

SIRIUS ASTRONOMER

NEWSLETTER OF THE ORANGE COUNTY ASTRONOMERS
See our web site at <http://www.ocastronomers.org>

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OCA Member John Rigoni took this photo of the October 2nd Minuteman missile launch at Vandenberg AFB from his back yard in Anaheim.

CHAPMAN MEETINGS

The next meeting of the OCA is on Friday, November 12, at 7:30pm in the Science Hall of Chapman University in Orange. The free and open meeting will feature Dr. Ken Croswell, author of *Magnificent Universe*, as well as a *What's Up?* Presentation by Chris Butler.

STAR PARTIES

The Silverado site will be open for observing on Saturday, November 6. The Anza site and Observatory will also be open Saturday, November 6. Dress warmly and check weather information before leaving town or call the Anza observatory at 909-763-5152.

COMING UP

Several Outreach opportunities are coming up this month. See p. 7 for details. Also, contact Jim Benet at 714-693-1639 for updated information.

OCA Board Elections are coming up, with Nominations opening at the November meeting.

President's Message

by Russell Sipe

So many of you have asked for more information about LASIK (following my October president's letter) that I thought I'd better give you an update and a bit more information.

First the update. Last month I indicate that after my LASIK procedure my eyes had gone from a moderate nearsightedness (about minus 5.0) to a mild farsightedness (plus 0.75). It turns out that I was plus 0.75 in one eye and a full plus 1.0 in the other eye. The effect of this was to make near focus more difficult than I wanted. I reported last month that I was told the farsightedness would most likely correct itself during the healing process. This is indeed what happened. My near sight improved each week after the procedure. I can now see surface detail on the Moon. One note, there is still some haloing with the bright Moon that somewhat affects the view, however even with haloing the view is so much better than before the procedure. Beyond the crispness of the astronomical views, there is better light grasp with LASIK. According to my optometrist normal glasses tend to absorb 7 to 8 percent of the light that passes through them. In a hobby where we pay hundreds of dollars to increase our light gathering power by a few percentage points, gaining 7 or 8 percent by getting rid of glasses light is a huge plus. So far I think my eyes are approximately one magnitude more sensitive than before LASIK.

A recent Time Magazine cover story on LASIK described the almost euphoric response the majority of LASIK patients reported after their procedures. Obviously I am a member of this group. However not everyone has a positive experience. For example OCA member Patricia Jonk wrote to me following my October president's letter wherein she describes her decidedly negative experience with LASIK. We are reproducing her letter in both the Sirius Astronomer (p. 4) and on our web site: www.ocastronomers.org. In my personal view here are three critical considerations in deciding whether LASIK is right for you, and in deciding who should perform the procedure.

EXPERIENCE: Is the person performing your procedure an expert? As mentioned last month, Barry Santini of Tele-Vue recommends 1200 LASIK procedures as threshold you are looking for. At present there are many new practitioners who have only a few hundred or perhaps only dozens of procedures under their belts.

TECHNOLOGY: You want an experienced practitioner who works with third generation LASIK technology. Third generation is much more accurate than first or second generation. Many of the negative stories you hear about LASIK come from those who had their eyes done on first generation machines.

EXTENDED CARE: I have had a lot of people tell me their experiences with LASIK. There seems to be a trend that those folks who have had negative experiences with LASIK had their procedures done by practitioners that did not have a rigorous follow up program. In my case, my doctor has a four visit follow-up procedure to track the surgery (one day, one week, one month, three months, and one year). A number of those that had bad experiences reported only a single follow-up. This is just another consideration.

CLUB NEWS

You may have noticed that I mentioned our **new web address: www.ocastronomers.org**. Thanks to Liam and Anna Kennedy for acquiring our new address which we will be transitioning to over the next few months. I am turning over a significant part of my OCA webmaster duties to Liam over the next few months. I think you will like some of the improvements Liam has in mind. The recent trip to Mt. Wilson was a total success. Look for articles on the web site as well as in the Sirius Astronomer. We will be returning in the spring.

By the time you read this in the Sirius Astronomer we will again be in the annual election process. Nominations will open at the November meeting. I want to take this opportunity to thank all the trustees and functionaries for the dedicated and often thankless work they put in on behalf of OCA. The selfless effort of these men and women provide the good services we all enjoy and sometimes take for granted. Please, find at least a couple of these people at the next OCA event you attend and let them know that you appreciate their efforts. Their names are on the back of each issue of the Sirius Astronomer.

I would particularly like to single out Charlie Oostdyk (treasurer) and Chris McGill (newsletter) for the hard work they put in each and every month to keep OCA humming and informed. Thank you.

What Does It Take To Make a Habitable Universe?

A Report on the OCA Banquet by Chris McGill, Editor

About 61 people attended this year's OCA banquet, held on Sunday, Oct. 17, at the Orange County Mining Company. The restaurant is situated atop a hill in East Orange. We were treated to a fantastic view and great food, thanks to the efforts of Suzanne Hall, Bob Gill, and Charlie Oostdyk. Included among the guests were past OCA presidents John Sanford and Wayne Johnson. Trustee Don French was unable to make the banquet due to an ongoing medical ailment, and our prayers are with him.

Vice President Jay Glowacki introduced the speaker, Dr. Laurance Doyle of the SETI Institute in Mountain View, CA. Doyle's talk and slide show presentation was both a surprise and a delight to me, not knowing really what to expect. He speaks often at clubs, organizations, and conferences. If anyone had a lingering notion that the search for extraterrestrial intelligence is carried out by "wild-eyed idealists", Doyle's amusing and instructive presentation completely dispelled such a notion.

Like a college professor, Doyle drew on Drake's equation (see last issue) to outline and expand upon his view of what are the necessary conditions for *intelligent* life to evolve. His ideas are based on his work at SETI's Center for the Study of Life in the Universe, where research addresses the multi-disciplinary aspects of planetary habitability.

Drawing upon Earth as a prime example, Doyle pointed out that the process of star formation forms an ultraviolet shield that guards the star's system from the harmful rays emanating from other stars. In addition, the presence of heavy elements like iron in certain stars makes them good candidates for life overall, because these elements are needed for planet formation. Where planets are concerned, water, energy, organic matter and gravity are necessary constituents of life. Where did water come from? Doyle explained that perpetual bombardment by comets brought water to Earth. What is interesting, though, is *how* this occurred. Comets could not have crashed into early Earth and deposit water with its constituent organic properties had it not been for the gravitational "cooperation" of the outer gas giants in the solar system: Jupiter, Saturn, and Neptune. These planets deflected the paths of these fast-moving celestial objects toward Earth and into the oceans, where the first life forms evolved. Cyanobacteria and blue-green algae were early existing life forms, the latter causing the "Cambrian explosion" of the existence of life on Earth. And in general, terrestrial planets in the inner orbits of star systems are formed with the aid of gas giants in the outlying orbits. Jupiter-like planets, for example, remove debris from the inner solar system

Earth, said Doyle, is not unique in possessing life forms. He addressed other inner planets such as Venus and Mars. The reason Venus hasn't formed life is due, in part, to its proximity to the sun. Water vapor remained too long in its atmosphere, causing a moist, runaway greenhouse effect. The separated H₂ and O molecules therefore escaped into space. As for Mars, Doyle said that early Mars was probably habitable; however, along with its lack of an atmosphere, Mars lacks plate tectonics. Tectonic activity, which Earth so evidently possesses, is important because it produced a recycling of oxygen-containing rocks every 20 million years of early Earth history. Doyle pointed out that certain planetary moons like Europa are possible candidates for life. Europa should have liquid water beneath its icy surface. This moon undergoes something called "tidal healing" as it makes its 3 day, 13 hour journey about Jupiter. Tidal healing is caused by the gravitational pull of Jupiter on one side and Io and the other large moons on its other side.

Continuing his multi-disciplinary approach, Doyle pointed out that primitive humans practiced archeo-astronomy, giving examples like the stone pillars of the Namoratung'a people of Kenya, who arranged basalt pillars in astronomical alignments corresponding to stars as they would appear over 6,500 years ago. But, only recently, with the rise of civilization and the ensuing technological advancement could humans begin to control planetary resources. That includes space travel.



Stone pillars of the Namoratung'a people of Eastern Kenya.

Thus, in 100 million years, humans can populate the entire galaxy. If this is so, and if Earth is not unique in possessing life, one might ask, Where is everybody else? This lack of presence of other intelligent species in the galaxy is called the "Fermi paradox", named after Italian physicist and Nobel laureate Enrico Fermi.

Doyle discussed Project Phoenix, a radio search being conducted at Arecibo Observatory in Puerto Rico. Scientists listen for signals arising from space, using the 1 to 3 gigahertz bandwidth, where there's a water vapor hole in the atmosphere. Not to worry, though: SETI scientists have already designed a telescope, called the One Hectare Telescope—to be placed on the Moon's dark side—that will listen for signals. He showed a slide of a proposed array of such scopes filling up craters on the moon. With our current technology, we can only detect unmodulated signals (called Type I detection).

One of Doyle's own many projects is working with dolphins to determine the technology level of their language from the whistles adult dolphins make. Information theory (developed for quantifying the amount of information sent through telephone lines) states that information generated at a complex level translates graphically to a 45 degree angle on a scale of 0 to 90. In contrast, the sounds made by baby dolphins, who have no measure of complexity, would be represented by a 0 degree angle on such a scale.

Amateur astronomers can make substantial contributions by searching for planets in eclipsing binary star systems. How? By taking measurements of the orbital periods to determine whether anomalies due to the transits of planets occur. The data can then be reduced using software developed by SETI. This calculation program is free and available to interested amateurs who wish to assist in this endeavor. Contact Dr. Doyle at: ldoyle@seti.org. for more information on the program.

After concluding his lively presentation, Doyle answered many questions, both before and after the banquet ended. It was a memorable occasion.

A Different View of LASIK

by Patricia Jonk, OCA Member

I am so glad that Russ had a good result with LASIK. I underwent the LASIK procedure in July of 1998. Although the majority of LASIK surgeries end with a favorable result for the patient, I was one of those who had a negative result. I was mildly myopic (-2.00 each eye) and minimally astigmatic (-.25 or -.50 each eye). My doctor assured me that my results would be "excellent" because I had only a mild refractive error preoperatively. My pupils were of average size, 3mm in bright light, 4.5mm in dim light.

As a result of this surgery, I am now farsighted in my right eye (+1), still nearsighted in my right eye (-1.00) and my astigmatism was increased on both my eyes (-1). I experienced strong discomfort for about one year after surgery. Instead of being free from glasses, I must now depend on them because of my refractive error, as well as the imbalance in diopters between left and right eyes.

This surgery also left me with diminished contrast sensitivity. When I view the moon now with glasses, it is not as bright and clear as it used to be prior to surgery with glasses. I also see a glow or "ghosted" image around the moon. Telescopes and binoculars only provide spherical correction, but not astigmatic correction, so this is a potential concern for amateur astronomers.

I would suggest that anyone considering this surgery to check out the web site www.surgicaleyes.com. Unfortunately, I was not fully-informed about this surgery, and although my surgeon was board certified, I know now that he did not give me the proper preoperative examinations and that he was unwilling to deal with my problems after surgery. I would gladly speak to anyone considering this surgery if they are interested via e-mail at pjonk@ocsd.com.

The OCA Takes on Mt. Wilson

Several OCA members spent an exceptionally memorable evening October 9 at Mt. Wilson Observatory gazing and photographing through the 60-inch Hale telescope. The trip was organized by OCA Vice President Jay Glowacki. At a cost of a mere \$45, these folks, joined by two San Diego Astronomers Association members, enjoyed some apparently incredible views. Another trip is scheduled for next spring, but if you want to get in on it, you'd better hurry: the line's already started! Check out the website for photos taken by group members. Following are comments from some of the participants.

Tony Obra

Well, what can I say except that God occasionally grants us a perfect night. You know, It just wasn't that active when I joined MWOA but WOW, how a good thing spreads and the legend continues!! Don Nicholson of MWOA says, "The 60" activity is ever increasingly productive" and I guess that makes everybody happy. I really enjoyed looking at stunned faces and the speechlessness because I know what's going through their minds.....

Dean Jacobsen

The trip was great, most certainly worth the effort. We were lucky enough to be up there on a night of great seeing. The staff said that *the seeing was better than 1 arc second*. When we looked at Jupiter and Saturn, even the observatory staff were stunned. They said that they had never seen such stunning views of these planets. Just imagine the best photograph of Saturn and Jupiter, that was what we were seeing through the eyepiece. The views of the planetary nebulae that we were shown were picture perfect with gorgeous colors.

Dave Mehaffey

The weather was very comfortable, about 70 degrees, well into the nighttime. Calm, still, dry, - excellent seeing. All the attendees were astonished at the clarity of the images. We are not accustomed to such magnifications and such large images. Our guide docent was a most knowledgeable kindly silver haired gentleman named Don Nicholson, who told stories the entire evening, as well as shuttling people to the gate who had become ill due to altitude, virus, or sleepiness. The M15 globular star cluster literally covered the entire field of view. Each star was bright and pinpoint sharp. The atmospheric turbulence became apparent, as each star wandered a bit compared to its neighbors across the field of stars. This was my personal favorite.

Jim Satterfield

Using the 60-inch telescope at Mt Wilson was something I will never forget! It is a marvelous instrument. The views of Jupiter, Saturn and the Saturn Nebula had to be seen to be believed. I'd swear that Jupiter showed more detail in the eyepiece than in a Voyager photograph. The central star in the Ring Nebula was visible without using averted vision. The rings of Saturn showed very fine detail. The seeing was superb (I looked at Jupiter for more than a minute and it didn't even wiggle!), the weather perfect (warm with almost no wind) and the Mt. Wilson folks very accommodating. I'm looking forward to seeing the photos (digital and film) taken that evening when they are posted on the OCA site.

Dennis Ritz, SDAA

We first observed mu draconis, a close 2.6' double star and found seeing steady and excellent. For most of the night, resolution was sub arc second in shirt sleeve weather. The 'low power' 100 mm 4" eyepiece on the 60" f16 Cassegrain focus produced 240x. Planetary nebulae, including NGC 6543 Cat's Eye and NGC 7662 Blue Snowball showed complex shell structures with 15 magnitude central stars. Uranus had four visible moons and maybe some cloud banding. M15 was a treat of the evening, a globular cluster that was incredibly sharp, attesting to the fine optics ground and figured by Ritchey and exceptional seeing. Jupiter was amazing as was Saturn, and for several hours we Ooohed and Aaahed. Dawn arrived with M42, the Orion nebula, large and wonderful. As dawn broke we headed down the mountain, but it was a memorable night. Photos can be viewed at: http://www.sdaa.org/SDAA%20Events/mt_wilson_60.htm

Virtual Astronomy

by Dave Kodama

Transit of Mercury

The special astronomical events in November I briefly touched on last month include the grazing transit of Mercury and the possible Leonid meteor storm; both covered in the November issue of *Sky & Telescope*. Curiously, the table of time, position angle, and altitude given in the article on the Mercury transit did not include any U.S. city between Denver and Honolulu, but more complete lists can be found at:

http://www.lpl.arizona.edu/~rhill/alpo/transitstuff/merc11_99.html

<http://sunearth.gsfc.nasa.gov/eclipse/OH/transit99.html>

If you use the first site, you should be aware that the times listed are the minutes and seconds past the UT hour listed at the top of the table. The Goddard space flight center website (second entry above) has a table that's much less confusing to read. There may also be some live web views of the transit at: <http://sunmil1.uml.edu/eyes/tv.html>, weather and web traffic permitting, of course!

Leonids Again (?)

The potential Leonid meteor storm is also a hot topic on the web this month. But now I'm really getting confused about whether or not to expect much from this year's shower. Expert predictions on this year's shower (and explanations for the lower than expected 1998 meteor count) are starting to sound like stock market analyst pronouncements. The latest predictions of high Leonid activity seem to extend out as far as 2002!

<http://www.leonidstorm.com/predictions.html>

<http://www.eso.org/outreach/info-events/leonids99/>

<http://www.imo.net/leo99/leo99index.html>

<http://medicine.wustl.edu/~kronkg/leonid1999.html>

<http://www.arm.ac.uk/leonid/dustexpl.html>

<http://ssd.jpl.nasa.gov/leonids.html>

- summary from Aerospace Corp.
- ESO
- International Meteor Organization
- Gary Kronk
- Armagh Observatory
- Donald Yeomans (JPL)

Minuteman Launch

If you happened to be out at the OCA's Anza observing site for the star party on October 9, you probably saw the Minuteman launch at sunset. I was among the ones out there who were surprised by the launch. I scrambled to load my camera and snap a few pictures (they're at: <http://www.eanet.com/kodama/astro/>), but because of my unpreparedness, I only caught the lingering trail. Next time around, I'll be ready as I (re)discovered Brian Webb's website which includes a schedule of the Vandenberg launches:

http://ourworld.compuserve.com/homepages/rawhide_home_page/homepage.htm

His page also includes a photo of the missile just as it emitted a puff of exhaust when the second stage fired.

A Few Reminders

Finally, here's a reminder that you can save yourself a lot of URL typing because the links described in this column can be accessed from the OCA website page: <http://www.ocastronomers.org/virtual.htm>. Also, don't forget that you can receive a weekly email reminder of upcoming OCA events by sending a request to me at: kodama@alumni.caltech.edu.

OCA Outreach

by Jim Benet, Outreach Coordinator

The OCA outreach program continues to expand reaching out to more people each year. The Explore the Stars program, sponsored jointly by the U.S. Department of Forestry and the OCA, has just completed its fifth consecutive year. In this period over 2500 people have enjoyed viewing the sky under truly dark sky conditions at Palomar Mountain. This affords viewers the opportunity to see a much wider range of deep sky objects than they could at most other places where viewing is limited by light pollution. Each outing featured about a dozen telescopes, three quarters of them were owned by members of the OCA.

The OCA is starting an "Adopt a School" pilot program with Stephan White Middle School in Los Angeles County. A group of students along with teachers and parents will visit the OCA Anza viewing site a few times during the year to experience a unique educational opportunity. If this pilot program is successful, we will continue it next year expanding into schools in Orange County. In the past, the OCA has focused most of the Outreach programs at the elementary school level. However, this is changing. So far this year we will be doing programs at one middle school, two high schools, and two colleges. The schedule for fall OCA Outreach programs is shown below. We are very encouraged by these activities and we urge all OCA members to get involved. Please contact Jim Benet by phone at (714) 693-1639 or email at jim.benet@csi.com to participate. We need your help! Thanks, J.B.

Event:	Gilbert Elementary School , 100 people
Host:	David Mauldin
Date:	Monday, November 8, 1999
Time:	Slide Show at 6:00 PM; Viewing at 6:30
Place:	Gilbert Elementary School
Address:	7255 West 8 th Street; Buena Park
Directions:	Take the 5 Freeway to Beach Blvd. Head south on Beach to 9 th St. Turn right (west) on 9 th to Western Ave. Turn right (north) on Western to 8 th St. Turn left (west) on 8 th to Gilbert .
Event:	Girl Scout Brownies -- 200 Girls
Host:	Corrie Ruiz
Date:	Saturday, November 13, 1999
Time:	Viewing at 6:30 PM
Place:	Bryant Ranch Elementary School
Address:	24695 Paseo de Toronto; Yorba Linda
Directions:	Take the 91 Freeway East to Gypsum Canyon exit. Go north on Gypsum to La Palma. Turn left on La Palma to Via Lomas de Yorba. Turn right on Via Lomas de Yorba to Paseo de Toronto, then turn right.
Event:	El Camino Real High School -- 30 People
Host:	Sue Hayden
Date:	Monday, December 6, 1999
Time:	Viewing at 7:00 PM
Place:	Tucker Wildlife Sanctuary
Address:	Modjeska Canyon
Directions:	Take Santiago Canyon south past Silverado to Modjeska Canyon. Turn left on Modjeska Canyon to Tucker Wildlife Sanctuary.

Event:	Biola University Astronomy Class, 25
Host:	Dr. John Bloom
Date:	Tuesday, November 9, 1999
Time:	Viewing at 7:00 PM
Place:	Biola University
Address:	13800 Biola Avenue; La Mirada
Directions:	Take the 5 Freeway to Valley View. Go north on Valley View to Rosecrans. Turn right on Rosecrans to Biola Ave. Turn left on Biola .3 mi to Biola Univ.
Event:	Anaheim Elementary School, 200 People
Host:	Kim Meyer
Date:	Tuesday, November 16, 1999
Time:	Show at 6:30 PM, Viewing at 7:00 PM
Place:	Anaheim Elementary School
Address:	6450 E. Serrano; Anaheim Hills
Directions:	Take the 91 Freeway East to Imperial Highway. Turn right and go south on Imperial to E. Nohl Ranch Road. Turn left and go 2.4 miles to E. Serrano. Turn right on E. Serrano.
Event:	Crystal Cove State Park -- 100 people
Host:	Winter Bonnin
Date:	Saturday, December 11, 1999
Time:	Viewing at 7:00 PM
Place:	Crystal Cove State Park
Address:	On School State Road off PCH
Directions:	Take the 55 Fwy. S. to the 73 Freeway. Exit the 73 on MacArthur Blvd and go south to Pacific Coast Highway (PCH). Go So. on PCH about 5 miles to the stop light at School State Road. Turn left on School State to Crystal Cove Park.

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.chapman.edu/oca/> and select Space Update Online.)

Mars Climate Orbiter (MCO) - As reported last month, NASA lost contact with MCO. First indication of the cause was that it came much too close to Mars, missing its aim point of about 93 miles above the surface by perhaps 56 miles low. It would not survive the atmospheric heating of a passage this low. The engine fired exactly on time to force MCO into orbit rather than flyby. However a mix-up in use of US and metric units of force appears to have resulted in the mistake achieving the aim point. A full investigation is following the preliminary one, and all results are expected by the beginning of November. This will include causes, impacts to other spacecraft, and impact to the Mars exploration program. Although MCO was to relay data to Earth from the Mars Polar Lander, the lander data can be sent at lower speeds either directly or through the Mars Global Surveyor.

Chandra (X-ray observatory) - has taken stunning images of the Crab Nebula, discovering a ring brilliant in X-ray light around the heart of the nebula. It shows waves of high-energy particles that appear to have been flung outward over a light year from the central star, and high-energy jets of particles blasting away. Though previous X-ray observatories have shown hints of these structures, Chandra's vastly better resolution allows these to be seen clearly for the first time. The central star is the rapidly rotating neutron star left in the wake of the supernova explosion that was seen in the year 1054. It is about 6,000 light-years distant from us.

Galileo (Jupiter mission) - flew close to (about 380 miles) Jupiter's moon Io late the night of October 10 for the first time since 1995, when no images were taken. This flyby gathered a wealth of images and data, in spite of a safe-mode shutdown of Galileo only 19 hours before the flyby. Spacecraft controllers were able to pinpoint the problem to a failure in the memory of an on-board computer, change Galileo's instructions to avoid using the failed location, and restart the spacecraft, all in a few hours. The only data lost were a fields and particles experiment scheduled during the time controllers were fixing the problem, and a Photopolarimeter Radiometer observation that was cancelled in order to avoid the bad memory location. The failure was apparently caused by the powerful radiation near Io. The flyby was on the 24th orbit of Jupiter since Galileo arrived there in late 1995, and it approached Io from the night side. Another close encounter (about 190 miles) with Io is planned for late November 25, and may be targeted to pass through the plume of volcano Pillan Patara.

These encounters will try to solve many of the mysteries of Io, the most volcanic place in the Solar System. For example, we already know that Io's volcanoes spew out sulfur compounds, but they have been measured at over 1500 degrees C., much too hot for any sulfur compounds, unless mixed with molten basalt rock, which has not yet been detected. Temperatures have been measured on Io's surface as low as minus 150 degrees C., but we have not measured where on the surface different temperatures exist with enough precision to link types of surface features with hot or cold or in between. Much of the observation will be on 4 volcanoes: Pillan Patara, Prometheus, Loki, and Pele. Some images will have resolution 70 times as good as Voyager images. Geologists will analyze images of lava flows to determine the lava properties. Essentially every instrument on Galileo is observing during the Io encounters, not just the cameras, and they will study chemistry, heat distribution, gravity, magnetic field, and other properties.

Galileo images of Jupiter's moon Europa have been used to explain the cycloidal features, also called flexi, that have remained unexplained since they were first seen in Voyager images in 1979. The cycloidal features are chains of scalloped lines, joined arc-to-arc at the cusps, running for hundreds of miles across the frozen, fractured surface. They are unlike any other features seen in the Solar system. The explanation is that tidal stresses in Europa can raise the surface over 30 yards, assuming the surface is fractured ice overlaying a liquid ocean (this assumption is the best guess of Europa's surface). This tidal motion will exceed the strength of the ice, causing a semi-circular tear. The tears range from about 50 to 120 miles in length. The next tide, one Europa month (3.55 Earth days) later, will start at the end of the previous month's tear. The fact that the theory matches well with the observations, and the theory requires an ocean below the surface in order to get the correct surface strength, is perhaps the most convincing evidence yet for an ocean on Europa.

You may be wondering why Europa has tides at all. On Earth, we get a tide every time the Moon goes overhead or underfoot, as seen from our rotating Earth, resulting in a pair of tides about every 25 hours. But Jupiter causes the tides on Europa, and it does not pass overhead on Europa; the planet appears to sit nearly stationary in the Europa sky, because Europa is always presenting the same face toward Jupiter, rather than rotating relative to the planet. So it would seem the tides would not change on Europa, until we take into account that its orbit is elliptical, not circular. It is the approach to Jupiter at the low point of Europa's elliptical orbit that causes the high tide. There is also tide on Europa caused by a complex effect of a bulge on Jupiter. Galileo also found sulfuric acid, the same chemical as in car batteries, exists on the surface of Europa. It has taken some time to match spectral readings seen for some time with sulfuric acid. Now further research needs to be done to determine if the source of the acid is from inside Europa, or is arriving there from the volcanoes of the moon Io, which are known to spew out sulfur compounds.

HST (Hubble Space Telescope) - astronomers are trying to solve the question of which came first: the stellar disk of galaxies, or the central bulge? A study with HST showed that the central bulges of more tightly wound spiral galaxies were all created at more or less the same time in the early universe. The outer parts of these galaxies (the outer disk) are considerably younger than the central bulges. Another study showed that galaxies with bar structures across the center and with generally small central bulges grew more recently, through markedly different processes. Apparently, a small bulge formed in this type of galaxy early in the history of the universe, and then the bulge grew over time with material flowing into the center along the bar. The studies looked deep within the centers of more than 200 neighboring galaxies, out to a distance of 100 million light-years, using visible and infrared light. The colors of stars were measured, corrected for the reddening of dust in space, and then those colors were used to estimate the ages of the stars.

Lunar Prospector - was intentionally crashed into the south pole of the Moon after its mission was complete (as reported here previously), to try to stir up the water ice suspected of existing in the permanently shadowed craters at the pole. The final report is in on all observations of this, and no cloud of water debris was seen. It was observed by the Hubble Space Telescope in ultraviolet and many ground-based telescopes. Scientists were unable to distinguish among several possible causes for this lack of detection, which include, among others: spacecraft may have hit a dry area, there really is no water because the previously detected hydrogen at the pole is not water, the debris cloud was smaller than expected, crater walls hid the debris from view.

Mars Global Surveyor (MGS) - One new study of high-resolution images from MGS has found that there is no evidence of shorelines that surrounded an ocean that is thought by some astronomers to have existed in ancient times. They said that there is significant other evidence of water flowing on Mars in the past, and it is still possible that evidence of a shoreline might exist in other areas than those examined. However the areas examined were those thought most likely to have shorelines based on lower resolution Viking images. For much more information on the topic, including opposing views, see the November issue of Sky and Telescope, p. 38.

LINEAR (Lincoln Near Earth Asteroid Research) - a project of MIT's Lincoln Labs, using an automated telescope and data collection system near Socorro, New Mexico, has discovered a comet that may get bright enough to see with the naked eye next summer. It is named Comet C/1999 S4 LINEAR, and is currently magnitude 16, but may reach magnitude 3 in July, when it will appear in our northwestern sky after sunset. Other recent discoveries by LINEAR (besides 1000s of asteroids) include recovery of a Trojan asteroid not seen since 1906 and finding another asteroid that comes quite close to Earth. Trojan asteroids are ones orbiting the Sun at about the same distance as Jupiter, but about 60 degrees away from the planet, at one of the LaGrange stable points.

MIDEX missions (Medium-class Explorer) - NASA has selected the next 2 missions of the MIDEX class: Swift Gamma Ray Burst Explorer and Full-sky Astrometric Mapping Explorer (FAME). Swift will be launched in 2003 will be able to point its gamma ray, X-ray, and ultraviolet/optical telescopes at gamma ray bursts detected by other satellites within minutes to try to identify what objects emit these bursts. In between observing bursts, the 3 telescopes will survey the entire sky for new black holes and other sources of cosmic gamma rays. FAME will be launched in 2004 to precisely measure position and brightness of 40 million stars with 30 times greater accuracy than previous spacecraft. It should be able to accurately determine distances by the parallax method to all stars in our half of the Milky Way, detect planets around stars within 1000 light-years of us, and measure the gravitational effects on star motions of dark matter in the Milky Way. New technologies used include a solar sail instead of thrusters to orient FAME, and an on-board artificial intelligence program to control pointing of Swift. Because parallax forms the basis for essentially all distance measures used at greater distances, FAME should improve all distances in the universe, and help pin down the expansion rate of the universe (the Hubble Constant) and its age.

Comet Hale-Bopp - Observations of Hale-Bopp are still being analyzed, and the latest discovery is a new molecule, nitrogen sulfide (NS) in the comet. All chemicals found in comets are significant because astronomers believe that comets hold the best samples of the materials from which the Solar System was formed. It remains to be seen if the NS existed from the start, or is the result of other compounds in the comet breaking apart. Deciding this will take further observations to see if NS is found in different concentrations in different parts of a comet, and these observations will have to wait until the next bright comet comes by.

Giotto (European Comet Halley mission) - Although it did not get as much press coverage at the time, Giotto flew by Comet Grigg-Skjellerup 6 years after the much-publicized Halley flyby. Data from the Energetic Particle Detector (EPONA) is still being analyzed, and a new conclusion is that there was another comet near Grigg-Skjellerup that was not noticed visually. This is based on particle detections that matched the approach of the known comet, but occurred 50,000 miles past it, and were enough weaker to indicate a comet 3 to 4 times smaller than Grigg-Skjellerup. The smaller comet was probably a piece that broke off the main comet shortly before the spacecraft encounter.

Radarsat (Canadian radar satellite) - has completed the most detailed map ever made of the Antarctic continent in an effort taking 18 days. The map it replaced took five different satellites 13 years, and never once found a few areas free of clouds. The radar sees through the clouds. New findings include a complex network of ice streams, and details of human occupation, such as snow tractor tracks and new research buildings.

Kuiper Belt Objects - Astronomers studying the Kuiper Belt Objects, those asteroids or comets orbiting a bit beyond Neptune's distance, announced a new theory that some of them may be leftover shards from the collision that formed Pluto and its moon Charon.

Another planet? - An astronomer, John Murray, further studying the long-known fact that long-period comets we have observed seem to be not randomly oriented in space, has concluded that this non-randomness could be caused by a large undiscovered object in an orbit far from the Sun. His best guess is that the object is larger than Jupiter, and is 32,000 times as far from the Sun as is the Earth, in the midst of the Oort Cloud, where long-period comets are thought to originate. He noticed that many comets originate along an arc in the sky, and believes the predicted object must be orbiting along this arc, and gravitationally perturbed the comets into our inner Solar System. He states it could be large enough to be a brown dwarf rather than a planet. Since there are other theories on the non-randomness of comets, don't make any large bets on the predicted planet yet.

Another crater - has been identified by geologists in South Africa, which appears to be the largest and oldest known impact crater on Earth. It is about 150 to 190 miles in diameter. It had been known for some time, but was thought to be volcanic until geologists proved it was instead caused by impact of an asteroid or comet.

November's Featured Speaker

Dr. Ken Crowell, Astronomer

Author, *Magnificent Universe*

Dr. Ken Crowell is an astronomer in Berkeley, California, who received his Ph.D. from Harvard University for studying the Milky Way Galaxy. He is the author of two highly acclaimed books, *The Alchemy of the Heavens* and *Planet Quest*. His work has appeared in *Astronomy*, *New Scientist*, *The New York Times*, and *Sky and Telescope*, as well as on the Star Date radio program. His just released (10/99) book, *Magnificent Universe*, considered the successor to Timothy Ferris's acclaimed book *Galaxies*, is advertised as the most beautiful astronomy book ever published—a lavish celebration of the cosmos, with contributions from HST, an armada of interplanetary spacecraft, and outstanding observatories and astrophotographers on six continents. Dr. Crowell will tell us all about galaxies: what they are, how they evolve, how they behave and help cosmologists probe the universe, and how they made life on Earth possible. His talk will of course be illustrated with color slides from the new book. To find out more about Dr. Crowell and his books, visit <http://www.cnet.com/~galaxy/> and to hear a 10/97 interview of him or hear him read from his Planet Quest book, visit <http://www.annonline.com/interviews/971015/>.

ASTROLLANEOUS

UPCOMING OCA BOARD ELECTIONS

Reminder: **Elections** for the 2000 OCA Board of Trustees will be held at the January Annual General Meeting. Nominations for the Board will remain open through the end of the December meeting. Any member may be nominated; however, you may want to check first with the member to be sure he or she will accept the nomination.

MICROSOFT PRODUCT YEAR 2000 INFORMATION

The year 2000 is rapidly approaching, and there are simple steps you can take to get your hardware, software and data ready. We at Microsoft want to make sure you have the information you need to make this transition as easy as possible.

In order to keep you updated, we've set up a Web site that you can access whenever you wish. Just go to <http://www.microsoft.com/y2k> to get year 2000 information and Microsoft® software updates. In order to work properly after the year 2000, some Microsoft products may require a year 2000 software update. We recommend that you install the software updates so you'll continue to have the best computing experience. Of course, access to this Web site and any software updates you need are free of charge (connect time charges may apply).

CLASSIFIEDS

FOR SALE--- ECLIPSE STAMPS FOR SALE: five sets (20) of the last eclipse this century from Esfahan. normal set with no frame \$10 and with very beautiful Iranian fine art frame \$25. The prices are all including postage and insurance for all five sets. Please contact Hassan moonlite9@hotmail.com

FOR SALE--- 80 mm F-11 Celestron Refractor scope 1-1/4" Rack-and-pinion focuser. \$175.00. Pick up or add shipping. Contact Jim Leonard at First Light Observatory, Inyokern, CA, 760-377-3474.
Email: supersaw@ridgecrest.ca.us.

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