



# The Refractor

*The Bulletin of the Eastbay Astronomical Society*

Founded in 1924 at Chabot Observatory, Oakland, California

Volume 72  
Number 12  
August 1996

## Laboratory Measurements of Extraterrestrial Objects

Saturday, 3 August, 7:30 p.m.

Physics Classroom, Chabot Observatory

Lecture: Space Science Classroom

4917 Mountain Boulevard, Oakland

### Dr. Simon Clemett

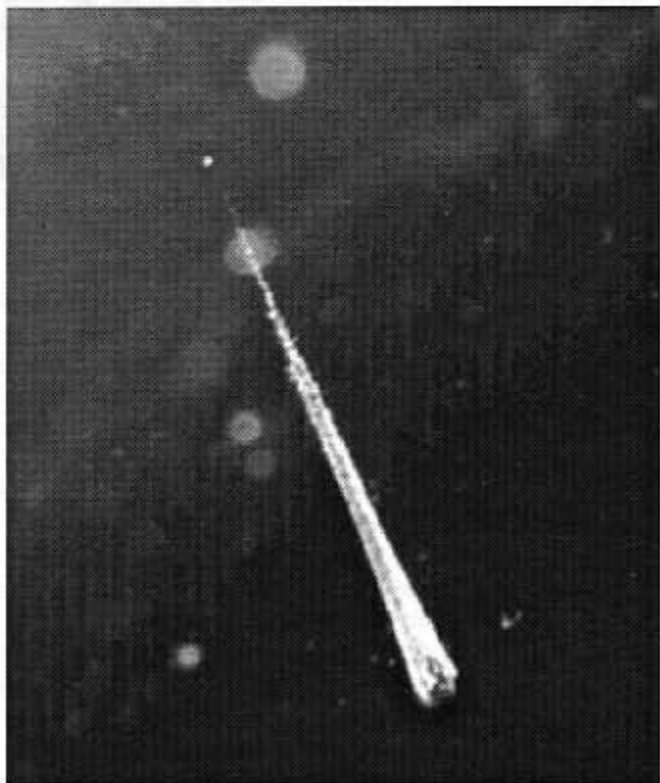
*Department of Chemistry*

*Stanford University*

Most of the knowledge of the world outside of our planet comes from observational astronomy, a form of applied spectroscopy whose power has grown markedly in the past few decades as we have been able to go from the optical portion of the electromagnetic spectrum to both longer (radio and infrared) and shorter (UV and x-ray) wavelengths. Given the vastness of space and the apparent inability to exceed the speed of light, we seem destined never to get our hands on what's out there in our lifetime other than the occasional moon spaceshot at a cost that is also astronomical. Yet another strategy is possible, namely, the chemical analysis of visitors that wittingly or unwittingly come to us—extraterrestrial visitors in the form of meteorites and interplanetary dust and cluster particles. Dr. Clemett's talk will present our efforts to analyze such materials for their chemical composition and to draw some conclusions from what we find. Using two-step microprobe laser mass spectrometry we are searching for the organic constituents in such extraterrestrial objects in hope that such information can help to suggest answers to some puzzling questions as: "In what molecular form is most of the carbon in the Universe?", "How did life begin on Earth?", and "Is life on Earth so unique?"

Technology in this field is expanding at a rapid pace, and it is evident that our knowledge will quickly advance as well. Dr. Clemett may make a public announcement concerning these intriguing links to other worlds.

Dr. Simon J. Clemett is currently a postdoc in the laboratory of Professor Richard N. Zare, Department of



*This carrot shaped track is actually little more than 5 hundredths of an inch long. It is the trail of a meteoroid through a gel exposed to space in low earth orbit by the shuttle-launched EURECA (European Recoverable Carrier) spacecraft. The meteoroid itself, about a thousandth of an inch in diameter, is visible where it came to rest, just beyond the tip of the carrot. Chemical analyses of interplanetary dust particles similar to this one suggest that some of them may be bits of comets and represent samples of material from the early stages of the formation of the Solar System.*

*NASA's Stardust mission, planned for launch in 1999, will attempt to collect dust directly from the tail of a comet and return it to Earth.*

Join us for

### DINNER WITH THE SPEAKER

5:28 p.m., 3 August 1996

#### PEARL OF SIAM RESTAURANT

5498 College Avenue, Oakland (510 / 420-8600)

Please call Betty Neall at 510 / 533-2394 by Friday, 2 August to confirm your place. Please be on time to allow ample time for dinner and to facilitate a prompt meeting time of 7:30 p.m.

*Continued on page 3*



## Aquarius, Source of All Rivers

according to the Arabs, is a constellation associated with the rainy season of the ancient middle east. Persian, Syrian and Turkish languages call it the Water Bucket. The Egyptians associated these stars with Khnum, their god of water, who caused the Nile to overflow when he dipped his water bucket into the river. Remember the importance of the overflowing Nile as it brought nutrients and fertility to the crops. The Egyptian hieroglyph for water is the same as the sign used by astrologers for Aquarius, a pair of wavy lines suggesting the surface of a river. At times the constellation has been depicted as an ass carrying two water jugs on its back.

The Greeks held to this same idea, but named the constellation for Ganymede, the Trojan boy carried off to Mount Olympus to serve as cup-bearer to the gods.

Aquarius is the first sign of the zodiac in India, where its patron saint is Varuna. This ancient god was originally the all-powerful lord of all the heavens and creator of the stars. But later he was looked on as just god of the water who looked down on the Earth through the thousand eyes of the stars. From his throat issued the seven streams of heaven. Varuna patrols his realm on a fabulous steed, half crocodile and half bird. So he is quite able to patrol both the air and the sea. The monster, Makara, is identified with the stars of Capricornus, which lie just below those of Aquarius.

The stars of Aquarius lie between those of Pisces and Capricornus along the ecliptic. To the north is the Great Square of Pegasus, and to the south is the first-magnitude star Fomalhaut. Thus it is an important star group, although it has only a few important stars. Its alpha star, Sadalmelik, is only at magnitude 3.2, and there are only about 20 other stars brighter than fifth magnitude. However, some of these stars form asterisms, star patterns such as the Water Jar, a trefoil (resembling the Mercedes-Benz symbol) of Pi, Gamma, and Eta-Aquarii surrounding Zeta. This Y-shaped group can be found to the east of Sadalmelik. This central  $\zeta$ -Aquarii is one of a number of interesting double stars. It is a beautiful pair of fourth-magnitude stars separated by about 3 arcseconds. The colors of the

Please welcome as a new EAS member:  
Paul Fitzgerald, Alameda

pair are given as pale green and pale yellow. Another star of note is R-Aquarii, a Mira-type variable star which, over the space of about a year, changes from a dim magnitude 11 to a magnitude of six.

There are three Messier objects in Aquarius, including M2 and M72, both globular clusters. M2 is one of the better clusters and one which can be visible to a keen-eyed observer on a really dark night. In a small telescope it becomes a ball of faint stars of magnitude 13. M73 is an asterism of stars that Messier mistook for a nebula. Two planetary nebulae take preeminence in a long list of other deep-sky objects in Aquarius. The Saturn Nebula, when seen through a telescope, is a small blue-green dot that Lord Rosse thought looked like a ringed planet. The other—the Helix Nebula—is the closest planetary nebula to us and occupies an area about half the diameter of the full Moon.



*This Conrad Jung photo of the pretty Helix Nebula in the constellation Aquarius was taken from Fremont Peak on Fuji SG800 color negative film, using an 800-mm lens and a half-hour exposure.*

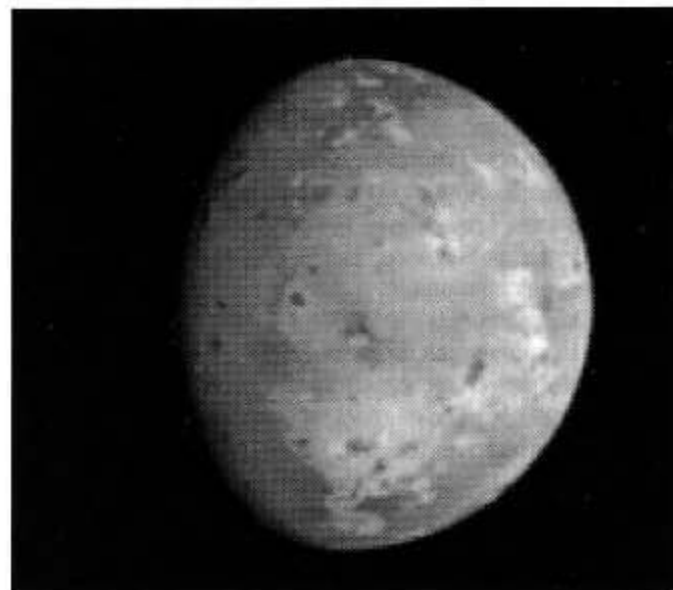
This marvelous deep-sky object can be seen in binoculars from dark skies. A cloud of gas and dust ejected from a central star, it resembles a dim smoke ring. Doppler-shift measurements confirm that the ring is expanding by 20-40 km/sec. Planetary nebulae were named by Sir William Herschel in 1785 because in telescope views they may resemble planets. About a thousand of these shells of stars in their final stages of evolution from giants to dwarfs are known. The central stars are usually blue in color with temperatures of from 30,000 to 400,000°K.

The planet Neptune was discovered among the stars of Aquarius 150 years ago, in 1846, after its presence had been predicted and calculated from irregularities in the orbit of Uranus. Aquarius is also the radiant location for several meteor showers, including the Eta Aquarids of May, the North Delta Aquarids which peak on July 29, the South Delta Aquarids which peak on August 13, and the lesser Iota Aquarids of August.

Articles and photos for *The Refractor* are encouraged. Deadline for the September issue is August 21, 1996. Items may be submitted by mail to the editor, Ellis Myers, 215 Calle La Mesa, Moraga, CA 94556. Files on disk should be ASCII PC format, 3.5-inch 1.4M. Internet e-mail address is emyers@a.crl.com. For further information please call (510) 284-4103.

## A New Image of Io

Jupiter's volcanically active moon, returned by NASA's Galileo spacecraft shows that significant changes have occurred on the moon since Io was observed 17 years ago by the exploratory NASA spacecraft Voyagers 1 and 2.



This Galileo image, taken on June 25, 1996 at a range of 2.24 million kilometers (1.4 million miles), is centered on the Media Regio area and shows details of the volcanic regions and colored deposits that characterize Io. North is at the top of the picture and the Sun illuminates the surface from the east (right). The smallest features that can be discerned here are approximately 23 kilometers (14 miles) in size, a resolution comparable to the best Voyager images of this face of Io.

Io's surface is covered with volcanic deposits that are thought to contain ordinary silicate rock, along with various sulfur-rich compounds that give the satellite its distinctive color. In the brighter areas the surface is coated with frosts of sulfur dioxide. Dark areas are regions of current or recent volcanic activity. Planetary scientists say many changes are evident in the surface markings since this region of Io was imaged 17 years ago by the Voyager spacecraft. The bright regions near the eastern limb of the moon are much more prominent in the Galileo images than they were previously. Surface details have also changed dramatically in the vicinity of the eruptive volcano Masubi (the large, predominantly white feature seen near the 6 o'clock position in this view). Masubi was discovered as an active volcano during the Voyager encounters of Io in 1979.

Galileo promises to return new views of volcanic activity on Io throughout the spacecraft's remaining 17-month mission orbiting Jupiter. Higher resolution images of Io will be taken in coming months.

Launched in October 1989, Galileo entered orbit around Jupiter on December 7, 1995. The spacecraft's mission is to conduct detailed studies of the giant planet, its largest moons and the Jovian magnetic environment.

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Chemistry, Stanford University. He was born in Portsmouth, England, January 8, 1968. He received his BA (with Honours 1990) and MA (1993) at Wadham College, Oxford University in England. He received his Ph.D. in Chemistry under the direction of Richard N. Zare at Stanford University. His Ph.D. dissertation was titled: "Laser Microprobe Studies of Complex Aromatic Molecules on Meteorites and Interplanetary Dust." Dr. Clemett is a member of a number of professional societies, including The Royal Society of Chemistry, The Oxford Society, The American Society of Mass Spectrometry, The American Physical Society, The American Chemical Society, and The Meteoritical Society.

## A Legendary White Mountains Trip

will be from Thursday, August 15 to Monday, August 19. Organized once again this year by Dave Rodrigues, this is the star party to end all star parties! We will be observing in the White Mountains, to the east of Bishop, California, from 8,000 to 12,400 feet at one of the darkest sites in the United States. On Thursday, we will be at Grandview campground at 8,000 feet and on Friday, Saturday and Sunday, through special dispensation, we will be at the Barcroft High Altitude Research Facility at 12,400 feet. Barcroft is half antarctic research station, half Shangri-La with real beds, flush toilets, showers, tools, the highest library and pool table in the lower 48, very good, warm food cooked for you, and an unforgettable view. It is a good guess that this is the "highest" star party in the United States. If you haven't been there before, talk to one of the members who has. You even get oxygen in the dining room! The White Mountains are the home of the world's oldest living things, the Bristlecone Pines. This is also a wonderful excuse to explore the many amazing sites of the beautiful eastern Sierra.

The price this year will be \$38 per person per night for room and board at Barcroft. Grandview is free. Dave Rodrigues will be accepting checks until the Saturday, August 3 meeting but spaces go fast so don't delay. Due to tightened Barcroft requirements, full refunds will be not be available. For more information, call Dave at (510) 483-9191.

Send checks payable to: David Rodrigues, 1633 Graff Court, San Leandro, CA 94577-3938.

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## Roberts Rules

Changes have taken place for the **Chabot Observatory and Science Center** relocation project. In mid-June the architectural firm of Backen Arrigoni and Ross withdrew from the project. Harry Overstreet, of the lead architectural firm Gerson Overstreet, was able to arrange for Fisher Friedman Associates of San Francisco to take over. They have hit the ground running and are making rapid progress. Everyone involved in the project will have to work hard to keep up. We wish to thank Aus Vitols of ICF Kaiser, who is the Project Manager, for his work in smoothing over what could have been a major disaster.

COSC has hired the firm of Meridian Mapping in Oakland to prepare a new topographic map of the project site. The previous surveyor failed miserably in at least five attempts to produce a map. Don Stone and I spent a considerable amount of time over the past 8 months checking up on him and pointing out gross errors. Every edition corrected a few things (often very few) and introduced more errors. The resulting map is not suitable for calculating the cut and fill required for the building, parking lot, and roads.

**The Annual Fremont Peak Star-B-Que** will take place on Saturday, 10 August. This event is open to anyone with an interest in astronomy. You do not have to be a member of any club to attend. You can bring your telescope or mooch photons from the many other telescopes that will be there. The 30-inch telescope will be open in the evening and will be staffed by Bob Fingerhut and Carter Roberts. See the enclosed flyer for details.

Once again EAS will be presenting a **Star Party for the East Bay Regional Park District**. It will be at Bort Meadows in Anthony Chabot Regional Park on Tuesday, 20 August. To reach Bort Meadows from Oakland, take Redwood Road over the hill and go about 1.5 miles past the junction with Pinehurst. The Bort Meadows Staging Area is the wide turnout on the right. The gate should be open so we can drive down the road toward the meadow. At the fork in the road, those without telescopes should turn left to the parking area. If bringing one or more telescopes, keep to the right until you reach the turnaround in the meadow. Sunset is at about 7:54 p.m. There will be a 6-day-old (39% illuminated) Moon and Jupiter will be well placed in the south-southeast. Comet Hale-Bopp should be easily visible in a small telescope, even with the Moon in the sky. Please arrive about 7:30 p.m. so you can get set up before dark. Bring a jacket since it can get cold.

**The Chinatown Streetfest** in downtown Oakland will take place on Saturday and Sunday, 24-25 August from 10 a.m. to 6 p.m. The location is close to the 12th Street BART station. The COSC booth has been located on 8th Street between Franklin and Webster before but that location hasn't been confirmed yet for this year. If you enjoy bringing astronomy to the public, come on out and stand by a telescope for a while. We expect to have details by the August EAS meeting.

Saturday, 19 October is the date for **Astronomy Day**, the second of the year. We want to have more activities this time, possibly including some solar viewing at the new COSC site. Do you have an idea for something different? Let us know and maybe we can implement it.

## The Perseid Meteor Shower

is the most famous of all meteor displays. Although visible between July 23 and August 22, maximum occurs during August 12/13, with the radiant located at RA=48°, Dec=+57°. The hourly rate typically reaches 80, although some years have been as low as 4 and as high as 200. The meteors tend to be very fast, possess an average magnitude of 2.3; and about 45% leave persistent trains. The Perseids' summertime appearance tends to provide the best opportunity for the general public to "wish upon a falling star."

Anyone can observe meteor showers and can contribute data useful to science. All that is required is an awareness of which meteor showers are active on the nights you observe, together with patience, persistence, and a smattering of knowledge about the constellations.

Counting meteors is the simplest type of work a person can perform in studying showers. One must be able, however, to distinguish shower meteors, which emanate from a certain radiant, from sporadic meteors, which do not. For the experienced meteor observer the counting method includes estimates of the brightness, color, and duration of any existing train left by each meteor as it speeds across one's view.

This month's Perseids offer a good opportunity for you to embark on what could be an experience—more than just a show! Find an open space with a clear view and a clear sky. Have a companion and notebook or tape recorder at hand. James C. White II, professor of astronomy at Middle Tennessee State University says, "As observers, we are interested in the number of Perseids per time interval. Choose an interval whose length you feel comfortable with. Why not try successive 15-minute intervals, with short breaks between intervals to give you a chance to stretch."

White continues: "At the beginning of each interval, have your companion record the time. Then, simply lie there for 15 minutes, looking straight up, and count. Each time you cry, "Meteor!" your observing buddy should make a mark. Don't look away during these observations or else you'll miss some. At the end of the interval, record the local time and switch jobs with your companion. Complete as many of the observing intervals as you care to; the more you make, the more useful your data will be. I encourage you to begin your observations about a week before the night of August 11-12 and continue until about a week after. On each evening of your observations, you should assess how bright the sky is. To do this, estimate the magnitude of the dimmest star you can see. Sky charts provide you with magnitudes of easily identified stars. The brightness of the sky will determine how many meteors you can see—and will allow us to compare counts from different locations.

"Incorporate your observations into a document with your name or the name of your group, latitude and longitude of the observing location, mailing address, telephone number, and e-mail address if possible. In your report please provide accurate time and date information, as well as written commentary. Please submit your report by September 30, 1996 by e-mail to 2032694@mcimail.com or by regular mail to John Isles, Attn: Guest Observers, 1016 Westfield Drive, Jackson, MI 49203."

## Comet Comments *By Don Machholz*

Comet C/1996 N1 (Brewington): Howard Brewington discovered this, his fifth comet, on the evening of July 3 from his home in Cloudcroft, New Mexico. Using his 8-inch reflector, which is mounted on top of his 16-inch reflector, he visually swept up this comet some 702 search hours (and nearly four years) after his fourth find. This is the longest that Brewington has searched for a comet, his previous four finds took a total of 725 hours.

An early orbit calculation shows the comet to be approaching a perihelion distance of 0.92 AU on August 3. Comet Brewington should remain in our evening sky for the next two months, moving north and dimming slowly.

Elements for C/1995 O1 (Hale-Bopp):

Perihelion: 0.9140971 AU [1997 04/01.14561]; Arg. (2000): 130.59227°

Ascending node(2000): 282.47087° Eccentricity: 0.9950784  
Inclination (2000): 089.42807° Orbital period: 3000 years

Elements for 22P (Kopff):

Perihelion: 1.5795617 AU [1996 07/02.19980]; Arg. (2000): 162.83487°

Ascending node(2000): 120.91329° Eccentricity: 0.5440739  
Inclination (2000): 004.72143° Orbital period: 6.45 years

Elements for C/1996 N1 (Brewington):

Perihelion: 0.92309 AU [1996 08/03.418; Arg. (2000): 044.120°  
Ascending node(2000): 235.119° Eccentricity: 1.0  
Inclination (2000): 051.672° Long period

| Date (00UT)   | R.A. (2000) | Dec.    | Elong. | Sky | Mag. |
|---|-------------|---------|--------|-----|------|
| C/1995 O1 (Hale-Bopp) [Serpens Cauda-Ophiuchus]               |             |         |        |     |      |
| 07-31   | 18h12.0m    | -08°59' | 142°   | E   | 5.7  |
| 08-05   | 18h05.5m    | -08°32' | 136°   | E   | 5.7  |
| 08-10   | 17h59.4m    | -08°07' | 130°   | E   | 5.6  |
| 08-15   | 17h53.8m    | -07°44' | 124°   | E   | 5.5  |
| 08-20   | 17h48.7m    | -07°21' | 118°   | E   | 5.5  |
| 08-25   | 17h44.2m    | -07°01' | 113°   | E   | 5.4  |
| 08-30   | 17h40.3m    | -06°41' | 107°   | E   | 5.4  |
| 09-04   | 17h37.0m    | -06°23' | 102°   | E   | 5.3  |
| 22P/Kopff [Sagittarius]                                       |             |         |        |     |      |
| 07-31   | 19h26.2m    | -22°03' | 162°   | E   | 7.3  |
| 08-05   | 19h28.2m    | -22°36' | 157°   | E   | 7.4  |
| 08-10   | 19h30.8m    | -23°05' | 153°   | E   | 7.6  |
| 08-15   | 19h34.2m    | -23°30' | 149°   | E   | 7.8  |
| 08-20   | 19h38.2m    | -23°49' | 145°   | E   | 8.0  |
| 08-25   | 19h42.9m    | -24°02' | 141°   | E   | 8.2  |
| 08-30   | 19h48.3m    | -24°10' | 138°   | E   | 8.4  |
| 09-04   | 19h54.2m    | -24°13' | 134°   | E   | 8.6  |
| C/1996 N1 (Brewington) [Coma Berenices-Canes Venatici-Boötes] |             |         |        |     |      |
| 07-31   | 12h54.2m    | +28°35' | 58°    | E   | 9.2  |
| 08-05   | 13h09.7m    | +32°34' | 58°    | E   | 9.2  |
| 08-10   | 13h25.5m    | +36°19' | 58°    | E   | 9.3  |
| 08-15   | 13h41.8m    | +39°49' | 59°    | E   | 9.4  |
| 08-20   | 13h58.8m    | +43°04' | 60°    | E   | 9.5  |
| 08-25   | 14h16.9m    | +46°04' | 62°    | E   | 9.7  |
| 08-30   | 14h36.5m    | +48°49' | 64°    | E   | 9.9  |
| 09-04   | 14h58.1m    | +51°18' | 67°    | E   | 10.0 |



## Keeping Up With Hale-Bopp

as it heads in our direction, we can watch it grow in apparent size and brightness. Last month, Conrad Jung's picture was a fuzz spot, while four weeks later the comet had moved from Sagittarius into Scutum and had become noticeably brighter, its tail taking on a more definite direction and structure. On July 15, Conrad obtained this view (right) from Fremont Peak, using



an 800-mm lens at f/5.6 and a 30-minute exposure. The picture on the left was taken by Carter Roberts about 24 hours earlier, also from Fremont Peak. Notice the distance the comet had traveled in that amount of time, judging by its position relative to the small star cluster, NGC 6649. Carter's exposure was 20 minutes on Kodak Pro 400 film, using a 200-mm lens at f/2.8.

## DATELINE AUGUST

- 11 1877 Mars satellite Deimos discovered, Asaph Hall
- 17 1877 Mars satellite Phobos discovered, Asaph Hall
- 5 1930 Neil Armstrong, born Wapakoneta, Ohio
- 27 1962 Mariner 2 launched
- 20 1977 Voyager 2 launched
  
- 5 1996 Last Quarter Moon, 10:25 PDT - 05:25 UT 6 July
- 11 1996 Perseid Meteor maximum,
- 14 1996 New Moon, 00:33 PDT - 07:33 UT
- 21 1996 First Quarter Moon, 10:49 PDT - 03:37 UT 22 July
- 28 1996 Full Moon, 10:52 PDT = 17:52 UT

## FUTURE CONJUGATIONS

- 3 August. EAS lecture. Dr. Simon Clemett.  
Laboratory Measurements  
of Extraterrestrial Objects.
- 8 August. EAS board meeting, 7:30 p.m.
- 10 August. Fremont Peak Star-B-Que.
- 15-19 August. White Mountains Trip.
- 20 August. Star Party, East Bay Regional Park  
District, Bort Meadow, 7-11 p.m.
- 24-25 August. Chinatown Streetfest.
- 26 September. Total lunar eclipse, 8 p.m.
- 18 October. COSC Ground-breaking, 10 a.m.
- 19 October. Astronomy Day.

Planetarium shows at Chabot. Fridays and Saturdays, 7:30 p.m.  
Information, (510) 530-5225.

|  | August |   |   |    |    |    |    |    |    |    |  |
|--|--------|---|---|----|----|----|----|----|----|----|--|
|  | 2      | 3 | 9 | 10 | 16 | 17 | 23 | 24 | 30 | 31 |  |
| The Dark of Night                              |        |   |   |    |    |    |    |    |    |    |  |
| The Sky Tonight                                |        |   |   |    |    |    |    |    |    |    |  |
| Convicted by the Sun,<br>Acquitted by the Moon |        |   |   |    |    |    |    |    |    |    |  |

The place to be on Friday evenings

### TELESCOPE MAKERS WORKSHOP

Chabot Observatory

Call Paul Zurakowski for more information  
(510) 447-6837



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