SIRIUS ASTRONOMER

www.ocastronomers.org

The Newsletter of the Orange County Astronomers

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OCA Member John Castillo created this image of the Horsehead Nebula in Orion on 12/30/2011 and 1/1/2011 using both H-alpha data from these sessions and RGB data from an earlier session in 2008. Though not an easy object for visual observers, the Horsehead is one of the more spectacular photographic objects in the winter sky.

OCA CLUB MEETING

The free and open club meeting will be held February 10th at 7:30 PM in the Irvine Lecture Hall of the Hashinger Science Center at Chapman University in Orange. This month our speaker is Dr. Helen Mahoney, who will discuss the 'Top Twenty Things An Amateur Astronomer Should See'

NEXT MEETINGS: Mar. 9, Apr. 13

STAR PARTIES

The Black Star Canyon site will be open on January 28th. The Anza site will be open on January 21st. 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, February 3rd at the Heritage Museum of Orange County at 3101 West Harvard Street in Santa Ana. Next month the class will be offered on December 2nd.

GOTO SIG: Feb. 6
Astro-Imagers SIG: Feb. 21, Mar. 20
Remote Telescopes: TBA
Astrophysics SIG: Feb. 17, Mar. 16
Dark Sky Group: TBA

February 2012 President's Message

Reza AmirArjomand

We have an exciting year ahead of us! Eight years have passed since the last transit of Venus across the sun and Venus is due to do this again on June 6th of this year but perhaps after that we won't be observing another such event in our lifetime. I particularly remember the events in 2004 and the transit of Venus, as that is how I got introduced to Orange County Astronomers; it was a lecture by Liam Kennedy (OCA president 2001-02) at Sharif University of Technology in Iran.

In my two years as the Vice President of the club (2010-11) and responsible for recruiting speakers for the general meetings, I had the opportunity to meet some of the sharpest minds in the field of astronomy; people who, are not only capable of conducting cutting edge research but are also gifted in walking laymen through their work. In fact there is a story behind each one of the 25 speakers I have invited to the club so far. For the first time in the history of the club I had a presentation done over the internet (televised speaks had been done before via ham radio for special interest groups). I also challenged the club by having a few speakers that while they appealed to a part of our membership repelled the others! I am passing the baton of choosing speakers to Greg Schedcik and looking forward to work with him as the club's new Vice President. Greg has a strong enthusiasm for the club, last year when we became aware that Bob Buchheim's Lockheed Martin facility is no longer available for our board meetings, he immediately offered his and although he is being provided with the list of speakers that I have already lined up for 2012 he is well on task for securing even more attractive speakers for the year after and possible last minute call-offs.

I am taking over the leadership of this fine institution at a time that it has just a little fewer than 750 members, conducts two start parties (Anza & Black Star) per month, in addition to its monthly general meetings, has several monthly or bimonthly special interest group meetings, including the beginner's class, and runs a very rich outreach program; all thanks to its multiple volunteers who's names you can find on the back of this publication. However there are a few things that I envision to improve upon, during my presidential term.

Extended relations with other clubs, locally, nationally and internationally, is one of them. Activities like joint star parties, meetings and fairs will bring in variety to our experience of the club and astronomy, and will help us recruit members. Some of our members are also members of Riverside, Los Angeles, San Diego astronomical societies. One step that I have already taken into this direction is to invite "What's Up?" presenters from other clubs (03/09/2012). Joining efforts in international collaborations are another step. We are already involved in Dark Sky (www.darksky.org) thanks to Barbara Toy. I would like to add to that, Star Peace (www.starpeace.org) which is a cornerstone project of the international year of astronomy trying to surpass political boundaries by running simultaneous star parties in neighboring countries.

A few moth back Steve Short initiated a review of our Loaner Scope program and found out that it is in a less than desirable condition. This has been a topic of discussion for several of the board meetings and I would like to force this to come into a conclusion. In addition to refurbishing the telescopes that are already in the program and restocking it with working ones, we need more volunteers to help run it.

One other area of the club that can see improvement is its appeal to younger people and thus its youth membership number. Having strong relations with local colleges, libraries and their astronomy programs in parallel with, perhaps, creating a youth special interest group serves this purpose.

At the end, I am always appreciative of any criticism or comments and suggestions that are sent my way. You can find my contact information along with all the other board members on our website (www.ocastronomers.org/about_oca/contacts) and back of this magazine.

AstroSpace Update

February 2012

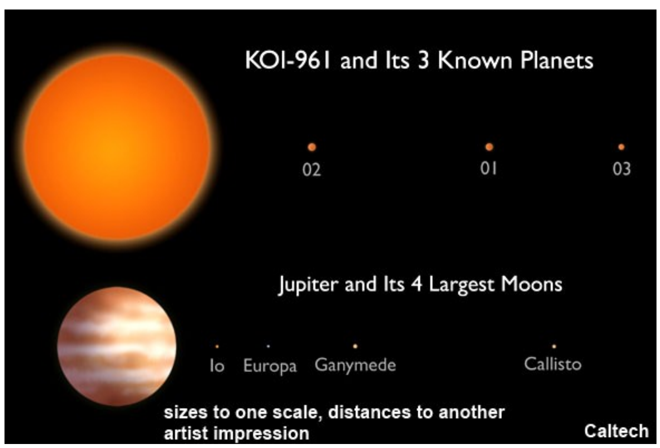
Gathered by Don Lynn from NASA and other sources

Exoplanets – A team of astronomers announced 18 new exoplanets (those orbiting stars other than our Sun). They were found by a survey of 300 massive stars (about 1.5 times the Sun's mass), searching for wobbles induced by the gravity of planets orbiting the stars. The 18 planets have masses similar to Jupiter's. This is a 50% increase in known planets orbiting massive stars. Of the 2 theories of planet formation, that of clumping particles or that of cloud collapse, only the former predicts that the characteristics of planets will correlate with the mass of their star. The newly discovered 18 appear to be correlating with mass, so the first theory is supported. The 18 showed more frequency around more massive stars, and also showed wider orbits around more massive stars. The new batch of planets seems to have fairly circular orbits, while planets orbiting less massive stars often show more elliptical orbits.

Kepler (planet-finding space telescope) discovered the first Earth-size exoplanets orbiting a Sun-like star (smaller ones are known orbiting a pulsar). The planets are known as Kepler-20e and Kepler-20f, part of a 5-planet system. It is about 1000 light-years away in Lyra. All 5 of the planets orbit quite close to their star, closer than Mercury is to our Sun. That makes them quite hot, so none of them reside in the "habitable zone", where temperatures allow liquid water to exist on the surface of a planet. The other 3 planets are almost Neptune-sized. Strangely the 5 planets alternate large-small as you move out from their star. On the basis of the solar system and planet formation theory, it was thought that small rocky planets formed near their star, and gas giants formed farther. Apparently not in the case of Kepler-20. It is thought that no planets can form as close to their star as these 5 are, but instead they must have formed farther out and then migrated inward, probably due to drag from the disk of material from which they formed. Kepler-20f is barely larger than Earth, at 1.03 times the diameter. It takes only 19 Earth-days to orbit, and it is more than 1400° F (760° C). Kepler-20e measures 0.87 times the size of Earth, orbits in 6.1 Earth-days and is about 800° F (430° C). Kepler-20e set the record for the smallest known exoplanet orbiting a Sun-like star, a record it held for 2 days.

More Kepler – A team of astronomers that were using the Kepler data to study pulsations in stars (instead of searching for planets) found variations in their data for one particular star that could only be caused by 2 (or possibly 3) planets. It wasn't the transiting of the planets in front of their star, which is what Kepler was designed to find, but variations in light caused by the planets going through their phases (full, half, crescent). The planets were calculated to be 0.76 and 0.87 times the diameter of Earth. This was announced 2 days after Kepler 20. The new smallest-exoplanet record isn't even the best part of the story. The planets are extremely close to their star, taking only 5.76 hours and 8.23 hours to complete their orbits. Their temperatures have to be around 16,000° F (9000° C), since they are so close to their star, which is a very hot star. Now here's the shocker: the star has already evolved past its red giant phase, so the 2 planets survived being engulfed by the star when it swelled up as a red giant. Astronomers had generally believed that this would destroy any planets caught up in the swelled star. At best, this would strip everything off a planet except its core, so the 2 planets are thought to be just the cores of former gas giants. Since the 2 planets were not verified by the Kepler team of astronomers, they have not been given Kepler planet designations (like Kepler-20f above), but they were given Kepler planet candidate designations of KOI 55.01 and KOI 55.02. The discovery team says that the existence of these 2 planets raises the question of whether they participated in the huge mass loss that red giants undergo on their way to the next phase of a star's life. The details of this mass loss are not understood. The smallest-planet record set by KOI 55.01 lasted nearly 3 weeks. Records for the smallest known planet are important not so much just because they are records, but because they represent advances in astronomical technology. We are quite certain that exoplanets and exoasteroids exist the size of Earth and much smaller; the larger ones we have found already could not have formed without also forming large numbers of smaller ones in the same processes. We just need better technology to find the small planets, and these records demonstrate that this is happening.

Yet more Kepler – Astronomers not on the Kepler team, but using publicly available Kepler data, found 3 planets orbiting a star designated KOI 961, the smallest of which is about the size of Mars. The 3 are 0.78, 0.73 and 0.57 times the diameter of Earth. All 3 are believed to be rocky planets. Only a handful of the more than 700 confirmed planets are known to be rocky. They orbit close to their star, taking less than 2 Earth-days to orbit, so are too hot to be in the habitable zone. The star is a red dwarf only 1/6 the diameter of our Sun. So the whole system is the smallest planetary system known, looking more like Jupiter and its moons than like a solar system. These planets are the 7th, 8th and 9th confirmed planets found in the Kepler public data by astronomers not on the Kepler team.

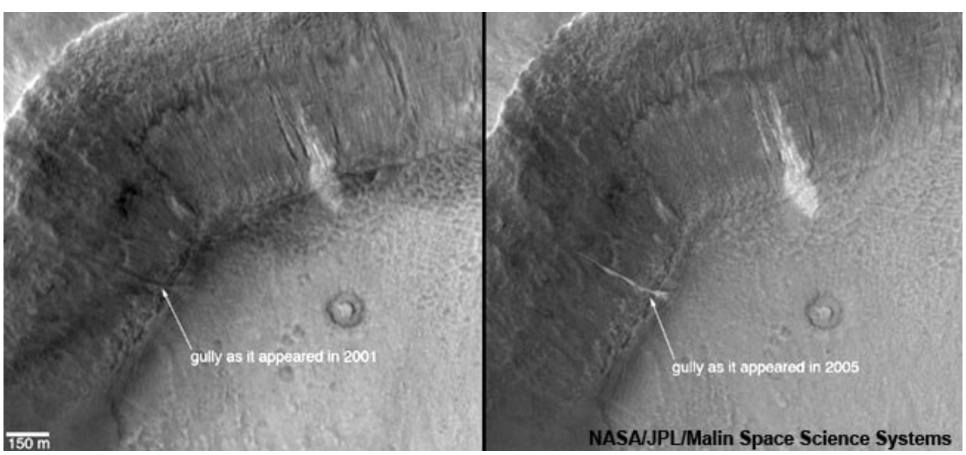


Dust ring – The adaptive optics camera on the Subaru Telescope in Hawaii, using a technique that suppresses the light of a star, has taken an image of a faint dust ring orbiting the star HR 4796A, a young 8-10 million-year-old star that is 240 light-years away. The ring is off-center from the star, which is probably caused by planets orbiting the star. No planets were seen in the image, so they are probably too faint for current instruments. The ring is about twice the size of Pluto's orbit. There are 2 types of dust rings about stars: the left-over dust from star formation, which forms planets and then dissipates; and the dust debris from collisions of asteroids, which persists much longer. The imaged ring is the 2nd type.

Microlensing exoplanets – The PLANET group for the last 6 years has been following up discoveries of star microlensing events, using telescopes around the world, to monitor for planet microlensing events caused by planets orbiting each newly discovered star. If a star passes in front of another from Earth's point of view, the gravity of the star in front, like a lens, bends the light of the more distant star, brightening it. Any massive object, even planets, can form such a gravitational lens. Such microlensing by a star typically lasts a month, while those of planets last a few hours to a couple of days. The mass of the lensing object can be calculated from the time of the brightening. 40 star events were monitored, and 3 of those were accompanied by planets that also were lined up well enough to lens the background star. Even with only 3 events, rough statistics can be obtained. Microlensing turns up stars and planets randomly, of essentially all masses, while all other techniques for finding planets are heavily biased toward finding massive planets, or planets close to their stars, or planets around certain types of stars. So these new statistics could not be obtained by any other method. The new results: There are at least 100 billion planets in our Milky Way. There are more than 10 billion terrestrial (Earth-sized rocky) planets in our galaxy. There are a minimum of 1500 planets within just 50 light-years of Earth. 1 in 6 stars has a Jupiter-sized planet, 1 in 2 stars has a Neptune-sized planet, and 2 in 3 have an Earth-sized planet.

Exorings – A new paper calculated that a planet roughly like Saturn would allow the rings to be detected in Kepler or possibly CoRoT (planet-finding space telescopes) data, if the rings were oriented favorably. A team of astronomers plans to search Kepler and CoRoT data for such exorings, as well as exomoons. A few weeks after the paper was published, a team of astronomers who apparently did not know that it should take a high-tech space telescope to discover exorings, announced that they had discovered an exoring system using ground-based 3 and 4 inch diameter telephoto lenses. The SuperWASP and ASAS projects use such lenses with CCD cameras to monitor millions of stars for changes in brightness due to planets passing in front or other reasons. One suspected transiting planet was found to have a peculiar pattern to the light during transit, which the astronomers determined is most likely caused by a large ring system (much larger than Saturn's rings). The system has at least 4 rings and 2 large gaps, and is likely made of dust. The star being transited is similar in mass to the Sun, but is much younger (about 16 million years old), and it lies about 420 light-years away. The object at the center of the rings is very low mass, either a planet, brown dwarf or very low mass star. Observations will be made to try to detect this object by the radial velocity method, which can pin down the mass and distinguish which type of object it is. In addition, efforts will be made to directly image the object and rings.

Supercritical exoplanet – 40 light-years from us the exoplanet 55 Cancri e orbits perilously close to its star, 26 times closer than Mercury is to the Sun. Astronomers have believed since its discovery in 2004 that it must be a wasteland of parched rock. New observations by the Spitzer space telescope suggest it is weirder than that. Spitzer observed its transits in front of its star in infrared and got more precise numbers for its diameter and mass. The resulting density cannot be explained by hot rock. It has to contain considerable light materials, including water. With the pressure and temperature there, these light materials would have to be supercritical fluids. A supercritical fluid is a material at very high temperature and pressure, so that it behaves both like a gas and a liquid, often becoming a powerful solvent.



Martian gullies that change over time have been seen for years now. Many scientists have attributed these to brief releases of salty water (salty to prevent immediate freezing) that rushed down slopes to form or change the gullies. However a recent computer simulation has been able to form results similar to those seen on Mars by releasing carbon dioxide gas into sand on a slope. It is known from watching the dry ice (frozen carbon dioxide) at the Martian polar caps melt in spring that bursts of carbon dioxide can be released on Mars. The scientists that made the new study believe that gullies near the poles are likely caused by such discharges of carbon dioxide. Gullies far from the polar regions may still be caused by water discharges.

Opportunity (Mars rover) has found bright veins of a mineral that is probably gypsum, which had to be deposited by water flowing through a crack in rocks. The rover's microscopic imager, alpha particle X-ray spectrometer and camera with multiple filters were used to examine one vein, which has been informally named "Homestake". The vein investigated is less than an inch wide and about 1.5 feet (0.5 m) long, protruding slightly higher than the rock on either side of it. The veins are found on an apron surrounding the rim of Endeavour Crater. None like it were seen in the 20 miles (33 km) of crater pocked plains that the rover explored for 90 months before it reached Endeavour. Gypsum has been seen before in dunes by Mars orbiters, but this is the first gypsum found where it formed. It likely formed from water dissolving calcium out of volcanic rocks, the combined with sulfur either from rocks or volcanic gas, and was deposited as calcium sulfate (gypsum) into an underground fracture that later became exposed by erosion. This probably happened in the distant past, as water apparently does not flow on Mars now.

Opportunity has weathered 4 Martian winters without having to tip its solar panels toward the lower Sun in the sky. Its twin rover Spirit had to do that to survive. In fact Spirit's failure to reach such a slope last Martian winter is what led to its demise. But as another winter approaches, it was found that Opportunity has more dust on its solar panels this time, and so is generating less power. So the decision was made to find a nice slope facing the lower Sun. That slope has been informally named "Greeley Haven", in honor of Ronald Greeley, a professor of planetary geology who died last October. It is hoped that the IAU will formally name a crater for Greeley, but that process takes time. While Opportunity sits on Greeley Haven, it will still be able to move about a little, investigating interesting rocks there and taking panoramic pictures through all its filters. Because some rocks on the rim of Endeavour Crater came from considerable depth, they should be older than any the rover has examined previously.

Titan (Saturnian moon) – A new computer simulation of the atmosphere on Titan has finally matched the observed strange distribution of methane rain and clouds and methane lakes on Titan. The simulation shows that methane collects in lakes near the poles because the weak polar sunlight fails to evaporate the liquid there, while sunlight nearer the equator dries out the lakes. Saturn's elongated orbit makes the northern summer (which is rainy season) a little longer than the southern summer on Titan, and that is enough to create more methane lakes in northern Titan than in southern. The simulation shows that little rain falls near the equator, which matches cloud observations, but that occasionally an equatorial storm develops, usually at equinox times, and those storms bring heavy downpours. This matches with the heavy erosion, apparently from methane rain, observed in the equatorial regions, despite rare rain clouds.

Sungrazing comet – Last November Australian amateur astronomer Terry Lovejoy discovered a comet that was heading almost directly for the Sun. On December 16 it passed only 75,000 miles (120,000 km) from the surface of the Sun. On the basis of hundreds of past sungrazing comets, astronomers thought the heat would destroy the comet, even though it was somewhat larger than the average sungrazer. But it survived, and even flourished. The comet lost its tail during the passage, but within hours, the tail grew back, bigger and brighter than before. It must be bigger than estimated to have survived, probably the biggest sungrazer since Ikeya-Seki in 1965. Unfortunately for northern astronomers and late risers, the comet gave its best appearance in the southern hemisphere skies before dawn. How Lovejoy survived and why its tail wiggled wildly near the Sun will keep astronomers working for some time.


Comet Lovejoy and Space Station
Carlos Caccia

Comet Lovejoy from Space Station
Dan Burbank

Peculiar gamma-ray burst discovered by Swift (orbiting gamma-ray observatory) in December 2010 is still not understood, but there are now 2 theories to explain it: a novel supernova located 5.5 billion light-years away, produced when a neutron star became engulfed by its companion red giant; or a huge comet crashing into a neutron star, located within our galaxy, only 10,000 light-years away. The gamma-ray emission lasted at least 28 minutes, which is unusually long for a gamma-ray burst. It also had unusual X-ray emission lasting for several hours. Follow-up observations by the Hubble Space Telescope and ground-based telescopes were unable to measure the redshift of the afterglow, so its distance was not determined. Further observations with the Hubble and X-ray telescopes are planned to try to distinguish which theory is correct.

Fermi (orbiting gamma-ray telescope) team has released a census of very-high-energy (above 10 billion electron volts) gamma-ray sources. It took years to collect enough data for this, since very-high-energy photons of gamma-rays are extremely rare. The list has 496 objects. Only 4 very-high-energy sources were known before Fermi was launched, all of them pulsars. The newly announced sources include active galaxies (matter falling into supermassive black holes), pulsars, supernova remnants, and a few binary systems containing massive stars. Only 10% of the objects are inside our galaxy. More than 1/3 of the objects have no identified counterpart detected in any other part of the spectrum, so the type of source is completely unknown. Like objects that show up in infrared and not ultraviolet, or vice versa, some sources show up in high-energy gamma rays that do not in low-energy, and vice versa. For example the radio galaxy NGC 1275 fades in very-high-energy gamma rays, while IC 310 (also a radio galaxy) is brighter in very-high-energy than low-energy. The Fermi list will serve as an important observing list for other gamma-ray telescopes, including ground-based ones, which must be aimed right at the source. Fermi's main instrument sees 20% of the entire sky at any given time, and scans the entire sky every 3 hours.

Positrons (anti-electrons) – In 2008 PAMELA (cosmic ray satellite) found an excess of positrons, that is, more than can be explained by all physical processes known to be occurring in space. One explanation was that a concentration of dark matter particles that collided with anti-dark particles should produce positrons. However, dark matter theory predicted a drop-off in the number of positrons above a certain energy, and that was not found in the PAMELA data. Researchers tried to determine how to independently measure the positron excess, and came up with the fact that the Fermi gamma-ray space telescope should theoretically detect positrons when it passed through the strongest portions of the Earth's magnetic field. So Fermi data was processed to ferret out positron detections, and the result confirmed the PAMELA data: the positron excess exists, but the high-energy drop-off was not detected. So the positrons are still open to other explanations.

Hubble Space Telescope (HST) has uncovered a cluster of galaxies in its initial stages of development, which is the most distant such cluster ever observed. It is so far that its light took 13.1 billion years to reach us, so we are seeing it as it was only about 600 million years after the Big Bang. The distance was estimated based on the galaxies' colors, but follow-up spectroscopic observations will be made to determine redshift, and therefore more accurate distance. Only the 5 brightest galaxies of the cluster show up in the Hubble image. Many dimmer galaxies likely inhabit the area. The 5 seen are about ½ to 1/10 the size of our Milky Way, yet are comparable in brightness. The galaxies are bright because they are being fed large amounts of gas through mergers with other galaxies. Presumably it has since grown into a galaxy cluster similar to those we see today nearby, such as the Virgo cluster with more than 2000 galaxies.

Largest galaxy cluster – Chandra (orbiting X-ray observatory) and the ACT microwave radiotelescope in Chile have found the largest galaxy cluster known in the distant (and therefore early) Universe. Its light took over 7 billion years to reach us. The cluster was originally found through the Sunyaev-Zeldovich effect, which distorts the cosmic microwave background as it passes through the hot gas in a galaxy cluster. The Chilean astronomers involved have nicknamed the cluster El Gordo (Spanish for "fat one") due to its size. Further observations have shown that it actually consists of 2 galaxy clusters that are colliding. It appears that the ordinary matter (mostly hot gas) is being slowed by the collision, while the dark matter of each cluster has passed through the other. So the visible matter is no longer centered on the dark matter, a condition which was previously seen in the Bullet Cluster.

HST was used to study 166 galaxies so distant that we are seeing them as the existed 2-3 billion years after the Big Bang. They represent the most massive galaxies that had developed by that time. They differ from today's most massive galaxies in that 1) 60% of them are disk galaxies (as opposed to elliptical or lenticular), while today about 5 times less are disk galaxies; 2) many of them are prodigious star factories, churning out new stars over 100 times faster than present-day massive galaxies; 3) as many as 40% of them are ultra-compact, meaning that most of their light is jammed into a small radius, while less than 1% of today's massive galaxies are ultra-compact. The most popular theory of early galaxy growth is that it occurred by major mergers, that is, colliding with galaxies of roughly the same size. But this could not have happened to the 60% of these early galaxies observed, because major mergers will disturb the shape of a galaxy into elliptical. Minor mergers (colliding with much smaller galaxies) and cold mode accretion (pulling in cold gas from filaments, not galaxies) have been suggested as alternative growth theories consistent with this new study. The most massive early galaxies are believed to have transformed into today's most massive galaxies. But statistically there should not have been enough major mergers later in the history of the Universe to transform so many disk galaxies into ellipticals. More theoretical work on galaxy growth needs to be done to agree with this study.

HST has detected a supernova that exploded more than 9 billion years ago, but is so distant that its light is just now arriving. It is the most distant Type Ia supernova yet confirmed. This type of supernova, because of its known brightness, was used to measure the expansion of the Universe, which resulted in the discovery of dark energy. So the more distant that we can find these, the farther back in time we can measure the universal expansion. The newly found Type Ia was found in infrared. Objects that far away have their visible light redshifted into infrared.

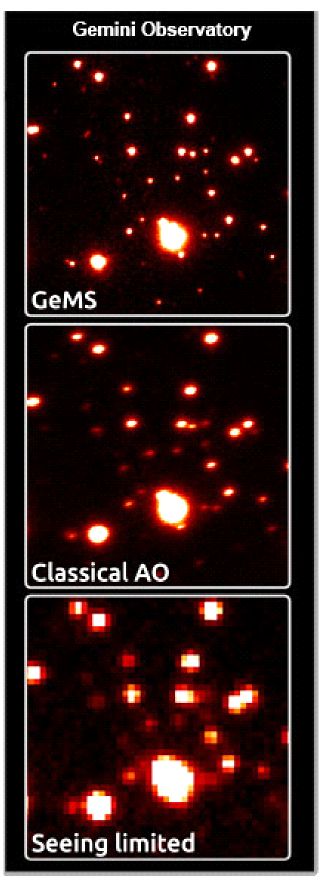
Star production – Observation using Spitzer (infrared space telescope) and HST have discovered that one of the most distant galaxies known is churning out stars at a shockingly high rate. The galaxy, called GN-108036, is the brightest galaxy known at such great distance. Light took 12.9 billion years to get here from the galaxy. It is producing about 100 suns per year. For comparison, the Milky Way makes 30 times fewer stars per year, even though it is 5 times larger and 100 times more massive. Only 2 galaxies have confirmed distances greater than GN-108036.

Type Ia supernova – HST was used to look for a star within a supernova remnant known as SNR 0509-67.5 in the Large Magellanic Cloud (LMC), a nearby galaxy. It was already known that the remnant was a cloud of material left by a Type Ia supernova. That type does not leave a neutron star behind, as other types of supernova do, because too much material is ejected in the explosion. But they can leave behind a companion star to the exploding one. 2 theories exist for how a Type Ia occurs: a white dwarf gravitationally pulls in material from a companion star until it become too massive and explodes (which would leave a companion star after the explosion), or 2 white dwarfs merge and then explode (which would not leave a companion star). The image did not show a star in the remnant, even though HST's sensitivity is sufficient to detect any such companion star. The conclusion is that this supernova occurred by the 2nd theory, merging of white dwarfs. The team of astronomers plans to look at other supernova remnants in the LMC to see which theory is predominant for causing Type Ia supernovas.

Sloan Digital Sky Survey data were used to determine the content of heavier elements (than hydrogen and helium) for both stars centered in the Milky Way's disk, and those a bit above or below the disk. The above/below stars have tilted orbits about the galaxy, while the centered ones orbit all in the same plane. For the stars in the plane, the heavy element content drops gently from near the hub to the outer reaches. Heavy elements are known to be created in stars and are distributed to each succeeding generation of stars through supernovas and stellar winds. So higher concentrations mean that more generations of stars have occurred in the area. Hence the plane of the Milky Way has seen more generations of stars near the hub, and fewer generations in the outer parts. This is just what theorists expected. Generations of stars should run faster in more dense regions. However the stars in tilted orbits showed a constant heavy element content from hub to outer reaches, and that concentration was consistently low. Therefore these stars have seen few generations of star formation. Astronomers proposed that either stars that form with tilted orbits undergo slower generations of star formation, independent of distance from the hub, or else stars that have less of heavy elements undergo some process that kicks them a bit out of the disk. No mechanism for either is known. More study is needed.

Chandra and XMM-Newton (orbiting X-ray telescopes) have discovered a young pulsar in a supernova remnant in the Small Magellanic Cloud (SMC), the 1st such combination found in the SMC. The pulsar is rotating unusually slowly, at once per 18 minutes, one of the slowest X-ray pulsars in the SMC. Since supernova remnants eventually dissipate, this pulsar is known to be fairly young. Estimates of its age range from 10-40 thousand years. It should have been formed by the supernova with a rapid spin, so it is a mystery how it slowed so much so quickly.

Rossi XTE (X-ray space telescope) – A team of astronomers has found in Scorpius what appears to be the smallest known black hole using data from Rossi XTE. The evidence comes from a specific type of X-ray pattern, nicknamed a "heartbeat". This pattern has been found with only one other black hole system. The new discovery is a binary system with a normal star orbiting a black hole. The X-ray data indicates the mass of the black hole is less than 3 times the Sun's mass. That is near the theoretical limit of how small a black hole can form from a star's collapse. Gas from the normal star streams toward the black hole and forms a disk around it. Friction within the disk heats the gas to millions of degrees, which is hot enough to emit X-rays. Variations in the X-rays reflect processes occurring in the disk, with the most rapid changes happening near the black hole's event horizon, the surface beyond which all matter and light are lost. As material heats in the disk, the glow can push back further material from falling in. Eventually the hot material falls to the event horizon, and the process repeats with new material falling into the disk. This results in oscillating X-rays, the heartbeat. This oscillation repeats in as little as 40 seconds on the previous instance, and as short as 5 seconds in the newly discovered one. The faster speed indicates smaller mass of the black hole.



Gemini South (telescope in Chile) has demonstrated a new adaptive optics system named GeMS that uses 5 laser artificial stars, multiple deformable mirrors, and a computer algorithm to counteract atmospheric distortion over a wide field of sky. The result was an improvement by a factor of 10 in resolution (about .05 arc sec) over the best seeing conditions that the observatory experiences, and that resolution over an area of the sky about 10 times as large (more than 1.4 arc minutes across) as any previous adaptive optics system. At the infrared wavelength used in this demonstration (1.65 microns), the resulting resolution is approaching the theoretical limit (.043 arc sec) of the 8-meter (26 foot) primary mirror.

Ultra-blue stars – HST has uncovered a large, rare population of hot bright flue stars in the hub of the neighboring Andromeda galaxy. The stellar oddities are aging, Sun-like star that have prematurely cast off their outer layers of material, exposing their extremely hot cores. While HST has spied such stars before in Andromeda, the new observation thoroughly covers a much broader area of the galaxy.

Roughly 8000 of the ultra-blue stars were found within 2600 light-years of the center, using ultraviolet light, in which this type of star stands out. As these stars evolved through their red giant phase, they ejected most of their outer layers to expose their cores. Normally Sun-like stars lose much less material in their red giant phase, so would never appear as bright in ultraviolet. Two theories have been proposed to explain why some stars become these ultra-blue stars: Stars richer in chemical elements heavier than hydrogen and helium would be more prone to ejecting lots of material into space through strong stellar winds; stars in close binary systems could lose mass to their companion stars. So far observations show that the pattern of these ultra-blue stars found in Andromeda matches both the pattern of stars higher in heavy elements and the pattern of stars in binary systems. All decrease in frequency similarly with greater distance from the galaxy center. Further observations will be needed to explain the ultra-blue stars.

KM3NeT (neutrino detector) – A consortium of European countries has revealed plans for the largest neutrino detector ever, to be built submerged in the Mediterranean Sea. Construction may start as soon as this year. When completed, it will be the 2nd largest human-made structure, behind the Great Wall of China, and will be taller than the tallest building. It will be composed of towers holding optical detector modules connected by cables, spread out over nearly a cubic mile (3 cubic km). It works by detecting muons interacting with seawater, since neutrinos interacting with matter create muons. The bigger the detection system, the more sensitive it is. Many astronomical objects, including the Sun, supernovas, and gamma-ray bursts, give off neutrinos.

Rossi XTE (X-ray space telescope) has been retired after 16 years of observations. It far exceeded its original science goals, but its instruments have been showing their age. Data from the mission have resulted in more than 2200 papers in journals, 92 doctoral theses, and will continue to supply astronomers with research material for years to come. Rossi will re-enter the atmosphere between 2014 and 2023, depending on upper atmospheric density and solar activity. Its data were used to establish the existence of magnetars, discover the 1st accreting millisecond pulsars, and provide the 1st evidence of frame dragging by a black hole, an effect of General Relativity that warps space and time around a spinning massive object. The mission was launched in December 1995, and the name Rossi was in honor of Bruno Rossi, an astronomer and pioneer in X-ray astronomy, who died in 1993.

GRAIL – Both GRAIL spacecraft fired into lunar orbit about New Years, to begin their mission of measuring the gravity field of the Moon. The initial orbits take about 11.5 hours to circle the Moon, but are being lowered through further rocket burns to a working orbit of about 2 hours. The final orbit is near-circular, near-polar about 34 miles (55 km) high. Science data collection begins in March. Gravity concentrations on and in the Moon are measured by their effects on the distance between the spacecraft as they orbit over. In addition to the gravity experiment, each spacecraft carries a MoonKAM, to be used for education and public outreach, taking images of lunar landscapes.

Very Large Array (radiotelescope in New Mexico) has been updated to be 10 times more sensitive and cover 3 times the range of frequencies. In a re-dedication ceremony on March 31 it will be renamed the Jansky Very Large Array, in honor of Karl Jansky. He discovered radio emission from the center of the Milky Way in 1932, and so became the founder of radio astronomy. The name was chosen from among 23,000 suggested by the public.

Instant AstroSpace Updates

A new large mosaic of **WISE** (infrared space telescope) data showing 1000 square degrees of Milky Way has been released, showing numerous star-forming regions and bubbles formed by massive stars. It contains good evidence for triggered star formation (massive new stars trigger another generation of stars).

Curiosity (Mars rover), which launched in late November on an 8-month trip to Mars, has already begun taking data, by turning on the radiation detector. Data will help assess the radiation risk to life on future Mars missions.

Dragon, a spacecraft being developed by the SpaceX Company to carry humans, is scheduled to launch February 7 for the 1st docking to the International Space Station by any privately developed spacecraft. Dragon will carry only cargo this trip.

Fobos-Grunt (English: Phobos-Ground/Soil, Russian sample return mission to Martian moon Phobos) crashed into the Pacific Ocean in mid January. Since launch in early November, it had been stuck in low Earth orbit since its upper stage rocket failed to ignite and push it toward Mars, despite massive efforts to determine the cause of the failure and correct it.

A team of astronomers has analyzed the light from 10 million distant galaxies to find distortion caused by intervening dark matter (gravitational bending of light), and produced a map of **dark matter** over the largest area of the sky yet. Like smaller previous maps and maps of visible matter, it shows an intricate cosmic web.

2 more planets have been confirmed from Kepler data that each **orbits a pair of stars** (like planet Tatooine in Star Wars), after the first such planet reported here in November. Designated Kepler-34b and Kepler-35b, both are too close to their stars to be in a habitable zone.

A study in 1993 concluded that a **large moon** (such as ours is compared to the size of the Earth), which seems to be rare among planets, is needed in order to stabilize the tilt of a planet enough to make long-term climates conducive to the development of life over billions of years. A new simulation of Earth with varied moon sizes showed the large moon was not necessary for such stability.

NASA's new budget for the next year has enough money designated for the **James Webb Space Telescope** to permit launch by 2018. This is more money than originally requested, and certainly better than the complete cutoff of funds that had been threatened by some members of Congress.

Rob Roberson's image of the Rosette Nebula was acquired between December 30 and January 2 using an Orion 80mm apochromatic mounted on an LX-90 8-inch SCT with equatorial wedge. The total exposure time for this image was 8.9 hours in the H-alpha, OIII and SII bands.

A Convenient “Grab & Fly” Telescope Setup

February, 2012

By Tom Koonce

Lancaster, California

Have you ever headed out on a long trip and wished that you could do a little star-gazing once you arrived at your destination? But perhaps you have thought about the logistics of traveling with a telescope like the inconvenience of getting your telescope equipment through airport security, potential damage to the telescope, or maybe been daunted about what eyepieces and accessories to take? This article could help you to stop worrying… and start packing.

I had a unique opportunity to travel “down under” to observe from the dark skies of south central Australia, east of Melbourne, and then from the large island of Tasmania located off the southern tip of Australia. I knew I had to take a telescope with me or I’d certainly regret it. Major airlines fly into Melbourne, but only small “regional” airlines fly into Tasmania, so the amount of baggage I could take on the three week trip was strictly limited to a total weight of 23 kg (50.7 lbs). My astronomy setup would have to fit into an already limited volume that included work attire, a bulky jacket, shoes, shaving kit, notebooks of work materials, and a laptop. While the observing portion of this trip was secondary to the business portion of this trip, it was still very important to me personally and deserved careful planning ahead of time.

Some of my initial questions to be answered were concerning the climate of the location. Would it be hot or cold this time of year? Cloudy or clear? Dark skies or urban light pollution? My excitement grew as each of these answers were favorable to potential great southern sky views of the Clouds of Magellan, Southern Cross, Alpha Centauri, Canopus, the Coal Sack, the Tarantula Nebula, and on and on. Wow.

Now what telescope should be taken? It had to be portable, deliver wide-field views when paired with one or two eyepieces, but be of sufficient quality that I could “crank up the power” if I wanted to. It needed to be rugged enough to survive the jostling of going through security (I foresaw a major hassle regarding this) and the vibration shock of the flight and maybe a rough landing. It also needed to be light enough to be supported by a photo tripod since such a tripod was the only possible support within my weight and luggage volume limitations. The Tele Vue Pronto ED doublet refractor telescope with a 480 mm focal length, f/6.8 and an objective diameter of 70 mm was chosen. I had purchased a Pronto in mint used condition from a friend for $500 several years ago and loved it. When this short refractor is paired with both a Tele Vue 13mm Ethos and an 8mm Ethos, it can provide stunning views. The scope was also fitted with a 90 degree prism, two inch eyepiece focuser, a glass solar filter and a simple red dot sight.

I made a new foam insert for the stock Tele Vue Pronto padded carry bag to fit the telescope, both Ethos eyepieces, the right angle prism and accessories. I chose a closed cell foam with sufficient density to provide cushioning for all of the items, but rigid enough to hold each item securely. The solar filter, small red flashlight, my small southern sky atlas, dust blower and an O-III filter had to be carried in a 1 gallon ziplock in my suitcase, but still I was pleased that I managed to get my observing essentials down to such a small package.

The tripod I chose was the Manfrotto "Bogen" Carbon Fiber Tripod (BOG190CXPRO4) with a standard ball head. The entire tripod was no longer than the Pronto’s carry case and I attached to the case with Velcro straps. The tripod was very light, but surprisingly stable with the 6 lb Pronto, diagonal, and with a 2 lb Ethos eyepiece mounted on it. Its maximum load was stated to be 11 lbs. The lack of a celestial drive was not an issue for my visual observations made with this setup. Also the time to setup and take down was less than 5 minutes. There was the expected difficulty looking at any object at zenith with this setup. To be honest, a big reason why I chose this tripod was because a friend offered to let me borrow one for the trip, and it's hard to argue with "free". It is an expensive tripod, but a perfect "Grab and Fly" match for this telescope setup.

The "Grab and Fly" Telescope Case and Contents

Before the trip I had a concern regarding what this telescope/eyepiece/tripod package would look like to the airport security folks on their scanners since they probably didn't seen too many telescopes come through as carry-on baggage? Primarily because of this, an extra hour was planned for security questions prior to the flight. I could have relaxed. I had no fluids (of course) in the bag, and nothing looked like a weapon on the X-ray. The TSA was very reasonable and had no problems whatsoever with the telescope. They did ask me what it was, to which I told them it was a "telescope lens", and then they sent me on my way. I was to my gate with an extra hour to spare. Once on the plane, this entire setup conveniently fit into an overhead aircraft bin, even on the regional-type aircraft from Melbourne south to Tasmania.

The trip allowed me ample time to observe the southern sky. The telescope setup worked like a champ. While I only used the solar filter once, I had the telescope out every night for at least two hours and all night long on the weekends. The weather in Tasmania had me chasing openings in the clouds for a couple of nights, but it cleared up and provided the darkest observing skies I have ever seen in my life. Regretfully the 70mm Tele Vue Pronto isn't made anymore, but its been replaced by its close (more expensive) cousin, the Tele Vue 76 APO Doublet Refractor.

While this article has been about the selection of a convenient "Grab and Fly" telescope that could be taken anywhere one may be headed, I haven't said much about the deep sky views I had on my trip, of the hours I spent smiling, ear-to-ear, as I leisurely cruised from the Tarantula Nebula over to the Clouds of Magellan, or mention the friendliness of the Australian amateur astronomers I met. Those experiences were the real story made possible by having a "Grab and Fly" telescope.

<u>Telescope Reviews:</u>

Pronto: http://www.company7.com/televue/telescopes/pronto.html

Ranger: http://www.company7.com/televue/telescopes/ranger.html

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