

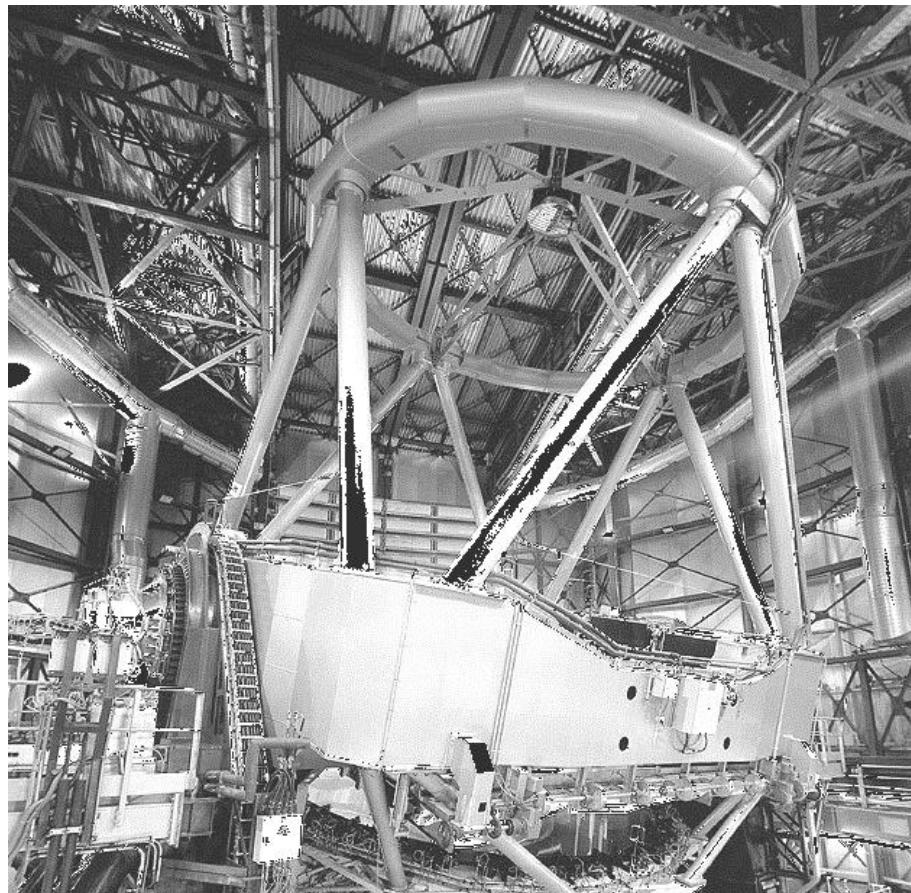
SIRIUS ASTRONOMER

NEWSLETTER OF THE ORANGE COUNTY ASTRONOMERS
See our web site at <http://www.chapman.edu/oca/>

March 1999

Free to members, subscriptions \$12 for 12 issues

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The first of 4 8.2-meter (325-inch) VLT Unit Telescopes (UT1) of the European Southern Observatory is already producing impressive work, such as the observation of what astronomers believe is a "dissolving" globular cluster, NGC 6712, into the Milky Way halo. The cluster moves in a loose elliptical orbit through the plane of our galaxy, where it has already lost some of its composition. Photo courtesy of the ESO.

CAPTION

The next meeting of the OCA is on Friday, March 12, at 7:30pm in the Science Hall of Chapman University in Orange. The free and open meeting will feature Dr. Gary Peterson, whose will talk on "Basaltic Flooding of Terrestrial Landscapes." There will also be a "What's Up?" presentation by Chris Butler, plus open slides/videos.

STAR PARTIES

Both the Silverado site and the Anza site and Observatory will be open for observing on Saturday, March 13. Note: both sites will feature the annual "Messier Marathon" and are open to anyone to attend. Rules are listed on p. 11. Come prepared for cold weather - dress warmly---and if in doubt, check the satellite weather pictures before leaving town or call the observatory.

COMING UP

In April, our speaker will be Janet Mattei, AAVSO Executive Director. See pg.11 for an extensive listing of upcoming events such as: the 1999 OCA Messier Marathon, the IAPPP's 1999 Western Wing Conference, the Riverside Telescope Makers Conference, and the Astronomical League's Astrocon '99.

The President's Message

by Wayne P. Johnson (aka Mr. Galaxy)

Our latest AstroImage '99 (AI '99) Seminar was a huge success both in terms of content and attendance. Nearly 100 people were present at CSU Fullerton's Ruby Gerontology Center for the event. This issue of the Sirius Astronomer will give a synopsis of what we were treated to.

It's hard to know whom to thank first, but I'd like to thank the speakers for the effort that they took to attend AI '99 (several came from great distances) and for the presentations they made. The content of the talks provided great material for others to emulate and they will, in turn, make further improvements. I hope that the people who were only attendees this year will come talk about their enhancements at future AI's! We saw many, many exquisite images, not only during the talks, but also on the display boards.

A big THANK-YOU to our volunteers, especially to Charlie Oostdyk, who acted as AI '99 Registrar and kept the finances straight, Rodrigo de la Mora, who made sure the refreshments were available for our hungry attendees and my wife, Arlene, for making the home-made items, Russell Sipe for posting and cleaning up the AI '99 announcements on the OCA webpage, Dave Kodama and Chris McGill for writing up a synopses of the Seminar, and, of course, Bob Gill and the Cal State Fullerton Physics Department for hosting us and providing the audio-visual equipment to make the presentations the success they were. Many of the above-mentioned worked on publicity for this event, too, which is crucial to its success. If you liked it, spread the word that the next AstroImage is tentatively set for the first or second Saturday in November 2000 and will be known as AI-2K. Hope to see you there.

Along the line of technology transfer seminars, the OCA is tentatively scheduling a CCD Workshop on October 23, 1999, featuring Jim Janesick, the well-known CCD guru. Jim was responsible for the device used on the Hubble Space Telescope and has been involved with design and fabrication of charge-coupled devices almost since their inception. He made an all-too-short presentation at AI '99 and we're hoping that he will be able to cover the material he couldn't get to in that talk at the upcoming workshop. This will be a good event to attend for beginner and advanced amateur alike. A lot of material will be covered. It will be structured much like the AstroImage Seminars and will cost \$25 for the day. See the OCA's webpage and the newsletter in a few months after we've finalized some details.

The OCA is planning an observing outing to use Mount Wilson's 60-inch telescope. A maximum of 24 people will be allowed on the trip. It will cost about \$40/person for one night's observing. Several other clubs in the area have taken advantage of this opportunity and they highly recommend it. The tour will probably occur in the next few months when the weather gets warmer. If it proves to be popular, we'll do it again.

Our Anza House is continuing to be improved thanks to the efforts of several volunteers (Gary Schones, Karen Caldwell and Lea Dawson). Among other activities, curtains are being hung and bathroom windows painted over to keep stray light within the house. That way, people who are in the house can read or watch TV, etc., without disturbing the stargazers outside. If you would like to help out on the Anza House contact Coordinator Roy Weinberger at 949-768-5205 or email him at oneleaf@earthlink.net. Roy mentioned that there is a specific need for plumbing and air-conditioning volunteers to check out plumbing problems, make necessary repairs and advise as to the best way to air condition (swamp cool?) Anza House for the fairly hot, dry summers. A handyman/carpenter type person who can help fill and cover holes where rodents are getting in to Anza House is also needed.

Clear skies, Everyone!

AstroImage '99 Conference

by Christine McGill, Editor

This year's AstroImage '99 was held February 6th at the Ruby Gerontology Center at Cal State Fullerton. The daylong conference featured presentations and slides by 10 speakers (including two OCA members) and an exhibit in a nearby hall. There were about 100 people in attendance, including our ex-prez, John Sanford. And there was also something new: AstroImage '99 was simulcast live via the internet to Eddie Trimarchi, an amateur astrophotographer, in Queensland, Australia! His impressions are included at the end of the article. Conference Chairman Wayne Johnson (Mr. Galaxy) opened the proceedings and introduced each of the speakers. What follows is a summary of the presentations given by most of the speakers.

Chris Cook took center stage first with a presentation entitled "Color Astrophotography with a Small Refractor." Chris recently reviewed the TeleVue 85mm f/7 APO refractor for Sky and Telescope magazine (9/98). He described its uses, combined with an optional field flattener and 2-inch focuser. He typically shot 2 to 3 long exposures with the TeleVue piggy-backed on a Celestron C8 focal reduced to f/6.3. The images were then scanned using a UMAX Powerlook 3000 scanner, blended with Picture Window and enhanced (mostly saturation and contrast) using Adobe Photoshop. His impressive slides included an image of M8 and M20, which consisted of two forty-minute exposures taken at Anza with hypered TPF film. For his output, Chris used the Fujix Pictrography 4000 digital printer. He commented that he has been very happy with the results obtained from using the highly portable TeleVue. Chris' email address is: ccook@starbase.com

Liam Kennedy followed Chris with his presentation titled "How much didn't that CCD cost you?" Liam, the proud owner of a 10-inch Meade LX 200, bought the QuickCam and a Meade T-adapter for \$70 (used, off the internet) to use in lunar and planetary photography. His clever technique was very popular with the audience, which suggests that the arena of astrophotography is accessible to anyone with imagination and a yen for tinkering. It involved opening the QuickCam (voiding the warranty, of course!), discarding the lens, puncturing a hole just large enough for the camera eyepiece T-adapter, reassembling the camera, and connecting it to a PC (via parallel or USB port). The images produced are 320 x 240 pixels in size with up to 64 shades of gray (later versions in color). The QuickCam comes with its own image and video production software, which Liam described, but for his animations, Liam used Ulead GIF Animator. He showed the audience a time-lapsed animation of Jupiter and its moons (featured on his website: <http://www.theKennedys.net/astronomy>).

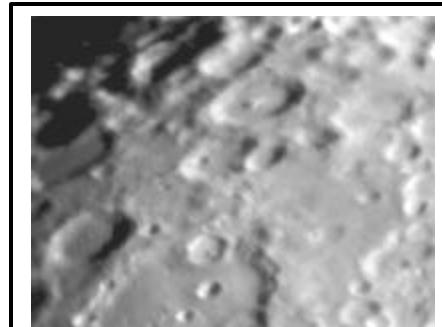


Photo courtesy of Liam Kennedy, all rights reserved.

Klaus Brasch, the next speaker, spoke about two relatively new Kodak films, "the Ektachrome 200-P slide film and the PMZ-1000 color negative film." Most of his slides were made using a Celestron C14 at f/11. He said that the EK200-P ("P" for Professional) is a finely grained film that has a nice contrast range and is good for piggyback, direct astrophotography. He displayed an image of M8 and M20 with a 400mm lens at f/6, but cautioned against overexposure. This type of film should be push-processed to a range of 400-800 mm for best results, but it tends to "fall apart", Klaus warned, above f/6. Why? Because the reciprocity is increased or the image shifts towards the red and won't record the blue. However, the PMZ-1000 has "phenomenal" contrast ability and is more suitable great for focal lengths of 400mm or higher. According to Klaus, it's great for prime focus astrophotography because it is very fast with very little reciprocity. Moreover, it has good color balance across the spectrum but should not be used for piggy-back or short focal length lenses because the grain won't do justice to the quality. Neither should it be hypered. Klaus's email address is : kbrasch@mail.csusb.edu.

Before the lunch break, **Jim Janesick** discussed "The CCD's 30th Birthday." Jim is a longtime professional astronomer who has been involved in CCD development for 28 of the 30 years of its lifetime. Its development was initially geared towards advances in bubble memory. Jim became involved in 1972 while working at JPL. He noted that astronomers were at first reluctant to use the device but quickly changed their minds once they saw its first product, an image of Uranus. Jim, incidentally, teaches a course at UCLA on the engineering and mechanics of the CCD; thus, his discussion was taken mostly from this material.

The CCD has four main functions: **charge generation, charge collection, charge transfer, and charge measurement.** In charge generation, Jim explained, the photoelectric effect is created when photons are captured by silicon. Silicon wafers are produced when the electric charge is collected in picture elements (pixels); typically, an 8x8-inch wafer will contain thousands of 1k-by-1k CCD's. Charge transfer is another part of the production process, which seeks to evaluate how sensitivity varies with wavelength. Charge measurement involves the transfer of the charge to a capacitor, which stores the generated voltage for each pixel. The voltage is "sent" through an analog signal change for use by end-users.

A means of evaluating noise sensitivity as a function of wavelength is accomplished through the use of **CCD transfer curves**, according to Jim. There are about a dozen curves employed by engineers depending upon design requirements. Another name used by designers is QE (quantum efficiency) curves. The optimum photon QE transfer curve is very important to CCD design. It plots noise (y-axis) as a function of signal (x-axis). The curve resembles a backwards "N", meaning noise can be reduced to a point at a specific wavelength, then rises linearly as a direct function of wavelength until it reaches a limit (called the "full well."). The signal-to-noise ratio most useful is the middle portion of the curve, also called the "shot noise."

Jim described charge generation as the process by which the CCD "sees" wavelengths in the near infrared, visible, ultraviolet, extreme ultraviolet and soft x-ray parts of the spectrum. In a design type called "backside illumination", a photon comes in through the rear end of the device at 10 microns (1 micron equals one millionth of a meter). It then strikes a pixel and an electron is released. The charge of the pixel is then measured in order to determine the energy of the photon collected. Why? By determining the energy, you can define the elemental makeup of the photon. Today, all CCDs are designed this way. The Hubble Space Telescope's CCD arrays, however, are not backside illuminated. They use lumigen (phosphor-coated) QE transfer curves, with frontside illumination, which was the best option available at the time, Jim said. Hubble uses the four 800x800 camera to go deep into the ultraviolet, giving it a sensitivity range of between 12 and 16 angstroms (1 angstrom equals one ten billionth of a meter). However, it fails in the infrared. Hubble's well-known *Deep Field* shows the optimum noise-to-signal ratio with a high QE and a low readout noise.

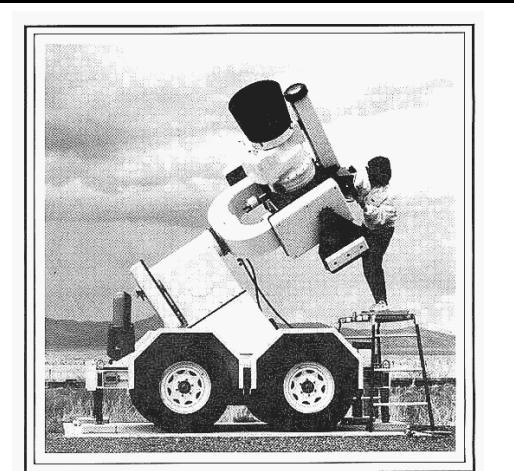
Charge collection in CCD design involves the format of the pixels and the capacity of the array. The most popular format is a 4k-by-4k design. A six-inch silicon wafer will contain thousands of these. Jim noted the next CCD array to be installed on the HST would be this type of design, which is backside illuminated, and having a maximum of 16 million pixels. Charge capacity is about 8000 electrons per square micron.

The mechanics of charge collection explain the high cost of CCDs. The silicon wafer fabrication process includes the possibility of leakage through a signal short, which can occur at any level of the chip. For example, Jim said that a short between the gate and the silicon caused by a dust particle would constitute a catastrophic failure of that pixel. Shorting, then is the primary concern of design engineers. Next comes the question of yield, that is: how much leakage can a CCD take? The earliest generation of CCDs---built with a 1k-by-1k format---had a yield of 70%. However, today's charge transfer rates are about 99.9999%, Jim said. And, the readout noise level is approximately 1 micron.

Jim described a couple of emerging technologies. One is an electron-bombarded CCD, in which an electron is created using a photo cathode, allowing you to physically see individual photons. The photon creates an electron, which is then accelerated into the CCD, generating hundreds of more electrons. Another emerging technology, one which carries an incredibly high cost, is the development of a digital projector for use by the film industry. Jim's talk was very well received by the audience; many questions were asked both during and after the presentation. Jim's email address is: mypixel@aol.com

Following lunch, the conference continued with **Tony Hallas**, whose presentation was titled 'Through the Picture Window.' He spoke about processing color images using a combination of Adobe Photoshop and Picture Window. The program allows multiple images to be superimposed upon another. Tony described taking 3 scanned photo negatives into Picture Window to increase the signal (the actual image) to noise (the grain pattern) ratio. He uses a Polaroid Scanner, which scans at 12 dpi and outputs at 8dpi. So, the user must tell the software which 4 bits to discard. Tony noted that Picture Window would blend 2 images by aligning a star at each corner of the view, producing a composite that is then aligned with the last negative. The final product is a hybrid with a gain of 1.7 in signal-to-noise ratio. The image is then moved into Photoshop for processing. Here, he might adjust properties like brightness and contrast. The image, now a Photoshop file, is converted to slide film with the use of Polaroid Film Recorder. Tony showed stunning images of the Orion Nebula, M33 showing a brown dust cloud in the nucleus, Hale-Bopp, and M81 and M82 (which showed the shock wave coming from M82). He owns a Celestron C-14, an Astrophysics 7 inch f/7 refractor, and a 12.5 inch f/7 Newtonian reflector, on which he mounts nitrogen-hypered film in a 35-mm camera. Tony's email address is: ahallas@west.net.

Graham Flint took the podium next and to discuss his impressive project titled “Vista Galactica: A Full-color Portrait of the Milky Way.” Now 5 years in the making, the Vista Galactica™ Project involves construction of a 3-ton camera that has a wide angle, the choice of film to be used, and a format large enough to accommodate the image. The decision to use Kodak 14-by-14 inch plates (having a 20-inch diagonal) was made for practical reasons---he needed flat-field camera optics. The choice lens conformed to this requirement: it is a 36-inch 7-element night-reconnaissance lens with an f ratio of 4 and a field of view of 20x20 degrees. It has been modified to correct for the red/green/blue spectral region. The camera actually takes exposures in black and white, but through narrow band red, green and blue filters to maximize film response to the spectral emission lines of hydrogen, helium and oxygen. Since the Milky Way exceeds 20,000 square degrees, Graham decided to assemble the mosaic from 56 frames, each with (diagonal field of view of 31 degrees). The astrocamera was built in Graham’s house and is so large that he had to lower the floor of the garage to transfer it to the trailer! The unit is completely remote-controlled. Also, David Malin is involved in the southern portion of the sky photography.



Graham Flint’s wife Catherine adjusts a setting on the 36” f/4 Vista Galactica™ Camera. Despite weighing in at 3000 lbs., the camera uses a fisherman’s digital scale to balance to within a few ounces! Copyright by Graham Flint, all rights reserved.

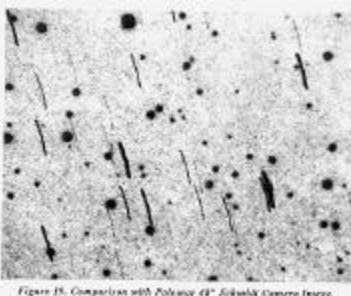


Figure 19. Comparison with Palomar 48” Schmidt Camera Design.

A microscopic representation (magnified 17X) of a direct comparison of the Vista Galactica™ camera with Palomar’s 48” Schmidt is presented. The Vista shows a slightly trailed exposure. Copyright by Graham Flint, all rights reserved.

When construction of the camera was completed, it was hauled up Mount Baldy in New Mexico and installed in an observatory leased to the project by the University of New Mexico for \$1 a year for 10 years. Graham is looking for volunteers to assist with the photography and running the hypering chamber. He can be reached at TechEditions, P. O. Box 9374, Albuquerque, NM, (505) 255-4813.

Chris Schur’s presentation was entitled “Digitized Schmidt Astrophotography from Arizona.” Chris has an 8-inch Celestron Schmidt camera (no longer marketed by Celestron) that he uses from his roll-off roof observatory in Payson, AZ. The Schmidt has very fast exposure times (less than four minutes), and he indicated that it took him a couple of years to get up to speed. The Schmidt’s 9.25 inch primary mirror has a spherical surface with a photographic plate at the primary focal plane instead of an eyepiece. The plate is also curved, but the inventor of this camera, Bernhard Schmidt, placed an aspheric connector lens at the center of curvature of the primary mirror. The result of this technique is a very fast camera that produces images which are razor sharp and of uniform quality over the full field of view.

With unhypered film, the camera has an f ratio of 1.5. Chris processes multiple images by scanning them first with a Polaroid ESX Printscanner, which produces a 25Mb image. The file is then imported into Photoshop where skyfog is subtracted. For this, Chris employs extensive use of the histogram. The output from Photoshop is moved into Picture Window as a negative. He uses Picture Window’s filter function to combine multiple negatives into a hybrid negative. The combined negative gives you a dense, rich product. From there, a final image is produced, which can be outputted to a slide, a printer, or the web. He displayed an image of rho Ophiuchi, which had a variety of rich star colors, a brownish-yellow cloud of dark nebulosity, and red filaments throughout the field of view. Chris has a number of images taken with a variety of equipment on his website: <http://pulsar.la.asu.edu/~chris>.

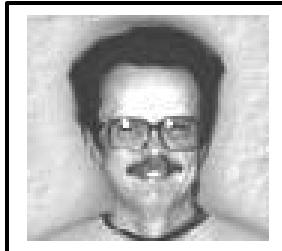
OCA member **John Hoot** followed Schur with a presentation entitled “CCD Time-lapse Animation Tools and Techniques.” The type of format used is the most important decision prior to embarking upon an animation project. John has used all of these formats and compared and contrasted them. Although video is the most flexible, GIF formats are most accessible. This format, however, should be used for black-and white because of its 256-color limitation. The Wintel AVI format is very widely supported, with a variety of codings, John said. However, there is no support for the MAC platform. The QuickTime format, one that is widely known, is supported on all formats and has free viewers available from the internet. John displayed an animated video of Comet Giacobini-Zinner filmed with a Meade Pictor 416XT CCD camera with a 15 arc-minute field of view. There were 6 minutes between frames and 10 total hours of filming. The video had separate scenes where either the comet was moving or the background moved. John cautions that you keep exposures and intervals identical. After this, you must create a script. John mentioned that on his website---

<http://www.ssccorp.com/astrostf.htm>--there are detailed instructions on creating scripts, computer animation tools, as well as links to other freeware. He uses Ulead GIF Animator 3.

Eddie Trimarchi's involvement in AstroImage started with his subscription to a CCD emailing list, which carried an announcement of the conference. He contacted Charlie and, together with Bob Gill, worked out the details for a live transmission using Microsoft NetMeeting. At my request, he provided feedback from the Queensland, on Australia's Gold Coast. He writes: "It was a great pleasure to remotely attend the conference via the internet and I would like to thank all of those involved in making it possible, especially Charlie Oostdyk, with whom I was in contact for most of the day... The conference started at 3am local time. And although I was keen, I just could not get myself to the conference at that early hour. By the time I did wake up proper, it was 7:30am and I logged onto the conference server to find that everyone was out to lunch... When the post-lunch session commenced and I heard my presence introduced to the audience I felt as though I was really a part of the conference as opposed to someone just receiving a broadcast.

Network communication across such a distance, however, proved to be a bit of a problem. The audio, which he said was nearly flawless, didn't suffer quite as much as the video, despite Eddie and Charlie's best efforts at tweaking. But from his standpoint as an amateur astrophotographer who is comfortable with the CCD camera, Eddie expressed admiration about the presentations: "I heard some wonderfully informative talks from the speakers, and on the odd occasion, managed to see some great video. At one stage I heard John Hoot talking about his comet animation and I switched to the video window to see a perfect video feed of the animation. I also got a few nice glimpses of Tony Hallas' images although they were severely resolution-challenged, it was great to see and hear and made me wish I was there to see those pictures in all of their glory. In spite of the technical difficulties, I did manage to get lots of useful information from the presentations. The Picture Window software sounds great and I can't believe I had never heard of it. Being an active member of SUIPP, the "Search for the Ultimate Image Processing Program" evaluating image processing software has become a bit of a hobby. The registration ability of the software for aligning multiple images was particularly interesting. I have also done some of my own comet animations by compositing multiple single frames from a cookbook CCD camera, so I paid particular attention to John Hoot. The glimpse of his animation that I did get was spectacular." Finally, he concluded: "if the ultimate aim of this endeavour was to share knowledge on the great topic of astronomy without geographical constraints, then that was definitely achieved. P.S. Has anybody realized yet that I did not pay my attendance fee?" Eddie can be reached at: eddie@fan.net.au, and his website address is: www.fan.net.au/~eddiet.

MARCH'S FEATURED SPEAKER



**Dr. Gary Peterson, Professor of Geology
San Diego State University, San Diego, CA and
Fellow, The Geological Society of America**

Dr. Peterson's talk is entitled "*Basaltic Flooding of Terrestrial Landscapes*." He describes the topic as follows: all terrestrial planets (plus the moon) have extensive areas covered with widespread basalt flows. On the Earth, geologists term these volcanic eruptions "flood basalts." On the moon, similar flow rocks are referred to as "mare basalts", and the flat-floored Lunar Maria provide outstanding examples. Mercury, Venus and Mars also have comparable outpourings. Flood basalts are characteristic features of planetary landscapes and seem to be intricately associated with asteroid impacts large enough to trigger the voluminous volcanic outpourings. Although highly controversial, geologists are beginning to consider at least some major earthly basaltic eruptions to have a similar origin and to be analogous to the features observed on the other terrestrial planets.

On the emerging field of planetary geology, Dr. Peterson writes: Solar System exploration programs provide detailed imaging of all planets and major satellites except Pluto and Charon. Landings on Venus, Mars and the Moon enrich the available imagery. The only way to interpret this information is to place it within the context of our understanding of the Earth. That field of endeavor is Planetary Geology. The persons most adept at interpreting features of other planets and satellites would be those who know the most about the Earth. See his website: www.geology.sdsu.edu/people/faculty/peterson/index.html.

Observing in Cancer

by John Sanford

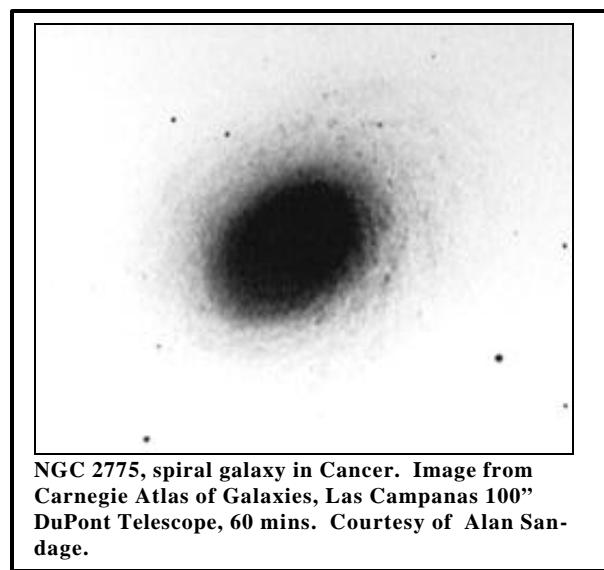
Cancer is a visually unimpressive zodiacal sign located between brilliant Gemini and Leo to the east. North is little known Lynx, and south part of Canis Minor and Hydra, the Seasnake. It does, however, have several binocular and telescopic treasures, making Cancer a worthwhile observing project. It has one of the largest and nearest open clusters, M44, or Praesepe, some good multiple stars, and a few galaxies.

Let's start with the multiple stars category. There is one notable triple star, Zeta Cancri. Zeta has three stars, with the brightest two being a close binary double, of 5.6 and 6.0 magnitudes, separated by only 0.8 arcseconds, while component C is 5.7 arcsecs away. This will require very still seeing and high power with a well-collimated telescope to resolve all 3 components. Give it a try; it's a nice object. Iota Cancri is a lovely colored double easy in any telescope. The two components are 4.2 and 6.6 magnitudes at a 30.6 arcseconds distance. Let me know what colors you see here as descriptions vary in the literature. Lastly, take a look at another multiple system; this one should be easy for most amateur telescopes. Struve 1254 has an A-B couple separated by 20.5 arcseconds, A-C by 63.2, A-D by 82.6. The magnitudes for B, C and D are 8.9, 8.6, and 8.9.

Cancer is home to 2 notable open or galactic clusters. One is the naked eye group M44, also called the Beehive and Praesepe, the Manger. According to Burnham, it contains over 300 members down to 17th magnitude. It is about 500 light-years away. In the telescope there are many lovely triangles and doubles, as noted above. M44 makes a charming grouping with Delta and Gamma Cancri, the whole probably best seen in large binoculars or a small rich field telescope.

M67 is the other interesting cluster in Cancer. It is a grouping of several hundred stars starting at about magnitude 9 and spanning almost 30 arcminutes in diameter. M67 is well studied because it is one of the oldest open clusters known, with many stars twice as old as our Sun, or about 10 billion years. It has an unusual boxcar-like almost rectangular shape. It is easily found about 2 fields west of Alpha.

There is one galaxy in Cancer worth looking at in a medium-sized amateur telescope (ie. 8-12 in.), NGC 2775, appearing as a slightly



elongated 10th magnitude glow about 4 arcminutes in length. It is a face-on Sa spiral galaxy of high surface brightness. There are quite a number of faint stars in Cancer, including several galaxy clusters.

So even though Cancer is not much to see visually with the unaided eye, apply a telescope or binoculars, and there are several very nice objects there. The message, I suppose, is get out there and mine that treasure!

Virtual Astronomy

by Dave Kodama

March means Messier Marathon (madness) time again. For the OCA, this will be held on March 13th (with the 20th as an alternate date). If you're new to organized astronomy, and you don't know what the Messier Marathon is, don't worry. Until I joined the OCA, I had never heard of such a thing either.

Basically, the Messier Marathon is a race that starts and ends with a sprint, but lasts all night. The race is not so much against anyone else, but a challenge of your skill, with the goal being to observe all 110 objects on the Messier object list in a single night. Because of the arrangement of the objects in the sky, it is only possible during a narrow time window in March and best done from about 25 degrees north latitude. In order to get close to succeeding, you must observe the objects in a particular order since many of the objects will be visible for only a short time before they set, or they may be tightly sandwiched between the time they rise and the onset of dawn.

The standard reference on the Messier Marathon is **The Messier Marathon Observer's Guide**, by Don Macholtz, but there are also a number of online sites you should visit. Your first stop should be the SEDS (Students for the Exploration and Development of Space) web page:

<http://seds.lpl.arizona.edu/messier/xtra/marathon/marathon.html>

Here you can find a nice summary of the Messier Marathon with some historical notes, as well as links to information you need in order to prepare yourself for the marathon:

- <http://seds.lpl.arizona.edu/messier/xtra/marathon/marath3.html> – the marathon list in observing order. Each object has a small photo of the Messier object, which can be clicked to open a detail page with a larger photo, coordinates, and a wealth of additional background information on the object.
- <http://seds.lpl.arizona.edu/messier/xtra/marathon/marath.html> – a tabular list of the Messier objects in observing order with coordinates and some other information. This list is something you might want to print out and take with you when you go observing.
- <http://www.kalmbach.com/astro/Hobby/Backyard/Observing/MessierMarathon.html> – another tabular list (from *Astronomy* magazine), but with a slightly different observing order.
- <http://seds.lpl.arizona.edu/messier/xtra/marathon/marath1.txt> – a printable log form to be filled in as you observe. OCA log forms are available from Doug Millar (dougnhelen@moonlink.net), or you can pick them up at the March general meeting (March 12).
- <http://www.astronomical.org/astbook/messier1.htm> – tips for surviving the marathon by John Barra.
- <http://seds.lpl.arizona.edu/messier/xtra/marathon/mm-dates.html> – for the compulsive, a list of the best dates for a Messier Marathon until the year 2019!

While we're on the topic of Messier objects, I should also point out that the SEDS website also has a very nice page listing the Messier objects (<http://seds.lpl.arizona.edu/messier/more/m-aat.html>) with photographs by David Malin. Fantastic images!

And finally, also in the category of fantastic images, is a 360-degree Milky Way panorama, which was assembled by amateur astrophotographer Axel Mellinger. This was constructed from sixteen 35mm photos taken with a 28mm lens. Each photo had to be corrected for lens distortion, mapped to sky coordinates, then merged onto the final panorama. The final product can be seen at either of the following locations:

- <http://canopus.physik.uni-potsdam.de/~axm/images.html#mwpan>
- <http://moore4.cchem.berkeley.edu/~axel/images.html#mwpan>

If you have any comments or you would like to receive weekly OCA meeting notices, you can reach me via email at: kodama@alumni.caltech.edu.

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.)

Compton Gamma Ray Observatory - has been detecting gamma ray bursts every few days for years now, but it was only recently that any of these bursts, which last from a few seconds to a few hours, was observed in visible light. As reported in this column recently, observing the afterglow of a burst in a ground-based telescope finally proved that these bursts were at distances of billions of light years, settling a long-standing dispute over whether the bursts occurred inside or outside our Milky Way galaxy. That distance implied that the bursts are unexplainably powerful to be detected so far away, sometimes giving off as much power as the rest of the visible universe combined. So further observation in all wavelengths of light --radio, infrared, visible, etc.-- have been attempted to learn more. But until January, a burst had never been observed in visible light while it was still bursting, rather than just the afterglow later.

An automatic warning system triggered by Compton has been set up to advise astronomers when a burst occurs, and on January 23 an automated camera system in New Mexico began taking pictures of the burst just 22 seconds after burst was detected by Compton. Later the exact location was determined by the Italian-Dutch BeppoSAX satellite, more accurate than the rough position from Compton, and the burst was positively identified in the pictures from New Mexico. It reached 9th magnitude, bright enough to be seen in good binoculars, and had faded by a factor of 100 in brightness within 8 minutes. Within a few hours, the Palomar Observatory was photographing the object, now a faint afterglow, and the next day the Keck telescope in Hawaii took a spectrum showing by the red-shift that the burst was 9 billion light-years away. Theories explaining the huge energy of gamma ray bursts include merging of colliding neutron stars or black holes, or a hypernova, a hypothesized sort of instant supernova.

Hubble Space Telescope (HST) - has produced dramatic images of disks of dust encircling young stars, giving astronomers a new look at what may be the early formative stages of planetary systems. The pictures don't show planets, but show edge-on dust disks, out of which planets are believed to form, in some of the clearest views to date. Although more than a dozen possible extra-solar planets have been discovered, but not imaged, over the past few years, astronomers lack detailed pictures of the environments around newborn stars where planets form. Even in nearby star-forming regions, circumstellar disks are hard to image, lost in the glare of the star, but edge-on disks appear a bit darker (looking through more dust), so were more easily imaged. While the existence of these disks has been known from prior observations, the HST images reveal important new details such as a disk's size, shape, thickness, and orientation. The new study showed disks around 6 young stars in Taurus, and the disks have sizes 8 to 16 times the size of Neptune's orbit. The images show dark clumps and bright streamers above the dust lanes, suggesting that raw material is still falling into these disks and driving outflowing jets of gas from the forming stars. A dust system was also found around a double star, answering the question of whether double stars would always disrupt the formation of a planetary system. The size of dust particles in the disks was calculated from color and reflectivity data, and the particles were larger than those in interstellar space, suggesting that the dust is clumping together and beginning to make larger bodies. The total mass of the disks was calculated to range from 1/200 to 1/1000 of the mass of the Sun.

Stardust (comet sample mission) - was successfully launch atop a Delta II rocket on February 7, the second day of its launch window. Stardust will arrive at Comet Wild-2 (pronounced "Vilt", because the discoverer pronounces his name the German way) on January 2, 2004, will gather particles flying off the nucleus of the comet in a block of aerogel, then return to Earth 2 years later, dropping by parachute in the Utah desert, where it will be retrieved so scientists can analyze the contents. Comet Wild-2 is considered an ideal target for study because, until a chance encounter with Jupiter in 1974, it was a long-period comet that rarely ventured close to the Sun. So it has lost little of its original material compared with other comets that come near enough to send a spacecraft to, which have been passing close to the Sun for eons, melting away much of their material.

Aerogel, the lightest man-made solid, is over 95% air. It is made by removing the liquid from a gel (thick liquid like jello) made of silicon substances. It is such a good insulator that it was used on the Mars rover Sojourner to keep the electronics inside at a temperature of 70 degrees F., while the temperature outside plunged as low as -88. However, aerogel was used on Stardust because it slows particles (like comet grains) gradually and engulfs them, rather than allowing them to bounce away or obliterating them. Comet particles will hit Stardust at 20 times the speed of a rifle bullet, so obliteration is a clear danger that must be avoided in order to have something left to study. The particles actually leave a furrow through the aerogel that can be examined to learn more about each particle.

Mars Global Surveyor (MGS) - has been dipping into Mars' upper atmosphere to drag it down to a more desirable low orbit, in a maneuver called aerobraking. MGS completed the aerobraking February 4, fired its rocket to prevent further contact with the atmosphere, and has achieved the desired orbit for a Martian year of highly detailed mapping. The orbit is nearly polar, and passes over the strip where it is 2:04 Martian time (2:04 AM on the pass toward the North Pole, and PM on the other half of the orbit). You can set your watch if you are ever on Mars and MGS passes over you. Of course, it has to be a Martian watch that registers one day every 24 hours and 37 minutes of Earth time, and it has to increment the year every 687 Earth days.

MGS is just about a year late reaching the mapping orbit, because the aerobraking had to be slowed to prevent further damage to one solar panel arm, broken during launch from Earth. The extra year was not wasted, as MGS produced spectacular images of Mars during the added aerobraking, some images better than is possible from the final mapping orbit. The aerobraking required more than 800 passes through the atmosphere, and it reduced the height of the orbit from over 30,000 miles to just a few hundred miles. Mapping should already have begun by the time you read this.

Galileo (Jupiter mission) - made its last flyby close to the Jovian moon Europa on January 31, and as has been too usual lately, experienced a glitch that sent it into safe mode. Fortunately this time, Galileo had completed most of its observations for this pass, since the glitch occurred 4 hours after closest approach. The remaining months of its mission will consist of 4 passes close to moon Callisto, then 1 or 2 past Io. During the Europa flyby, at an altitude of 894 miles, observations were made of Europa's surface in ultraviolet, the Tegid crater to see if it has a central dome like some other craters, an area of Europa not mapped well previously, mottled terrain, the Pwyll crater, a highly reflective spot, and the exact rotation of Europa to determine if it rotates exactly synchronously (once side always facing Jupiter), or only close to synchronously. The exact rotation makes a big difference in the theories of tidal heating of Europa, which may be keeping an ocean liquid just beneath the icy surface.

The glitch causing safe mode occurred when a planned turn of the spacecraft failed to complete in the allotted time. In safe mode, the spacecraft cancels operations and waits for further instructions from Earth. It was brought back to operation by Earth commands, as has happened several times before. Analysis of data showed that the turn was made through the least sensitive spots of 2 sensors on Galileo, and they apparently just failed to sense the turn completing. This is unrelated to any previous safe mode glitches, except that the sensors may be losing sensitivity due to long-term exposure to the heavy radiation near Jupiter, which has affected other spacecraft parts involved in the other glitches. Galileo controllers believe that the spacecraft will be able to complete its mission, at least until the flyby of Io, at which point the radiation encountered will probably be very high.

Analysis of earlier Galileo data shows that Callisto has a very thin atmosphere containing carbon dioxide, and that gas also exists on Callisto's surface. This means that all 4 large Galilean moons of Jupiter have some form of atmosphere. Previous finding indicated that Europa and Ganymede have thin oxygen atmospheres, while Io's contains sulfur dioxide. Callisto's atmosphere is so tenuous that the carbon dioxide molecules are drifting around without bumping into one another. An atmosphere this thin is easily lost due to ultraviolet radiation from the Sun, which breaks the molecules into ions and electrons, which are swept away by Jupiter's magnetic field. Finding this atmosphere implies that there is a steady flow of carbon dioxide into the atmosphere to replace that lost. Venting of gas from the interior is one possibility, and Galileo images show surface erosion that suggests carbon dioxide outgassing. During closer passes to Callisto in the next few months, Galileo will look for other gasses in its atmosphere.

NEAR (Near Earth Asteroid Rendezvous) - has returned observations of asteroid Eros, including 222 images and spectral observations, obtained during the aborted attempt to go into orbit about the asteroid (see last month's column). Eros is slightly smaller than indicated by the best previous measurements (by radar), 21 by 8 by 8 miles in the three dimensions, and appears to have no moons. Ida, one of now 4 asteroids ever imaged closely, has a moon, so astronomers were looking for any moons at Eros. First observed from earth more than 100 years ago, Eros was known to be an S-type asteroid, one with high concentrations of silicate minerals and metal. The density of Eros was measured at 2.7 times that of water, about the same as the crust of the Earth and asteroid Ida, another S-type asteroid, but about twice as dense as asteroid Mathilde, which is C-type, or carbon-rich. A ridge-like feature was found on Eros, and that combined with the high density suggests that Eros is a homogeneous body rather than a collection of rubble that Mathilde appears to be. Eros might even be a remnant of a larger body that was shattered by an impact. Craters pock the surface of Eros. The 2 largest are 4 and 5.3 miles across, less than half the size of the largest craters on Mathilde. The existence of fewer and smaller craters could be an indication that Eros has a relatively young surface. Well, now we wait until February 2000, when NEAR will get its next opportunity to go into orbit about Eros. Then images 200 times closer can be taken.

Chandra (X-ray Observatory) - was delayed for its launch again in order to check circuit boards that had given problems on other spacecraft. All such boards in Chandra were replaced or tested. In order to accommodate a later launch, the next 2 Space Shuttle missions were reordered: the May launch of Discovery will continue assembly of the Space Station, while the July flight of Columbia will launch Chandra, the heaviest Shuttle cargo

ASTROLLANEOUS

THE 1999 MESSIER MARATHON IS HERE!! This year's Messier Marathon will be held on Saturday, March 13th, with the 20th as a cloud-out date. Anyone may participate from any site and the log you turn in should be from one night's observing. Logs are available from **Doug Millar** and can be received by fax, picked up at March's general meeting or picked up at Anza on Friday or Saturday or at Silverado on Saturday. Participants can use a variety of instruments for their observing: eyeballs, binoculars, someone else's scope, your own, etc. Observing aids are available at the site. We have a check-off list, sky chart, and observing order sheets that may be of help. All who turn in a log will receive a certificate stating how many objects they have observed. Those that observe the most Messier objects will receive special recognition at the April 9th meeting. Parents are encouraged to help their children participate. There will be special recognition for the highest child's score. If you have questions call Doug Millar at (562)424-3737 or email at: dougnhelen@moonlink.net.

The 17th Annual Meeting of the International Occultation Timing Association (IOTA) will be held at Chamberlin Observatory in Denver, Colorado, on Saturday, April 17 and Sunday, April 18 already expected are presentations on current image intensification technology and on airborne observations of stars by major and minor planets. IOTA's Web site at <http://www.sky.net/~robinson/iotandx.htm>.

1999 IAPPP Western Wing Conference Announcement and Call for Papers on Photometry, CCD Imaging and Related Topics. The 18th Annual International Amateur-Professional Photoelectric Photometry (IAPPP) Western Wing Conference (IAPPP-West) will be held this year at the Mile High Lake Arrowhead Resort on May 26 - 27 just prior to the 1999 Riverside Telescope Makers Conference (RTMC) in Big Bear. Anticipated topics include: Adaptive Optics, Remote telescope operations, CCD Photometry and Astrometry, and Advanced CCD Imaging Techniques. Persons interested in making a presentation or participating are urged to contact: Wayne Johnson, 21870 Mary Street, Mead Valley, CA 92570, (909) 653-8813; wayne.p.johnson@boeing.com; or Bob Bell at "What In The World," P.O. Box 1767, Lake Arrowhead, CA 92352, (909) 337-5080; arrowheadbob@earthlink.net; fax (909) 337-6134.

Riverside Telescope Makers Conference (RTMC). The 31st Annual RTMC (Riverside Telescope Makers Conference) will be held Friday, 28 May 1999 through Monday, 31 May 1999 (Memorial Day weekend). It will be held at the Y.M.C.A. Camp Oakes (eight miles east of Big Bear City on Highway 38 at Lake Williams Road – which is between mileposts 44 and 45). This location is about 50 miles northeast of Riverside in the San Bernardino Mountains. Follow Highway 38 east and north off Interstate 10 in Redlands. A map will be mailed with your registration confirmation. For more information, see the website: <http://www.rtmc-inc.org/>.

The 1999 Astronomical League will be holding its 52nd annual convention, ASTROCON '99, "A Thousand Years of Stars & Space", at Eastern Washington University in Cheney, Washington, just outside Spokane, July 13th-17th 1999. This will be the first time in 10 years that the convention has been held in the Northwest and 8 years since being held on the West Coast! The long list of speakers includes Dr. F. Story Musgrave, Astronaut and HST primary repair mission specialist, Dr. Donald Parker, President of ALPO (Association of Lunar & Planetary Observers). Besides the speakers, there will also be many workshops and activities. For more info, check out the website: <http://www.SpokaneAstronomical.org/astrocon99>.

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