouds were found to form mostly near the equator and are probably explained by the more extreme daily temperature variations there.

Venus Express has made the most accurate map of the location of water vapor and other gases in the lower atmosphere of Venus, using infrared to penetrate the thick clouds. Carbon monoxide and carbonyl sulfide have also been mapped. These were previously known to exist on the planet, but this is the first time their distribution has been extensively mapped. The data show that concentrations of these 2 gases are inversely linked; wherever concentration of one is high, the other gas is scarce. The spacecraft has confirmed the large-scale circulation of the Venusian atmosphere: air rises at the equator, moves toward higher latitudes, both north and south, and then descends.

Cepheid distance – The New Technology Telescope in Chile has measured the distance to the Cepheid variable star RS Puppis to unprecedented precision, using a new technique. RS Puppis is the only known Cepheid surrounded by a nebula. Every time the star pulsates (which it does every 41 days), a sphere of light (called a light echo) grows around the star, expanding through the nebula at the speed of light. By measuring these spheres grow, astronomers were able to calculate the distance to the star as 6500 light-years, with possible error of only 90 light-years. It is important to accurately measure distances to Cepheids because almost all distances ever measured outside our Milky Way have been based directly or indirectly on Cepheid distances. The brightness of a Cepheid depends on its period of pulsation. So knowing how bright it is and how bright it appears allows calculating how far it is.

Hubble Space Telescope (HST) has taken images of a dust disk encircling a nearby young star (HD 61005) with a unique shape, which has earned it the nickname "The Moth". Such disks are normally pancake shaped. Astronomers think the shape was caused by the star plowing through a local patch of higher-density gas. The question that arises is: if planets are forming within the disk, a frequent occurrence, then what effect is this disturbance of the disk shape having on those planets? The Moth was observed in an infrared survey of Sun-like but young stars to study planet formation and evolution. The HST coronagraph is being used to block out the light of stars to reveal the dimmer disks about them.

Spitzer (infrared space telescope) has been observing 2 filaments connecting to the galaxy cluster Abell 1763. Such filaments, containing a few galaxies, connect major galaxy clusters throughout the Universe. Spitzer found several galaxies traveling along the 2 filaments toward the cluster. Galaxies having starbursts (great activity forming new stars) were found to be more than twice as common in the filaments as in the galaxy cluster. Astronomers will try to fit this fact into theories of galaxy evolution and star formation.

Early galaxy – Both HST and Spitzer were used to look through a gravitational lens made by a massive galaxy cluster (Abell 1689) and found one of the earliest galaxies known. It was so distant that light left there only about 700 million years after the Big Bang. It would have been too dim to image except for the brightening and magnifying power of the gravitational lens. A gravitational lens occurs when a very massive object (the galaxy cluster) bends light from objects behind it, according to General Relativity. The images reveal bright, dense clumps of hundreds of millions of massive stars in a compact region about 2000 light-years across, a tiny fraction of the size of our Milky Way galaxy. The mass is also small by Milky Way standards, several billion times the Sun's mass. This type of galaxy was common in the early universe.

Stellar magnetic field – Some time in the last year, the Sun-like star Tau Bootis reversed its magnetic field. The Sun has long been known to do this about every 11 years, between sunspot cycles. But this is the first time it was observed on another star. A survey of magnetic fields of stars being made with the CFHT telescope in Hawaii caught the reversal. Maybe coincidentally the star was recently found to have a massive planet. Astronomers will continue to monitor the star to determine its period of reversals.

Smallest disk – Astronomers using adaptive optics and a coronagraph on the Subaru Telescope in Hawaii have resolved the least massive known planet-forming disk about the smallest star (FN Tauri) ever found to have such a disk. The star is 460 light-years away, is only 100,000 years old, and has a mass 1/10 that of the Sun. The disk appears nearly circular, so we are seeing it just about face-on. Its radius is 260 AU (an AU is the Earth-Sun distance).

Star formation – Using 2 and 3 of the Very Large Telescopes in Chile combined together as an interferometer, astronomers have probed the inner parts of the disk of material surrounding a young star known as MWC 147, which lies about 2600 light-years away in Monoceros. The star is in a class known as Herbig Ae/Be, which have a few times the mass of our Sun and are still forming, increasing in mass by swallowing material from the disk. The disk was measured at various wavelengths of infrared, which correspond to different temperatures within the disk. The temperature was found to drop off more steeply with distance from the star than expected. It was also found to be hot enough to destroy dust within 1-2 AU. The disk extends to about 100 AU. The star is increasing in mass by swallowing material at the rate of 7 millionths of a Sun mass per year.

Nova – The 2 Keck Telescopes in Hawaii combined together as an interferometer have been used in the nulling mode on a nearby nova called RS Ophiuchi. In this mode, the light of a star is cancelled, so researchers can study the dimmer surroundings. The observations of RS Ophiuchi resulted in resolutions as good as .004 arcseconds. The nova consists of a pair of stars, a white dwarf and a red giant. The latter is gradually shedding its outer layers and the dwarf is sweeping up much of the mass. When the accumulated mass reaches a critical temperature, it erupts as the nova, which it has done at irregular intervals 6 times in the past 110 years. The last time was in 2006, and fortunately the Kecks were watching. Analysis has been completed that shows some surprises. Silicate dust was found beyond the blast zone, meaning that the dust was created before the latest nova, though it had been generally accepted that novas themselves produced dust. The new theory is that dust is created by the white dwarf stirring

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The Apple Stopped Here

By William K. Vogeler

Final part of a three-part series

Newton's Apple fell where the Earth used to be.

That's because the Earth is moving along its path in the expansion of the universe. Apples and other matter on the planet are moving along with it, but as they fall through space they are falling towards the place where the Earth was.

Indeed, the Earth orbits the Sun at about 66,660 miles per hour. So the Earth moved about 18 miles in the second Newton's Apple fell to the ground.

This observation has implications for general relativity. In the cosmos, general relativity provides that massive bodies curve space and create the effect of gravity. This curvature of space and time is called spacetime.

In a solar system, for example, planets orbit their star by following the curvature of spacetime the star creates. The planets also curve spacetime, creating the effect of gravity on their moons.

But on a planet like Earth, general relativity must take into account the motion of the planet through space. This means that apples and other Earth-bound objects are not actually attracted to the Earth but to the curvature of spacetime that trails behind the planet as objects are in freefall.

It is a like a boat moving through water. The boat creates a wake, or turbulence, that affects anything that falls off the boat. Objects falling directly behind the boat get caught in the turbulence.

Likewise, objects on Earth are caught in the gravitational turbulence of the planet curving spacetime. This explains, in part, why an object on one side of the planet falls in opposition to an object falling on the other side of the planet. It is not due to gravity inherent in the mass of the objects or their individual curving of spacetime, but to the turbulence of the planet curving spacetime.

This effect may be observed on spacecraft entering the Earth's atmosphere because time and gravity fluctuate due to the turbulent curvature of spacetime. Indeed, time and gravity change for any object in freefall around the planet. The effects are more apparent the farther the object falls.

But even objects at rest on the planet will appear to have different weights as the Earth rotates and proceeds in its orbit around the Sun. This is manifest, in part, by the variances in gravity around the globe.

The greatest weight should be measurable when the Earth is closest to the Sun and moving the fastest. This may be extrapolated from experiments measuring the warping of spacetime around the planet.

At its core, the Apple did not have gravity at all. It was just just moving through space.

FOR SALE: Pentax K10 D w/18-55mm F3.5-5.6 AL zoom lens, charger, 4 GB memory, T-mount, remote cable CS-205, carrying case. All in original boxes w/warranty papers and software. Cost over $1400.00. Sell $900.00. Jim Leonard 760-377-3474

FOR SALE: Meade 10" LX200 Schmidt Cassegrain with SBIG ST-8 CCD Digital for computer imaging. TeleVue lens, 31mm Nagler, 35mm and 22mm Panoptic, 14mm and 8mm Radian, 2x Celestron Barlow, 12mm Meade Illuminated Reticle. Pelican 1500 hard case, one portable stand and one bolt-down stand. Over $12,000 in equipment. Asking $4500.00 Ray Vega 661-264-6627

FOR SALE: 10mm 2-inch eyepiece, $40. Also selling one brand-new (in box) green laser pointer, has a momentary switch (momentary is release and it goes off) for $50. This can be adjusted to about 4 times as bright as the pointers commonly seen for about $25 additional, but the beam is visible in the dark as is. Glenn Hand 909-861-6461 or email scopeguy20@gmail.com

PAD LICENSE FOR SALE: Located on **Jupiter Ridge**, second pad up from the bottom. The pad includes spacious pad area, a long gravel driveway for parking, electrical outlets at the redwood work bench and also attached to the heavy duty pier bolted down on the pad and light breaking bushes and trees surrounding most of the pad perimeter. The Schaefer type pier (96 lbs.) is metal and is 10" in diameter and 31" in height. I will sell the pad for what it cost to build and the pier for what I paid for it. Please call Roy at (949) 768-5205 for further information.

NASA's Space Place

Invisible Spiral Arms

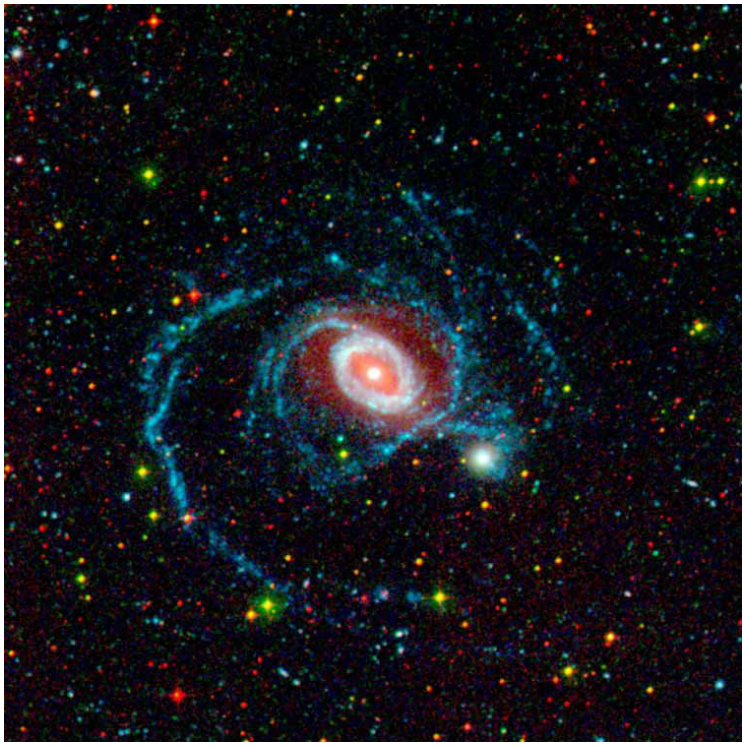
by Patrick Barry

At one time or another, we've all stared at beautiful images of spiral galaxies, daydreaming about the billions of stars and countless worlds they contain. What mysteries—and even life forms—must lurk within those vast disks?

Now consider this: many of the galaxies you've seen are actually much larger than they appear. NASA's Galaxy Evolution Explorer, a space telescope that "sees" invisible, ultraviolet light, has revealed that roughly 20 percent of nearby galaxies have spiral arms that extend far beyond the galaxies' apparent edges. Some of these galaxies are more than three times larger than they appear in images taken by ordinary visible-light telescopes.

"Astronomers have been observing some of these galaxies for many, many years, and all that time, there was a whole side to these galaxies that they simply couldn't see," says Patrick Morrissey, an astronomer at Caltech in Pasadena, California, who collaborates at JPL.

The extended arms of these galaxies are too dim in visible light for most telescopes to detect, but they emit a greater amount of UV light. Also, the cosmic background is much darker at UV wavelengths than it is for visible light. "Because the sky is essentially black in the UV, far-UV enables you to see these very faint arms around the outsides of galaxies," Morrissey explains.



In this image of galaxy NGC 1512, red represents its visible light appearance, the glow coming from older stars, while the bluish-white ring and the long, blue spiral arms show the galaxy as the Galaxy Evolution Explorer sees it in ultraviolet, tracing primarily younger stars. (Credit: NASA/JPL-Caltech/DSS/GALEX).

These "invisible arms" are made of mostly young stars shining brightly at UV wavelengths. Why UV? Because the stars are so hot. Young stars burn their nuclear fuel with impetuous speed, making them hotter and bluer than older, cooler stars such as the sun. (Think of a candle: blue flames are hotter than red ones.) Ultraviolet is a sort of "ultra-blue" that reveals the youngest, hottest stars of all.

"That's the basic idea behind the Galaxy Evolution Explorer in the first place. By observing the UV glow of young stars, we can see where star formation is active," Morrissey says. The discovery of these extended arms provides fresh clues for scientists about how some galaxies form and evolve, a hot question right now in astronomy. For example, a burst of star formation so far from the galaxies' denser centers may have started because of the gravity of neighboring galaxies that passed too close. But in many cases, the neighboring galaxies have not themselves sprouted extended arms, an observation that remains to be explained. The Galaxy Evolution Explorer reveals one mystery after another!

"How much else is out there that we don't know about?" Morrissey asks. "It makes you wonder."

Spread the wonder by seeing for yourself some of these UV images at www.galex.caltech.edu. Also, Chris Martin, principle scientist for Galaxy Evolution Explorer —or rather his cartoon alter-ego—gives kids a great introduction to ultraviolet astronomy at spaceplace.nasa.gov/en/kids/live#martin.

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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up the red giant's stellar wind as it orbits through it. This should create a pinwheel shape of dust. After the blast from the nova settles in the next few years, the astronomers plan to look for such a shape using the Spitzer infrared space telescope.

Integral (orbiting gamma-ray observatory) has made the first unambiguous discovery of highly energetic X-rays coming from a galaxy cluster, namely the Ophiuchus cluster. The X-rays are of too high energy to originate from ordinary hot gas clouds, suggesting that giant shockwaves must be rippling through the gas. The gas in this galaxy cluster is extremely hot, about 100 million degrees K. The X-rays observed could be produced either by electrons encountering magnetic fields or by electrons colliding with the cosmic microwave background. Scientists plan further observations with radiotelescopes to measure the magnetic field and with the HESS gamma-ray telescope to resolve this. In either case it is believed that the energetic electrons involved were produced by shockwaves created when the galaxy cluster collided with another.

Hypervelocity star – There are 10 known hypervelocity stars, those moving so fast that they are escaping our Milky Way galaxy. All but one of them have a type, speed and age that indicate they were thrown out from the Milky Way center, apparently by an encounter with the supermassive black hole there. This is expected for binary stars that wander close to a large black hole; one of the pair will be sucked into the black hole, while the other will be thrown out at high speed. The other hypervelocity star is a problem – its age is too young to have made the trip from the Milky Way center. It is about 9 times the mass of the Sun, about 35 million years old, and is zooming away at 1.6 million mph. New observations of the star show that its relative abundance of elements matches that of stars in the Large Magellanic Cloud (LMC), our neighboring galaxy. Its speed and rotation are consistent with having been flung out of the LMC by the usual black hole method. This implies there is a supermassive black hole in the LMC, but none has yet been observed there.

Extragalactic meteors – Russian astronomers used a 6-meter telescope to take spectra of meteors and they concluded that some of the ones they observed came from outside the solar system, in fact outside our Milky Way galaxy. The speeds were too fast, the composition was different, and the grain size was too large to be solar system meteors. The speed in particular indicated a source outside the galaxy. Further observations are needed to confirm this.

Planet search – The Deep Impact spacecraft, having completed its comet mission in 2005, has now begun its next mission. It is observing 5 nearby stars that are already known to have transiting planets (ones that pass in front of their stars) in hopes of discovering other planets orbiting the same stars. These can be detected either by transits or by perturbations to the timing of the known transiting planets. Astronomers believe this technique could detect planets as small as the Earth. The 5 transiting planets being observed are all "Hot Jupiters", that is, very large planets orbiting so close to their stars that they are quite hot. The spacecraft is currently on its way to Comet Hartley 2 for its 3rd mission, to flyby in October 2010. The planet observing mission is called EPOCh, and the Hartley mission is called DIXI, or the combination EPOXI.

Instant AstroSpace Updates

Another set of observations, this one of the distribution and motions of thousands of galaxies in the distant Universe by the Very Large Telescope in Chile, has provided another indication that **dark energy** (the unknown force that accelerates the expansion of the Universe) must exist, in order to fit the patterns seen.

New very detailed images taken by **Mars Reconnaissance Orbiter** of wind-sculpted landforms have raised questions of whether the current thin atmosphere of Mars (less than 1% that of Earth) is capable of forming these features, or whether the atmosphere had to have been thicker or faster moving in the distant past. Further observation and analysis will be needed.

The European spacecraft Mars Express has been **mapping Mars** in stereo, producing a highly detailed map including height. This 3-dimensional map has been released to the public on the web at hrscview.fu-berlin.de.

A team of scientists set up a remote-controlled observatory, with 7 telescopes, 4 of them 6-inch, on **Dome A**, high on the Antarctic Plateau, reputed to have the steadiest seeing on Earth, and definitely the coldest and driest place. It will run on solar panels during daylight (essentially the southern summer) and diesel generator in the dark.

A newly discovered **asteroid** named 2008 CTI, estimated at 25-50 feet across, passed Earth 3 times closer than the Moon on February 5. Not to be confused with 2007 WD5 that came 5 times closer than that to Mars January 30, or 2007 TU24, perhaps 1000 feet across, that passed 1.4 lunar distances from us January 29.

Astronauts performed a spacewalk at the end of January to change a failed motor on the solar arrays of the **International Space Station** (ISS). Work was done only while in shadow (33 minutes per orbit) to avoid the high voltage danger generated in sunlight. The repair was necessary to track the Sun and thereby generate enough power for the new lab modules being delivered.

The European-built **Columbus** laboratory module, after being carried up by Space Shuttle Atlantis, was attached to ISS during a nearly 8-hour long spacewalk on February 11, taking longer than expected, but perfectly successful. It was originally scheduled to launch in 1992.

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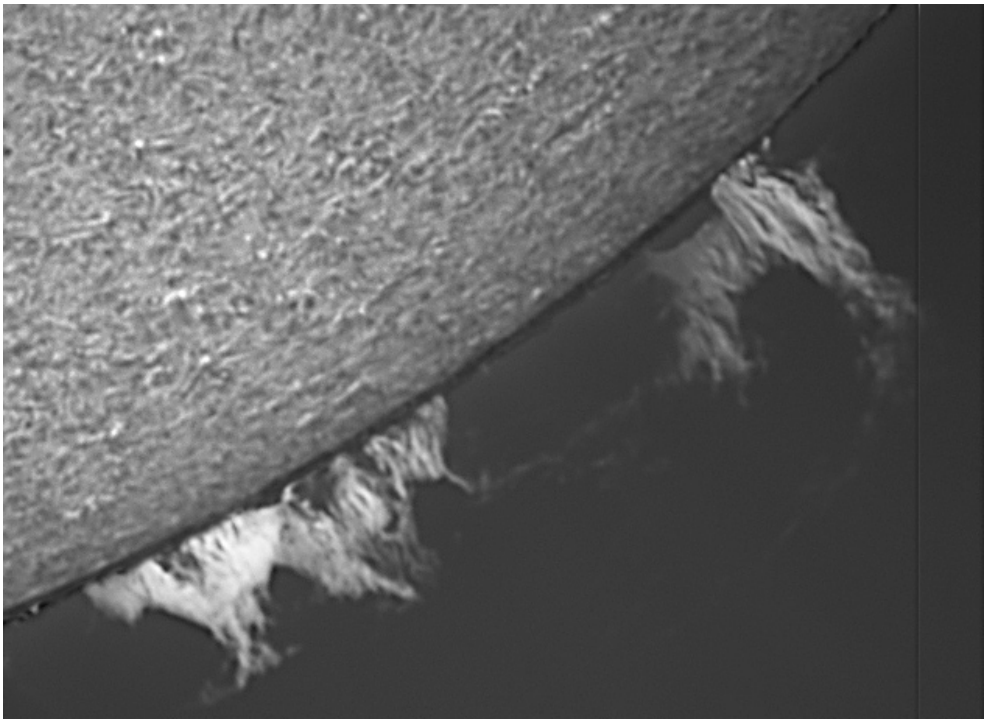
already a member. One benefit of the email group is that Scott Kardel of the Palomar Observatories (and our featured speaker at the February meeting) is a frequent contributor and gives us updates on issues that affect the Palomar area, which often affect our Anza site as it's in the Palomar Protected Zone, including his successes in working with some of the local tribes on casino lighting.

One way we as individuals can help improve the outside lighting situation is to be more aware of what types of outside fixtures give effective light in a night-friendly way – which, happily, is generally a more energy-efficient way as well. The light domes we see over populated areas are mainly from thousands of outside lights that send a lot of their light up into the sky instead of projecting it down onto whatever they are intended to illuminate – some may be due to reflected light, but most is from light that's wasted as it doesn't illuminate anything. Besides dimming out the stars, that misdirected light creates unnecessary glare (a real problem for those of us with aging eyes!) and wastes a lot of energy. A "night friendly" light puts its light where illumination is needed and stops it from going in directions where it's not needed – out to the sides, where it causes glare, or up, where it lights the sky but nothing useful.

The most effective fixtures are "full cut-off" lights, which have an opaque shield that hides the source of the light itself entirely when viewed from the side and that reflects the light that would otherwise go up or out so that it goes instead where the fixture is pointed, giving a lot more illumination to that area than a fixture with an exposed light source could give. Since as much as possible of the fixture's light is going to illuminate what it is intended to illuminate, these are also the most cost-effective types of lights for a given level of illumination. The most astronomy-friendly of the full cut-off lights are the low-pressure sodium versions, which minimize the amount of sky-glow they produce and limit it to a type of light that can be worked around fairly easily. You can see a lot of these types of street and parking lot lights on Highway 79 in Temecula if you happen to drive through there after dark, though their benefits are probably swamped by the glaring white lights in the areas around them.

There are a lot of outside fixtures you can see with shields that leave the light source partly exposed when seen from the side – these aren't as efficient or effective as full cut-off lights, as they allow light to shine out the sides where it creates more glare than illumination (we see things in reflected light, which is what gives illumination, and our ability to see them is blocked by glare – whether we're looking into the glare of the sun, oncoming headlights, or a poorly shielded or misdirected light fixture). Generally, some shielding is better than none, and the more shielding a fixture has the better. If you find that you have poorly shielded lights around your home that you don't want to replace, you might consider finding ways of adding some kind of shielding, either to the fixture itself or its location, to minimize stray light.

For more information on lighting fixtures and other dark sky matters, please check the International Dark-Sky Association (IDA) website: http://www.darksky.org/. And, if you aren't an IDA member but want to help protect the night sky – IDA is a major player in that area and well worth joining!



Solar prominences, February 11, 2008 (Pat Stoker)

Moon-Mars conjunction, December 23, 2007 (Michael Daugherty)

(continued from page 8)

Japanese astronaut Takao Doi will perform an experiment during his March stay on the International Space Station to determine if a **boomerang** will return to the thrower in the absence of gravity. Doi has been training with a world boomerang champion.

Space Shuttle **Endeavour** is scheduled to launch March 11 on a 16-day mission to deliver the first section of the Japanese lab module and the Canadian 2-arm robot Dextre.

Virgin Galactic unveiled their 60% complete **SpaceShip Two**, based on the design of their previous craft that won the $10 million X-Prize, but with space for 8 paying passengers. 200 people are already booked for a 2.5 hour flight into space, and 80 have begun medical evaluation and training. ■

Arts Council for Long Beach presents Smithsonian Week 2008

More information on this and other FREE Smithsonian events at

www.smithsonianweek.com

MARCH 13

Sputnik & The Space Race

Ristorante da Vinci
2801 E. Spring Street
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6 – 7 PM
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Free parking
Reservations required at www.smithsonianweek.com or 562-489-4658

Where were you on October 4, 1957? Noted Smithsonian Scholar and flight historian Tom Crouch was a 7th grader and can tell you exactly where he was and what the launch of Sputnik meant to him and America . This is the behind the scenes story of **the birth of the space age**.

After the lecture, which will be accompanied by student photograph and video exhibitions guests are invited to dine at Ristorante da Vinci and enjoy more intimate discussions on the Space Race and other flights of fancy with the scholar.

Pre-set dinner menu prices include one drink ticket, tax and gratuities for $80 per person. Great deal for an exclusive dinner with Smithsonian Scholar and flight historian Tom Crouch!

For dinner reservations following the presentation, call 562-432-5100, ext. 221 or 238 with credit card. Seats are still available but are limited. Call now and reserve! Please call before February 29th!

Past February 29th? No problem! To inquire about dinner reservations after February 29th please email Daisy at daisy@artslb.org and she will notify you if

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