SIRIUS ASTRONOMER

NEWSLETTER OF THE ORANGE COUNTY ASTRONOMERS

See our web site at http://www.ocastronomers.org

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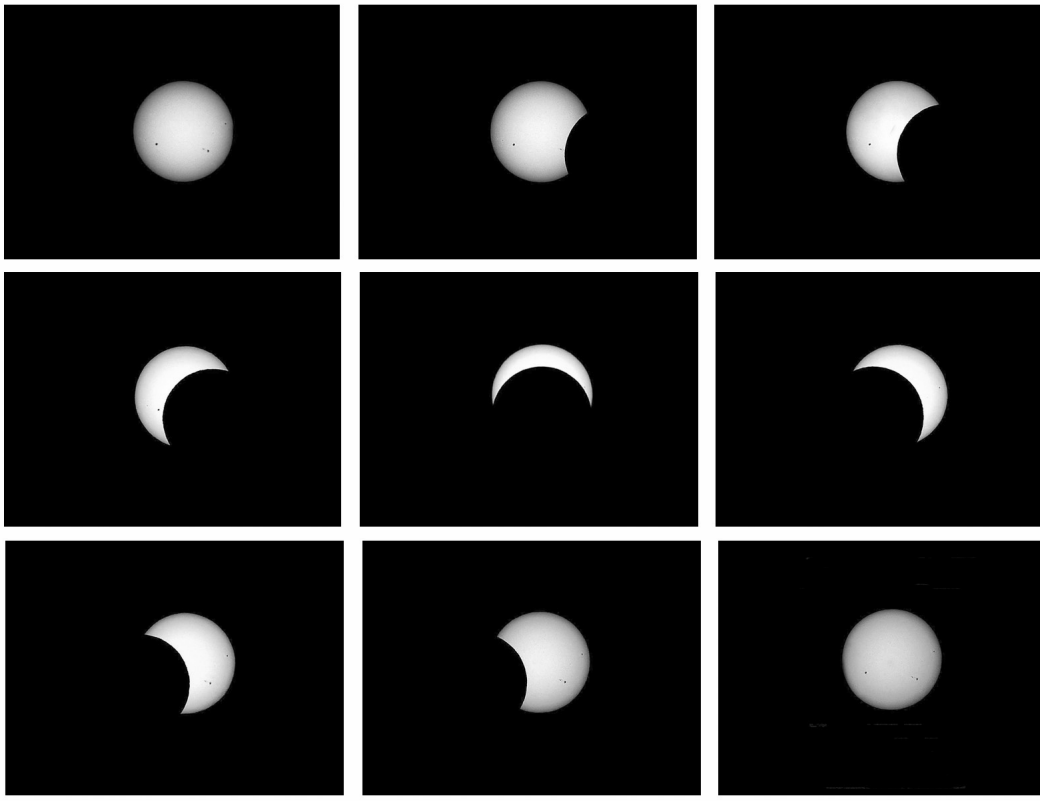

These stills are excerpted from an animation created by club member Gregory Pyros of the June 10 partial solar eclipse. Greg describes his method of photography as follows: "I piggybacked a TV-85 (600mm at f/7) on a 10" LX-200 and imaged with a Nikon D1 CCD (removable lens), using Baader (visual) Solar Astro film. This gave me a series of 2000x1312 resolution images at 12 bits per pixel, over 600 megabytes of data to start with. The camera was connected to a laptop using Nikon Capture 2 software to take an image every 60 seconds, with 115 images total being used in the movie. I reduced the images to 1024x768 and then cropped them all to 800x600, changing them from 12-bit to 8-bit and saving them out as jpegs by creating an Action in PhotoShop, then loaded the series into QuickTime to make both a QuickTime MOV and an AVI movie." The animation can be viewed at: http://www.gregpyros.com/assets/eclipse-pyros-sm.mov or http://www.gregpyros.com/assets/eclipse-pyros-

CHAPMAN MEETING

The free and open club meeting will be held Friday, July 12, at 7:30pm in the Science Hall of Chapman Univ. in Orange. Featured speaker will be Dr. Wendy L. Freedman on "The Runaway Universe." Also featured will be Chris Butler's "What's Up?" and "Astronomy Q & A."

STAR PARTIES

The Anza site and Observatory will be open Saturday, July 13. The Silverado site will be open for observing on Saturday, August 3. Check weather information before leaving town for both star parties; for Anza, you may call the Anza Observatory at (909) 763-5152 for up-to-date info or access the club website's new Webcam.

COMING UP

The Astro-Imagers' SIG will meet July 16, the EOA SIG will meet July 17, the Astrophysics SIG will meet July 19, the next Beginners' Class is August 2. Next general club meeting will be Friday, August 9.

President's Message

by Liam Kennedy

Major cleanup at Anza

I didn't manage to attend the Anza cleanup at the last star party on June 8th. However quite a few people did and now, the area around the observatory has been cleared of the "scrap-metal" that has been lying around for the past 10 years or so. The next time you are at the site check out the warming room in the club observatory as that has also been emptied of much of the junk that was stored there also. Maybe it can really be used as a warming room now! Some of the people who helped out include Barbara Toy, Jerry Mulchin, Dave Hobbs, Matt Ota, Bob Buchheim, Tony Obra, and Russell Sipe, who took the photograph. For more photos please go to Russ Sipe's web-site at http://www.sipe.com/starcruiser/html/anzacleanup.html

The following is an excerpt of an email by Vice-President Barbara Toy:

Thanks in large part to the strenuous efforts of Bob Buchheim, the warming room is totally cleared out. He even washed the floor. I did help with the cleanup there, but the bulk of the energy and vision that got that job done was his. We ran out of time and energy to do more than pick up some trash and do some straightening up in the observing area, so that area still needs work. The other big accomplishment was the transfer (with a lot of sweat, muscle strain and ingenuity) to the truck that Tony brought of the numerous steel and aluminum pieces associated with the radio dishes behind the observatory, including the pieces that had been stored in the warming room.

Photo courtesy of Russell Sipe.

So, some great advances were made, though there still are things to do out there that could keep us busy for quite a while. Thanks for your support.

Many of you have heard of my recent family news. My Father passed away in early June after a long illness. I had to fly back to the UK in order to support my family and attend the funeral. I was very touched by the many letters, cards and emails of support that were sent to me. I truly cherish this club and all of the friends that I have made while being a member. Your thoughts and support really helped me a great deal. Thank you all.

"Every day we are connecting ever more photons of light from distant galaxies to the eyes, hearts, minds and imaginations of our members and others in our community."

Galaxy Hunting with the ETX-90RA

by Chris Brown, OCA Member

They thought I was joking. I had a perfectly good 8-inch Dob (dobsonian) in my garage, and I was on my way to the high desert for a little deep-sky observing with an ETX-90RA. It was the middle of March.

"Why don't you take your big scope?" my friends asked, scratching their heads. "Nope," I said. "It's time to see what this little scope will do." I wanted to use the ETX for a travel companion, mainly for showing off the planets to my distant relatives and friends, but I was curious about it's deep-sky abilities, too. After all, I didn't want to be in the middle of nowhere with a boring telescope! My trip to the desert was the perfect opportunity to find the answers. Galaxy-hunting with a 90mm f/13.8 telescope may seem like an exercise in frustration, but I stacked the odds in my favor.

Along with the addition of a red-dot finder, I brought along a 32mm Plossl, good for 39x and over 1 degree true field. I also grabbed my 42mm Ultima (29x, 1.2 degrees) for good measure to brighten the image using the lowest magnification possible. I used Meade's new #884 tripod (overkill on the 90mm), and a wooden clothespin for the focuser knob to eliminate any shakiness during focusing. The 1-speed motor drive allowed nice, long looks at deep-sky objects, which proved to be quite a luxury to someone used to Dob driving. I left my charts in the car for this exercise, instead relying on my memory (I often visit the high desert) to find targets. Since I wanted to get an honest measure of the capabilities of the infamous ETX, I counted only direct-vision objects. My location of Yucca Valley (*in the high desert, near Joshua Tree National Monument ~Editor*) was windy and extra cold that weekend, as displayed by the large bank thermometer down the street which wouldn't budge past 45 degrees.

As night fell, the icy winds started to subside, so I decided to begin my observing session. After polar alignment, a quick look at Jupiter's wavy image revealed to me that this was no night for planetary viewing. The upper atmosphere had a lot of calming down to do, but I saw the Beehive cluster directly overhead, so all was not lost. I pointed to M42, and was rewarded with a bright, multi-layered fan shaped cloud that overflowed the eyepiece. I then searched out M1, not expecting much, but the Crab Nebula was an easy find, appearing as a dim, roundish smudge in the sky just skirting the edge of my averted vision. By now, my face was numb from the cold. My fingers were quite sore, and my speech was reduced to a mumble. It was time to break for supper. After a warm meal, the outside air seemed to rise 30 degrees, so I got down to business. At first, I was star hopping by twisting the ETX's tiny knobs, but I soon found that a better way to find objects was to grasp the dew shield and aim it as if pointing the world's smallest Dob! Even the diabolical 8x21 finder became useful using this method, and was able to reveal M35, 36, 37, and 38 quite clearly. At 39x, these clusters were bright and rich, featuring sharp pinpoints right to the edge of the field.

My first galaxy was M104, the famed Sombrero. It appeared relatively bright, with its predominate dust lane easily visible at 39x, but the 42mm Ultima definitely showed sharper detail and contrast. I tried my 15mm Axiom, but the image dimmed greatly. Barlowing the low power eyepieces brought similar results. I moved on to M65, and M66 in Leo. Again, the 42mm was the eyepiece of choice, showing definite brightening at the center of both galaxies as they shared the same eyepiece field. Somewhere in that same field was galaxy NGC3628, but even averted vision couldn't flush it out. Still, I considered sighting these dim, 9th magnitude galaxies to be a real victory for the little ETX. I then decided to pitch the polar alignment and point north for a while in the hopes of finding some of the brighter galaxies in and around Ursa Major. First up was M51, the Whirlpool. In the city, M51 is invisible to me, even with my 8-inch reflector. The ETX quickly found this small galaxy in the deep, dark desert with minimal effort. In contrast to the dimmer galaxies found previously, the Whirlpool was better resolved using the 32mm Plossl. Hmmmm. Its small companion remained a dim smudge, but the larger galaxy showed decent detail and brightness, and in times of good seeing, I could make out the direction of its swirl. Very beautiful! Adding the Celestron Ultima barlow for 78x smudged out the large galaxy, still very good for 90mm. I steered toward M94, a bright magnitude 8 galaxy, easily found in the city lights. The desert sky showed a bright, round blob with a noticeably brighter core--piece-of-cake! I decided to try my favorites, M81 and M82. These two are a real crowd-pleaser, especially when they share the eyepiece field, an easy accomplishment at 29x. M81 was a bright, distinct oval, with no spiral arms visible. Predictably, M82 took on a very slight rough appearance, and I spent the next 20 minutes marveling at the radiant view. Barlowing took away from these targets, but I enjoy M81, M82 more as a low power pair anyway.

My final target for the evening was the Globular Cluster M13, which was quickly rising in the northeast. I was surprised by the extremely bright view, as it appeared as a very large, dense star! While the central stars were undefined, the outside stars resolved nicely like little connect-the-dot legs, giving the cluster the striking spider-like appearance that it's so famous for! Magnificent! Despite its compact dimensions, I found the ETX 90RA to be a surprisingly good deep-sky telescope. What it lacks in aperture, it makes up for in image sharpness and contrast. The optical system is quite good for a mass-produced instrument (I have been able to split Epsilon Bootes at 312x in the city), and false color is never an issue on even the brightest targets. True, a clear desert sky can make a hero out of almost any telescope. Even the ETX's little finder scope performed beyond expectations. One has to realize, however, that these prime conditions are getting harder to find nowadays, so it proves to be a real advantage to travel with a lightweight telescope to improve one's mobility.

Happy star trails!

(Chris Brown, an OCA member since March, 2001, has been stargazing for about five years. He currently owns three telescopes: a 60mm refractor, an ETX-90M, and a "much-modified" Orion XT-8 dobsonian. Chris also writes for Astronomy-Quest.com's online newsletter. Look for more observing articles from Chris in the future. ~Editor)

OCA'S LIBRARY UNDERGOES A CHANGE

Catherine Weinberger, who served the OCA for 5 years as Club Librarian, turns over the keys to the new Librarian, Karen Schnabel. Well done, Cathy! Welcome, Karen!

OCA ATTENDS RTMC 2002

The entire group routinely gathers for the annual club photo in front of the Main Hall. Club member Greg Pyros graciously sat out the photo in order to take this snapshot. I was too late--and out of breath from running all the way from the main gate!--so Roy Weinberger caught me in front of the OCA banner. ~Editor

The 2002 IAPPP-WW "Symposium on Telescope Science"

by Bob Buchheim, OCA Board Member

Several OCA members are conducting research projects that will generate genuinely new science results in areas such as asteroid astrometry, supernova discovery, variable star photometry, and evaluation of new astronomical image-processing methods. For those of you are among – or are ready to join – this elite community, the annual gathering of the International Amateur-Professional Photoelectric Photometry "Western Wing" is a wonderful opportunity to meet other amateur researchers and their professional counterparts, learn about equipment and techniques that are being used, and become aware of research projects that are in need of amateur contributions. This year's meeting was held at Big Bear Lake, on the Wednesday and Thursday prior to RTMC, with the theme of "telescope science." The OCA members in attendance included: Bob Gill (who was a member of the conference committee), John Hoot, Wayne Johnson, Larry Owing, John Sanford, and Russ Sipe (and there may have been others that I didn't recognize).

John Hoot gave two papers. One described work that he has been doing to correlate filtered photometric observations made using standard UBVRI filters (expensive!) with observations made using Wratten color filters (cheap!). The results show promise, although some additional work is needed. His second paper described an image processing approach to improve the visibility of jets near the nucleus of a comet. His method used a rotational and radial derivative of the image intensity near the nucleus and showed very tantalizing results. John is interested in hearing from any of you who have digital images of comet Hale-Bopp to see if jet activity can be correlated with residuals in the comet's trajectory (material boiling off of a comet in "jets" provides a thrust that acts on the comet, perturbing its orbit).

Several of the presenters pointed out that sophisticated amateur observations can be a valuable contribution to a professional astronomer's work. Whereas most professionals have very limited telescope time (one or two nights, a couple of times per year, is typical), if you own your own telescope there is no "scheduling committee" deciding when, or if, you can use it. This makes amateur participation important for any project that requires continuous observation of a particular object, or periodic monitoring of an area of the sky, to watch for unpredictable changes. Real science can be done with relatively modest equipment (e.g. an 8-inch class telescope and a commercial CCD camera). These include projects such as:

- Variable star photometry. Surprisingly few "published" variable star light curves have been followed for extended periods of time, or re-visited at several-year intervals to see what's changed in the stellar system. Dr. Dirk Terrell's keynote address described the wide array of information that can be gleaned from high-accuracy, long-duration light curves of eclipsing binary systems, and he encourages more well-equipped amateurs to participate in his research on binary stars.
- Asteroid astrometry and photometry. There are a lot of those little guys out there – over 100,000 numbered objects – and most of them need occasional astrometric follow-up to keep track of their orbits. Photometric light curves are known for only about 1500 of them. Well-observed asteroid light curves can tell us about their rotation period, the orientation of their rotational axis, a little bit about their shape, and might be able to detect satellites of the asteroid.
- Asteroid occultations – one of my favorites – take advantage of the amateur's portable equipment to travel to the predicted "path of totality", the geographic location where an asteroid eclipses a star. By observing the "blink" when the asteroid blots out the star, we achieve very precise updates of the asteroid's orbit. Timings of the duration of the "blink" are the most accurate ground-based method available for determining the size and shape of the asteroid. Many occultations are available each year for those with 6-inch telescope and the willingness to travel a hundred miles or so to reach the occultation path.
- Supernova searching. Professionals can bring a lot of telescopic, theoretical, and instrumental power to bear in the study of supernovae, but only if someone tells them that it is happening. It is most important to identify the supernova prior to its reaching peak luminosity (the rise-time and peak luminosity are critical data for analysis of the event). Amateurs who photographically monitor galaxies have an important contribution to make here.
- Spectroscopy is a new realm for amateurs, but with a large amateur telescope (and a larger-than-average amateur budget) you can gather very interesting information in this way. The SBIG spectrometer has brought this technique within the reach of dedicated amateur scientists, enabling them to identify the elements in emission spectra, and observe red/blue shifting in the light of binary stars. Beware, however – I got the feeling that successful spectrometry makes conventional CCD imaging look like child's play!

(continued on page 11)

Virtual Astronomy

by Dave Kodama

An Eclipse Teaser

June provided us with a teaser eclipse event in the form of an annular solar eclipse, seen as a partial one from Southern California (~70% maximum coverage). Fortunately many of us managed to escape the June gloom coastal fog to get a good view and to bathe in the strange light of the eclipse. If you were not so lucky, here are some virtual views of the eclipse, from east to west:

http://www.christone.net/astro/june_11.htm	- from the Philippines
http://www.comet-track.com/eclipse/secl02a/secl02a.html	- from Mt. Wilson (multiple exposure)
http://www.astronomy-images.com/images/Solarsystem/eclipseanimation2.html	- from Sonoma, CA (GIF animation)
http://www.azastronomy.com/images/SunEclipse.jpg	- from Phoenix, AZ
http://nightskyevents.com/SolarEclipse061002.html	- from Des Moines, Iowa

Of special note is the eclipse time-lapse animation sequence assembled by OCA member Greg Pyros who caught the eclipse from his backyard in Newport Beach, CA. This sequence was also featured on the *Sky & Telescope* magazine website. It is in two formats on Greg's site:

http://www.gregpyros.com/assets/eclipse-pyros-sm.mov	(500K)
http://www.gregpyros.com/assets/eclipse-pyros-sm.avi	(900K)

Greg recommends the MOV version of the animation unless your system is not equipped to run it. *(Note: to run a MOV program, you must have QuickTime for Windows installed. ~ Editor)*

Another image of note was taken by Carter Roberts, who traveled down near the end of the centerline (south of Puerto Vallarta) with OCA member Joel Harris' Twilight Tours group of hard-core eclipse chasers. This is, to date, the only shot of the full annular eclipse I've found on the web. As can be seen in the image, clouds hampered viewing of the eclipse right up to totality, and even then, the eclipse was visible only through a narrow slit in the clouds, though the effect is certainly dramatic. Joel summed up the drama this way: "In 30 years of this pursuit, I've never come this close to NOT seeing the central phase of the eclipse and STILL seen it."

http://www.sciencecenter.net/twilighttours/scrapbk/02mexico/

Remember that this annular eclipse was just a teaser for the main event in December, when a true total solar eclipse will cross Southern Africa, the Indian Ocean, and terminate in Western Australia. The eclipse track details are here on the NASA eclipse page:

http://sunearth.gsfc.nasa.gov/eclipse/TSE2002/TSE2002.html

Free Virtual Moon Tour

For lunar observers, just announced for free download is a very nice product called "Virtual Moon Atlas." It's a lunar version of a computerized sky atlas, which allows you to see the moon's phases as well as to zoom in to see specific lunar surface features, complete with name, discussion of the type of feature, and some historical information. Unlike photographic atlases which can have variations of lighting affecting your perception of the topography, Virtual Moon Atlas presents a cartographic illustration version of the lunar surface with uniformly angled lighting. You can download it here:

http://astrosurf.com/avl/UK_index.html	Virtual Moon Atlas

I've just started playing with this program, but my impression of it is very good – another great program for those bright, moonlit nights!

Astro Space Update

gathered by Don Lynn from NASA and other sources

(To find out more on these topics, or those of past months' columns, through the World Wide Web, send your Web browser to our OCA website http://www.ocastronomers.org and select Space Update Online.)

Mars Odyssey - has found substantial amounts of water ice within a yard of the surface over much of southern Mars, as related in this column in April. The amount has now been quantified as being about double the amount of water in Lake Michigan. It lies inches below the surface at far southern latitudes, and descends to 2 feet or more beneath the surface in temperate latitudes. It appears to be a layer consisting of about 35% by weight of ice (higher percentage by volume) mixed with rock. Easily reachable water will make the future human exploration of Mars much easier. It is assumed that the ground ice extends far below the depth that the spacecraft's instruments can reach (3 feet), in which case there is perhaps as much water as an ocean lying beneath the surface of Mars. The northern hemisphere probably has similar ground ice, but it cannot be detected by Odyssey until the dry-ice frost that covers much of the northern hemisphere evaporates during Martian spring. The spacecraft found that the soil near the equator contains a few percent of water in the top yard, and this is probably the result of a little water being chemically bound in the minerals. Ground ice in the warmer tropical areas of Mars would probably lie deeper than the instruments can reach. Mars Express, the European spacecraft to be launched in 2003, will be able to map subsurface structure with a radar sounder to a depth of a few miles. Beagle 2, which is the lander portion of Mars Express, will dig soil to about 5 feet deep for analysis.

Mars Odyssey has made infrared images of the layered terrain found by Mars Global Surveyor, showing that these visual layers are made of different material. Images show a complex geology with craters and eroded surfaces, exposing at least 4 layers of distinct composition. More study is needed to determine if the layers were created by sedimentation in water, as most layered rocks on Earth are.

Hubble Space Telescope (HST) and Gamma-ray bursts - Astronomers believe that they have solved the mystery of what causes gamma-ray bursts with new observations by HST. Scientists have known for about 30 years that bursts of gamma rays, powerful forms of light lasting from seconds to an hour or more, are produced somewhere in space. For most of that time, astronomers had no clue where the bursts originated or what caused them. Less than 5 years ago, an object causing a gamma-ray burst was first seen in visible light and to last a few days after the gamma rays were gone, then it faded. That object, along with a few seen in visible light since, were all found to be many billions of light-years away. This created a problem because no previously observed phenomena had enough energy to produce a burst of gamma rays so bright as to be seen that far away. The only candidate theories that came close to the energy required were colliding neutron stars or a supernova that produced more energy more quickly than any supernova that has been observed (called a hypernova).

New observations with HST showed that the visible-light remnant of a gamma-ray burst has the spectrum of a supernova. The problem of supernovae not having enough energy to produce the gamma-ray burst has been solved with a new theory that says the burst is a tight beam of energy, not a burst in all directions. So the total amount of energy has been miscalculated by the false assumption that every direction gets as much energy as we see in our direction. This also means that instead of the 1 or 2 bursts that our gamma-ray satellites observe every day, there are really at least 500 such bursts every day, but nearly all of them point their beam somewhere other than toward earth. The astronomers who made the HST observations and the new theory propose that supernovae produce all longer gamma ray bursts, but many further spectra of gamma-ray burst remnants must be taken to support this. It is known that the quicker bursts have different characteristics from the longer bursts, so are probably produced by a different phenomenon. The mystery remains for short-period gamma-ray bursts.

Extra-solar planets - The first (outside our solar system) Jupiter-like planet in a roughly circular orbit at a Jupiter-like distance from its star (55 Cancri) has been found. It was found by Geoffrey Marcy and Paul Butler, the astronomers who have found the majority of the more than 90 planets now known outside our solar system. All previous planets either orbit far closer to

their star than does Jupiter to our Sun or they have extremely elliptical orbits. The new planet is 3.5 to 5 times the mass of Jupiter, orbits only about 6% farther than Jupiter's orbit, and takes 13 Earth years (compared to Jupiter's 11.9 years).

The 55 Cancri system is not exactly like the solar system, however, since it is known to contain 1 or 2 other large planets that are closer to their star than any planets in our solar system. 55 Cancri is 41 light-years from Earth and about 5 billion years old. The new planet was part of a group of 13 recently-announced discoveries, which also includes the smallest extra-solar planet found, one that is 15% the mass of Jupiter and orbits the star HD49674 in Auriga. Planets at a Jupiter-like distance from their stars take more than a decade to orbit, and that means that searching for the movement of stars in reaction to the orbiting planet requires more than a decade of observation. Astronomers are now monitoring 1200 nearby stars to detect planets--many of them for more than a decade--so they predict that they will be discovering more Jupiter-like orbits in coming years.

Cosmic Microwave Background (CMB) - First results have been announced from observations made by a radiotelescope built high on a peak in the Canary Islands specifically to study the CMB, that relic of radiation left from shortly after the Big Bang when the universe had first cooled enough to become transparent to light. The new radiotelescope is called the Very Small Array, since it has 14 small antennas, each only 6 inches across, linked together as one antenna. Analysis of the properties of the CMB can distinguish between competing cosmological variations of the Big Bang theory. The results confirmed other recent CMB observations in these conclusions: 1) the universe is flat; that is over very large distances, parallel light beams tend to remain parallel, rather than diverging or converging due to relativistic bending of light; 2) there is far more dark matter than visible matter; 3) there is a substantial cosmological constant, or "dark energy" as it is often called; 4) the statistics of the sizes of the slightly brighter areas of the CMB (called the CMB power spectrum) match those of microscopic quantum-mechanical fluctuations that have undergone inflation to astronomical size, thereby supporting the Inflation theory. Because these were rather revolutionary results when announced in recent years, it is important that they are confirmed by new observations made by a variety of instruments, such as this.

Recent results were announced from studies by another radiotelescope built specifically in the Andes of Chile--the CBI-- to study the CMB. They also confirmed the above 4 conclusions. The CBI is the highest observatory in the world, at an altitude of nearly 17,000 feet. It consists of an array of 13 antennas, each about a yard across. It has produced the finest resolution detail yet of the CMB. Thus, the most detail was seen of the density fluctuations that became the large structures of the universe (clusters of galaxies), and the most precise match was made of the power spectrum to that predicted by Inflation. The ability to detect polarization in the CMB is being added to CBI, which should give more information about the various cosmological theories.

Galileo (Jupiter mission) - Detailed studies of Galileo images of the moon Europa indicate that the ice shell over the ocean believed to lie beneath the moon's surface is 12 to 15 miles thick. This contradicts earlier evidence that the ice shell was only 2 to 3 miles thick. The new study showed that the shape of impact craters on Europa changes over the range of 5 to 19 mile diameters, and computer simulations show that this should happen only if the ice shell is 12 to 15 miles thick. The smaller craters resemble those on nearby Ganymede and Callisto, both of which have very thick ice shells, but the larger craters have no rims or uplifts around them but are surrounded by concentric troughs and ridges. The concentric features are created when the impact breaks through the shell. Some earlier computer models of how Europa's interior is heated by tidal forces had predicted a similarly thick ice shell. On the basis of earlier evidence for a thin shell, some scientists were beginning to plan spacecraft that could land on Europa and drill through to the ocean, but if the shell is this thick, drilling through will be very difficult. This thick shell does not preclude the possibility that bacterial life could have developed in the ocean below.

Dinosaur demise - Although many astronomers believe that the dinosaurs and 70 percent of life on Earth became extinct about 65 million years ago because an asteroid or comet crashed into Earth, many geologists believe that massive volcanic activity in what is now India wiped out the dinosaurs. A new piece of evidence has been announced to help distinguish which of these theories is correct. A study made of leaf fossils from 65 million years ago has revealed that a dramatic increase in carbon dioxide in our atmosphere occurred in 10,000 years or less, a relatively sudden rise in geological terms. The density of pores on leaves is sensitive to the amount of carbon dioxide in the atmosphere. The amount of added carbon has been calculated to be over 6 trillion tons, which would increase the concentration of carbon dioxide to 4 or 5 times what our atmosphere has today. This supports the asteroid impact theory, because an impact could burn that amount of carbon into carbon dioxide in a very short time, but even extreme volcanic activity would probably take millions of years to produce that much of the gas.

This much carbon dioxide was calculated to cause a rise in the air temperature, through the greenhouse effect, over the entire Earth, averaging about 13 degrees Fahrenheit, which would contribute substantially to the deaths of species. Further study is needed to confirm the carbon dioxide levels and the time it took to rise.

Asteroid breakup - It has long been believed that asteroid families, ones that share similar orbits, are each the result of a collision long ago that broke up a larger asteroid into the smaller pieces seen today. A new study has traced an asteroid family's orbits (the Karin cluster) back to a point 5.8 million years ago when they were at the same place. This is the first time an asteroid breakup event has been dated. This should now allow study of what happens to asteroids after collisions, study of space weathering on the surfaces exposed by that collision, rates of collision in the asteroid belt, search for meteorites matching this age, and more.

Star consumed by pulsar - Scientists have found a pulsar that has nearly consumed its binary star companion, leaving a large, planet-sized remnant instead of a star. The mass of the remnant studied was only 10 times that of Jupiter, and so is now too small to be a star or even a brown dwarf. The pulsar that nearly consumed the star is spinning 185 times per second. They orbit about each other every 43 minutes, so they are extremely close. It is only the third known pulsar that seems to be caught in the act of consuming its companion star. This confirms the theory that pulsars can spin up to really rapid rotation speeds due to the impact of material pulled by gravity to the pulsar from its binary companion. Large numbers of very rapidly rotating pulsars have been found, many that spin up to several hundred times per second, but very few have been found in the act of spinning up, and very few with companion stars. This find also shows the process of consuming material can continue until only a planet-sized object remains. No process is known that will stop this consumption of the companion star, so it is expected that eventually it will dwindle to nothing. This would explain the large number of rapidly rotating pulsars without companion stars.

Brown Dwarf weather - It was expected that brown dwarfs, those stars that don't quite accumulate enough mass to turn into nuclear fusion-powered stars, should steadily fade in brightness as they cool over millions of years. But recent observations show that they go through a short phase of their lives when they grow brighter as they cool. New computer simulations show that the way this happens is that brown dwarfs must have cloud layers similar to those of Jupiter, except that the clouds are of different material (such as iron vapor) that must occur in the hotter brown dwarfs. At a certain temperature during the cooling, storms form, then the clouds clear up. This causes the observed brightening, seen particularly in the infrared part of the spectrum, as interior heat can now escape.

Chandra (X-Ray Observatory) - has discovered hundreds of black holes or neutron stars in nearby elliptical galaxies. These are stellar corpses of bright massive short-lived stars, indicating that in the past these elliptical galaxies contained many bright massive stars, which elliptical galaxies do not contain today. The galaxies studied were NGC 4697, 4649, and 1553. Chandra also found that most black holes that have companion stars orbiting them are found not in the main bodies of galaxies, but in their globular clusters. It appears that these binary black hole systems occur only in regions dense in stars, like those that contain globular clusters. This suggests that the systems are a result of capturing stars into their orbits.

Dark Matter - An analysis of 7 cases of the gravitational lensing of light from distant galaxies by the gravity of intervening galaxies shows evidence that galaxies are surrounded by halos containing hundreds of invisible dwarf galaxies. The cold dark matter theory, which explains what dark matter consists of, had predicted that there should be swarms of dwarf galaxies surrounding large galaxies. Until now, only a few dwarf galaxies surrounding large galaxies were found. Apparently most dwarf galaxies are too dim to be seen.

NEAR Shoemaker (asteroid mission) - Although the NEAR mission ended February 2001 after relaying data from the surface of asteroid Eros after gently crashing there, plans are being made to turn on the spacecraft and revive it at year's end. At that time, the spacecraft's solar panels should be in strong sunlight, so a revival may be possible. NEAR was not designed to survive months of freezing temperatures, but then it was not designed to land on an asteroid either, and it survived that!

CONTOUR (comet mission) - should be launched by the time you read this. The mission plan includes encounters with old comet Encke in November 2003 and the relatively young comet Schwassmann-Wachmann 3 in June 2006 to get images of the nuclei from as close as 60 miles. The resolution should show rocks as small as cars. The latter comet split into pieces some

years ago, so the images may show fresh material from inside the original nucleus. CONTOUR's instruments will not only take pictures, but it will also measure the chemical makeup and analyze the surrounding gases and dust. The spacecraft's orbit is designed to make a swing by Earth after each encounter, so that a gravity slingshot can redirect it toward another comet. More comets or even asteroids may be added later in the mission.

Astrollaneous

VISITOR NIGHT AT THE UCI OBSERVATORY---Thursday, July 11, from 8:00p.m. to 10:00p.m., the UCI Observatory will be holding one of its occasional Visitor Nights. Amateur astronomers are invited to bring along their telescopes. The observatory's 24-inch computer-controlled telescope will be in use. The Observatory is located on the campus of the University of California, Irvine. From Peltason Dr. turn onto Gabriellino Rd. at the entrance to the University Hills housing complex. At the top of the hill, turn left and follow the gravel road to the dome. Park along the road and walk to the dome. In the unlikely event of rain, Visitor Night may be canceled, and a notice will be posted on the website by 3 p.m. For more information, see: http://www.physics.uci.edu/~observat.

The inaugural Shingletown California Star Party! For the past eight years the San Francisco bay area Internet observers group The Astronomy Connection (TAC) has been hosting star parties at Mount Lassen Volcanic National Park. The annual gathering continues to increase in popularity and attendance. This year we have moved the star party to Shingletown, a short drive from the National Park. In cooperation with Shasta County, Shingletown has arranged for our star party to have use of their airport for 5 days and nights. The airport will be closed to air traffic during our stay. We will be able to camp on site and leave our equipment set up. The dates are from noon July 10-noon July 15, 2002. This star party is open to all amateur astronomers. Come out and join the fun at a real dark sky event. More details and a sign-up form can be found at: http://www201.pair.com/resource/resource-intl/ssp.html or contact Mark Wagner by e-mail at mgw@resource-intl.com or by telephone 408-356-1125.

(IAPPP Symposium, continued from page 6)

The IAPPP symposium also featured several new product displays. For those of you interested in asteroid astrometry and photometry, the new version of Canopus MPO software is a real dream to use, greatly speeding up and semi-automating your data reduction. On the hardware side, for any observing program, one of the new Paramount German Equatorial mounts was on display, and it is a thing of beauty.

Peter Ceravolo showed us the pre-release version of a new photographic planetarium program called "Desktop Universe." This is a really neat product! Imagine spending 5 years taking 20,000 tri-color images (each about 6 X 10 degrees) covering the entire celestial sphere, knitting them together into a single database, and wrapping them into a planetarium-type program so that you can display on your computer screen any part of the sky, at any magnification, in full color. While fiddling with the program, I started with an "all sky" map, zoomed in to the handle of the Big Dipper, increased magnification to about 2 degrees field of view, and there floating clearly among the stars was M-101 – not as an oval symbol, but a clean little photographic swirl. The first release of Desktop Universe will be available in a couple of months. It won't take the place of *TheSky* or *SkyMapPro*, but for those of you who give lectures in classrooms, it's definitely worth evaluating. In a milestone of random irony, Peter was also the winner of one of the door prizes – his very own copy of "Astrophotography for Beginners."

I was very impressed with the level of sophistication and dedication that some of these "amateur" astronomers are displaying in their projects. The room was full of people who had the same dedication to science for the sheer pleasure of learning and

discovery that characterized the "gentlemen scientists" of the 17th century, now augmented by 21st century technology. It is a fabulous time to be an amateur astronomer!

SIRIUS ASTRONOMER

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President, Webmaster	Liam Kennedy	liam.kennedy@ocastronomers.org	949-552-6187
Vice President, Media, Public Obser.	Barbara Toy	btoy@cox.net	949-499-3132
Treasurer	Charlie Oostdyk	charlie@cccd.edu	714-751-5381
Secretary	Bruce Crowe	bcrowe12@pacbell.net	714-971-8427
Trustee	Bob Buchheim	rbuchheim@compuserve.com	949-459-7622
Trustee	Carol Copp	ocaastrogirl@juno.com	714-871-3430
Trustee	Steve Eubanks	sseubanks@earthlink.net	714-776-6361
Trustee, WAA Representative	Tim Hogle	tim.hogle@jpl.nasa.gov	626-357-7770
Trustee	Tony Obra	tonykathyodieseldr@attbi.com	714-952-8779
Trustee	Gary Schones	gary378@pacbell.net	714-556-8729
Trustee	Russell Sipe	sipe@sipe.com	714-281-0651

COMMITTEES, SUBGROUPS, AND FUNCTIONARIES

Sirius Astronomer Editor	Chris McGill	chrism31@gte.net	714-840-1026
Observatory Custodian	Bob Gill	rgill@fullerton.edu	714-525-0831
Anza Site Maintenance	Don Lynn	donald.lynn@opbu.xerox.com	714-775-7238
Astrophysics SIG, Fundraising	Gordon Pattison	glpbmp@cox.net	949-786-7079
Librarian	Cathy Bailey Weinberger	oneleaf1@cox.net	949-768-5205
Membership, Pad Coordinator	Charlie Oostdyk	charlie@cccd.edu	714-751-5381
Beginner's Astronomy Class	Antonio Miro	tycmiro@aol.com	714-898-9677
AstroImagers SIG	Greg Pyros	greg@gregpyros.com	714-708-3400x12
Explore the Stars Coordinator	Richard Cranston	rcransto@ix.netcom.com	714-893-8659
Silverado Star Parties	Bob Buchheim	rbuchheim@compuserve.com	949-459-7622
Star Member Training	Chuck Lodoza	flyman@ix.netcom.com	909-699-4699
OCA Outreach Coordinator	Jim Benet	jimbenet@pacbell.net	714-693-1639
Telescope Loaner Program	Henry Fry	henryfry@hotmail.com	714-635-6056
EOA Coordinator	Ken MacLeod	kenmacleod@earthlink.net	909-674-8877

OCA WEBSITE ..... **http://www.ocastronomers.org**
STARLINE 24-HR. RECORDING 714-751-6867
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