



The Refractor

The Bulletin of the Eastbay Astronomical Society

Founded in 1924 at Chabot Observatory, Oakland, California

Volume 72
Number 11
July 1996

Jai Singh and His Observatories

Saturday, 6 July, 7:30 p.m.

Physics Classroom, Chabot Observatory

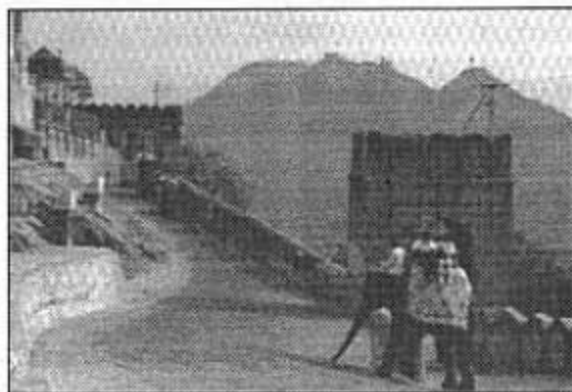
Lecture: Space Science Classroom

4917 Mountain Boulevard, Oakland

Carl Trost

EAS Member

Starting in the 1720s, over one hundred years after the invention of the telescope, the Maharaja Jai Singh built five observatories consisting of gargantuan masonry instruments. The observatory in Jaipur, with some fourteen instruments and what is touted as the largest "sundial" in the world, is a major tourist attraction. Delhi has fewer but more massive instruments in a serene, park-like setting (fortunately) ingored by the tourist industry. Rarely mentioned in the magazine articles are the small but interesting observatories at Varanasi (Benares) and Ujjain. The structures at Mathura were scrapped in 1857.



In mid-October last year Carl Trost embarked on a 30-day odyssey, his wildest astronomical adventure. Eschewing the organized eclipse tours, he met with noted Bay Area astronomer Tinka Ross and her cousin, Deborah Bouvier, in Calcutta. They followed a loosely-planned route across India to Delhi, visiting Allahabad for the October 24 total solar eclipse. Then, travelling mostly by (ugh!) public transportation—train, bus, taxi, bicycle rickshaw, chartered auto, elephant, tuk-tuk, donkey cart, and rowboat on the Ganges—they trekked to Varanasi, the Taj Mahal at Agri, and Jaipur.

The unscheduled tour came to its scheduled end in Delhi. Carl stayed on at the YMCA on Jai Singh Boulevard and visited the observatory for five days before deciding to hop a plane for a few days in Khatmandu, Nepal, and some aerial shots of Mount Everest.

Carl attended the University of California at Berkeley, where he spent most of his time in the Cal Band; but in spite of this he graduated (just barely) with an ordinary degree in electrical engineering. With no initials after his name, his one claim to fame is that he studied freshman physics under the late, great Luis Alvarez. His passions are white-water kayaking and photography. Because of the latter, he has sometimes been mistaken for an astrophotographer, even though he does not use a telescope. He does own an autographed copy of Olcott's *A Field Book of the Stars*. (It is autographed, "Merry Christmas, 1937, from Aunt Minnie".)

Join us for

DINNER WITH THE SPEAKER

5:28 p.m., 6 July 1996

PEARL OF SIAM RESTAURANT

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

Please call Betty Neall at 510 / 533-2394 by Friday, 5 July 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.

The Summer Triangle

is an asterism known to many, for its three bright stars, Vega, Deneb and Altair make a wonderful canopy shining over us when the weather usually cooperates to afford pleasurable evenings. Within this triangle in the sky lies the small but distinct constellation of Sagitta, the Arrow. And this collection of just a few stars is quite true to its name, as the ancient Arabs, Armenians, Hebrews, Persians—as well as the Greeks and Romans—all saw an arrow here. The stories differ, however, for to some it is the arrow of Apollo, to others that of Hercules, and to still others it is Cupid's Dart. Some consider it to be the arrow loosed from the bow of Sagittarius, the Archer, from his sky position to the south.

Sky features within the confines of Sagitta are quite limited, as there are no stars brighter than magnitude 4 and none that are named. There are some multiple stars worth checking with a small telescope, such as double Epsilon, with stars of magnitude 5.7 and 8, separated by 90 arcseconds; also triple Theta. The eclipsing binary U-Sagittae is good for binocular viewing. Every 3½



days the star steeply dives from magnitude 6.4 to 9.0; then, in just an hour and 40 minutes, the brightness swiftly climbs again.

The main feature of Sagitta is M-71, a loose globular cluster of stars that are about 18,000 light years from us. Conrad Jung's photo was taken with his 800-mm telephoto lens with a 30-minute exposure on Fujicolor Super G 800 film.

This Space Shuttle Re-entry

should not be missed by *anyone!* So we quoted Dave Rodrigues in last month's *Reflector* concerning the flight of STS-77 Endeavour. That was really the case, for it proved to be well worth the early wake-up call to be able to watch the Orbiter go from west to east in about two minutes, and to realize that 22 minutes later the craft would be on the ground in Florida.

If you *did* miss it on May 29, be sure that you are prepared to take advantage of your next opportunity, which—according to present schedule—will be Sunday morning, July 7, at 5:48 a.m. Predicted parameters indicate a maximum elevation of 35° for STS-78 Columbia as seen from this area. It will pass from west to east on its path across the country. The Sun will be just below the horizon. After the spacecraft leaves your view don't forget to stay tuned for the sonic boom. The estimated time for that to happen is 6 minutes, 45 seconds after closest approach.

Please refer to the June issue of the *Reflector* for a discussion on how to prepare for this re-entry observation. Of course, exact details for this flight are subject to the weather and to

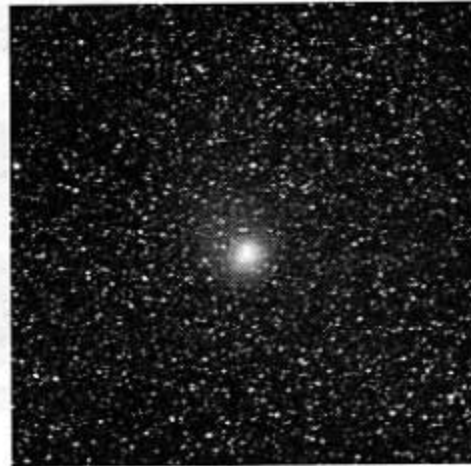
Hale-Bopp Appears

in the morning sky, and Conrad Jung reports that it was visible from Fremont Peak even in a 6×30 finder scope. His photo of the comet was taken on Monday, June 17, with an 800-mm telephoto lens on Fujicolor Super G 800 film and an exposure of 30 minutes. The comet is moving into Scutum from Sagittarius and is mid-way between the Teapot asterism and the eagle Aquila. It is about ten degrees north of Jupiter, which culminates at about 1 a.m. on the first of the July, about 11 p.m. on the last of the month. For the precise location, see Don Machholz's column on page 5. Seen through the telescopes at Chabot on June 22, the comet showed a definite, but beginning, tail structure. Its brightness is increasing, and by the end of July, Hale-Bopp should make a worthwhile backyard binocular quest. For July, the best viewing should be from Last Quarter Moon on July 7

until First Quarter on July 23.

The remarkable thing about Hale-Bopp is that it is already at the edge of naked-eye visibility although it is still distant from us about as far as Jupiter. It still has until April 1, 1997 to gain its perihelion.

As the comet continues its orbit in toward the Sun, it will pass through Ophiuchus this fall, then into Aquila by mid-January. On February 6 it will be just south of M-71. You can bet that by then its appearance will be more distinguishable from that globular cluster than it was when Conrad Jung took these photos last month from Fremont Peak.



NASA's possible schedule changes. Up-to-date information is available on the World Wide Web. Point your browser to <http://shuttle.nasa.gov>. In Contra Costa County, Channel 19 carries the live NASA TV feed.

The STS-78 flight involves the Life and Microgravity Sciences payload in the pressurized Spacelab module in Columbia's cargo bay and will focus on two main areas. The life science studies will probe the responses of living organisms to the low-gravity environment and highlight musculoskeletal physiology.

Microgravity experiments focus on subtle influences at work during processing of various samples, such as alloy materials, when gravity's effect is greatly reduced. On Earth, gravity distorts scientific results. Materials processed on orbit reveal underlying secrets masked in ground-based laboratories.

Free from gravity, the human body undergoes changes that can affect astronaut performance. While life sciences information will help prepare crews for longer duration missions, the causes of, and cures for, similar ailments experienced on Earth may be found.

Bardou et Fils Telescopes

were well known at the turn of the century. Indeed, some models were available through the Sears, Roebuck & Co. catalog. The firm also supplied telescopes to the French military. Unfortunately, these high-quality Paris-made refractor telescopes are now few and far between, and little is known about their history.

This spring, my physics teacher at Berkeley High School, Matt McHugh, discovered an old 80-mm Bardou and Son telescope in a school storeroom. The school has loaned it to me, and I, along with the help of some interested friends, am trying to research its history and the history of Bardou telescopes in general. We are also doing research to develop plans for restoring the instrument, accessories, mount, and box.



Photo by
John Hewitt

With the help of John Hewitt from the Lawrence Hall of Science, I have made several contacts already, including Roger Sinnott of *Sky & Telescope*, Debbie Warner of the Smithsonian Institution, and members of the Antique Telescope Society. Steve Craig, chairman of Morrison Planetarium at the California Academy of Sciences, was interested to hear of the telescope because someone recently donated a smaller Bardou to the Planetarium. He has looked at the telescope and has offered his advice. At the June meeting of the EAS, I presented the telescope. Some EAS members have examined it and are being quite helpful. Because of the work that I—along with everyone who has helped me—have done, the very small astronomy unit in the Physics course at Berkeley High may be expanded next year.

We think the telescope is between 100 and 120 years old, but we haven't been able to get an exact date. If anyone has any information regarding this particular instrument, its local history (perhaps you or someone you know attended Berkeley High in the '30s and used it in class), or on Bardou telescopes of any kind, please call me at (510) 524-9070 or send e-mail to

Please welcome as a new EAS member:

Eric Gerrick

103721.313@compuser.com. We plan to present a later report summarizing our findings of this truly interesting and historic astronomical instrument.

By Shayna Stanis

130 SEARS, ROEBUCK & CO., Cheapest Supply

SPY GLASSES AND TELESCOPES.

scope described on this page is guaranteed to be a perfect instrument, in every respect. It may be returned to us at our expense and money will be refunded. These instruments are manufactured especially for use as premiums, etc. They are guaranteed to be made by our expert optician before shipping, and we absolutely guarantee giving the diameter of the front lens or object glass in inches (the French quality of the lenses that provide the value of a spy glass or telescope is dependent upon the quality known as definition, that an instrument with extra high magnifying power, but poorer lenses. For example: Our Bardou Rifle is an ordinary instrument having a magnifying power of 40 or 50 times. Our achromatic lenses; our Nos. 208623, 208624, and 208625 are fitted with extra quality achromatic lenses, and the Bardou Rifle Range Telescope has absolutely the best lenses it is possible to manufacture.

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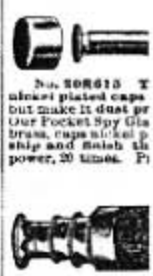
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No. 208676 Astronomical Eye Piece for Bardou Rifle Range Telescope, increasing the power to 50 diameters, thus making it an extra fine instrument for observing the sun, moon and stars. Price, \$3.00
If by mail, postage extra, 10 cents.

OUR SPECIAL MAHOGANY TELESCOPE



Articles and photos for *The Refractor* are encouraged. Deadline for the August issue is July 24, 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. Note the e-mail address has changed.

The Delmar 5 (made in four sizes with first quality lenses, carefully adjusted. They are provided with a slide cover to protect lens or eye brass cap to protect lens or object glass tubes are made from brass. All instruments Every Delmar Telescope in carrying No. 208601 D magnifying power 10 x No. 208601 I magnifying power 1 No. 208602 D magnifying power No. 208602 D magnifying power



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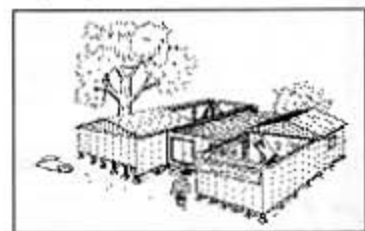
No. 208640 W have had this Telescope special designed for use in the leading telescope maker of Paris, and offer this reason for its first time. The no distinctive feature throughout. All the leading in appearance Beauty Telescope workmanship and optically perfect. Glass, thus making tubes of the moon, heavenly bodies or length when closed Price, complete

The Valley of the Moon

Observatory Association has announced ambitious plans for a "Robert H. Ferguson Observatory Project" which will be a public facility aimed at improving education in science and mathematics in the Sonoma County area and at increasing access of astronomy through large telescopes to the general public.

The project has been named after the late Bob Ferguson, an enthusiastic supporter of public astronomy programs and an important inspiration to all who met him. Bob was a tireless presenter of astronomy, one who was at his best when he was trying to build a fire under a class of bored elementary school kids. His experience with children gave him the idea of building a few telescopes that could be given away to kids who needed a spark to add to their own enthusiasm for astronomy.

Construction of a new building will begin in September, with the goal of opening by the end of the year in time to complement the excitement that will be generated around the appearance of Comet Hale-Bopp. Located at Sugarloaf Ridge State Park near Kenwood, the Observatory will consist of a classroom with a capacity of 49, flanked by two roll-off roof telescope rooms, one



for a 20-inch telescope and the other to house a 40-inch reflector. The 40-inch is the largest amateur telescope in operation in California. The telescopes, on equatorial mounts, will be computer controlled. Both telescopes will

be used visually, instrumentally with photometers and spectroscopes, and with CCD imaging, making the field of view accessible to many people at once using computer technology.

The project is being funded through individual contributions for charter and lifetime subscriptions and by grants from a number of foundations, primarily from Sonoma County. The business community is also much involved in the project, with contributions of cash, donated materials, and volunteer labor. For example, the Valley of the Moon Natural History Association and the Sonoma County Astronomical Society have each made grants of \$2000 to the project. If you would like to become a charter member of this organization, or to make a donation, you may contact: Valley of the Moon Observatory Association, P.O. Box 898, Glen Ellen, CA 95442. E-mail to George Loyer at gloyer@wco.com; or check out their WorldWideWeb location at <http://yorty.sonoma.edu/VMOA/>.

The 30-in. Challenger Telescope

invites you to come to Fremont Peak State Park for a free public program any Saturday through October, except around Full Moon. Viewing sessions and program begin at 8:00 p.m. and are presented by the Fremont Peak Observatory Association. While there is no charge except for admission to the State Park (\$3 per car or \$7 for a numbered campsite), donations are appreciated and help maintain the Observatory and the public programs.

Fremont Peak is about two hours from Oakland via US 101 south to San Juan Bautista, then east on State Route 156. Follow signs to County Road G1, then 11 miles to the peak.

Summer Workshops

for adults, young people and families will open up new vistas in astronomy, computers, and celestial navigation. Just announced by Chabot Observatory and Science Center, these Summer classes are all geared to your better understanding of the worlds around and beyond you. Here is a schedule, including costs. If you wish further information, please call the observatory at (510) 530-3480, or send a fax to (510) 530-3499.

Family Astronomy (For families, children over age 5)

Participate in hands-on planetarium activities, learn about telescopes, and explore astronomy sites on the World Wide Web. Stargazing at Redwood Park. \$75 for family of 4; \$10 per each additional family member.

Monday, August 5 and 19, 7-9 p.m.

Stargazing, August 12 and 26, 8:30-10:30 p.m.

Kids' Night Under the Stars (For youths, age 8-12)

Spend the night under the stars at Anthony Chabot campground. Activities include a nature scavenger hunt, nature trail hiking, campfire, and stargazing. \$60 per person, includes Saturday dinner, snacks, and Sunday breakfast.

Saturday, August 17, 2 p.m.-Sunday, August 18, 11 a.m.

Make Your Own Telescope (For youths, age 8-12)

Learn about the two different types of telescopes; make and use a simple refractor; and practice safe solar viewing through Chabot's fine telescopes. \$25 includes materials.

Thursday, August 1, 10 a.m.-noon.

Basics of Celestial Navigation (For adults)

Learn how to find your way in the dark, and how to find your location on Earth by observing the stars on the celestial sphere. \$25.

Saturday, July 27, 8-10 p.m.

Basics of Celestial Navigation (For family teams or youths, 10-17)

Learn how to find your way in the dark, and how to find your location on Earth by observing the stars on the celestial sphere. Added focus on finding and plotting constellations. \$25.

Saturday, August 10, 8-10 p.m.

Family Computing: Families On-line Workshop (For family teams of one adult and one child over 5)

Explore ways to access the Internet; examine a variety of Internet resources and tools; and discuss guidelines for appropriate use of the information highway. \$30.

Saturday, August 17, 9 a.m.-noon

or Tuesday, August 20, 9 a.m.-noon.

Family Computing: Report Writing Tools (For family teams of one adult and one child over 5)

Discover tips and tricks for creating successful written report presentations using "The Writing Center" desktop publishing program and CD-ROM Multimedia Encyclopedia. \$30.

Wednesday, August 21, 6-9 p.m.

Family Computing: Navigate CD-ROMs (For family teams of one adult and one child over 5)

Use CD-ROMs to explore the world of multimedia including sound, text, videos, and still pictures. \$30.

Tuesday, August 27, 6-9 p.m.

Comet Comments *By Don Machholz*

Comet Hale-Bopp (C/1995 O1) is now visible to the unaided eye—at least to some eyes. The rest of us will have to be content with binocular views of the comet for a while longer. This comet will likely be a naked-eye object for more than a year; the Northern Hemisphere will see it through mid-May, 1997. This affords an opportunity to conduct an experiment, and to set a personal record: for how long you can follow the comet without optical aid. In 1985-6 Halley's Comet was seen for about seven months, and early in the last century the Great Comet of 1811 was a naked-eye object for about nine months. Simply record the first night you view Comet Hale-Bopp with the unaided eye, and, sometime next May, your last naked-eye viewing. The comet is presently 3.2 AU from us and 4.1 AU from the Sun.

Meanwhile Periodic Comet Kopff is visible in the same part of the sky, but you'll need a pair of binoculars or a small telescope in order to see it. Other comets that we have been watching have now faded or moved south.

Date (00UT)	R.A. (2000)	Dec.	Elong.	Sky	Mag.
C/1995 O1 (Hale-Bopp) [Sagittarius-Scutum-Serpens Cauda]					
06-26	19h01.5m	-12°23'	165°	M	6.4
07-01	18h54.7m	-11°53'	168°	M	6.3
07-06	18h47.7m	-11°23'	168°	E	6.2
07-11	18h40.5m	-10°54'	165°	E	6.1
07-16	18h33.3m	-10°24'	160°	E	6.0
07-21	18h26.0m	-09°55'	154°	E	5.9
07-26	18h18.9m	-09°26'	149°	E	5.8
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
22P/Kopff [Sagittarius]					
06-26	19h20.7m	-17°28'	165°	M	7.0
07-01	19h21.7m	-18°03'	169°	M	6.9
07-06	19h22.3m	-18°41'	174°	M	6.9
07-11	19h22.7m	-19°22'	177°	E	6.9
07-16	19h23.2m	-20°04'	175°	E	7.0
07-21	19h23.8m	-20°45'	171°	E	7.1
07-26	19h24.8m	-21°25'	166°	E	7.2
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

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

Roberts Rules

There are a few items that I'd like to bring to your attention, looking forward to an interesting and busy summer for EAS members. First, though, a quick look back to the month that was. June included the Festival at the Lake, and also the annual meeting of the Astronomical Society of the Pacific. The first sightings of Comet Hale-Bopp using Chabot's telescopes has heralded another surge in public interest in observational astronomy. It was an active month, harbinger of more activity to come.

On behalf of all EAS members and COSC visitors, I want to extend thanks to everyone who helps out at our special events. A particular thank you goes to Alan Roche, who has finished a dedicated effort in restoring the aquarium in the Observatory corridor to full health. He has replaced the filtration system and has brought up the maintenance of the exhibit to the complete satisfaction of the resident fish.

I want to encourage everyone to come up to Chabot whenever you can. Your EAS membership entitles you to free admission to the Planetarium shows, and it also affords discounts at the Starry Nights gift shop. See the article below about new items for sale, and check out the schedule of planetarium shows. Plan to stay for looks at Hale-Bopp and other night sky objects through the 8-inch and 20-inch telescopes. Bring your family and friends.

This month's EAS board meeting, on July 11 will convene at a later time than usual. We'll start about 8:15 p.m. and all members are welcome.

The appearance overhead of shuttle Endeavour STS-77 was a spectacular apparition on May 29, and the spectacle will likely be repeated on July 7 with the return of Columbia STS-78 to a landing at Kennedy Space Center. Read the article on page 2 as well as one in the June Refractor, and be ready for another chance to see our tax dollars at work. By Carter Roberts

The Starry Nights

Gift Shop at Chabot Observatory has a great selection of items that you'll want to have for any of a number of reasons. There are two new T-shirts that glow in the dark; one featuring the Full Moon, the other the face of Einstein. Price is \$9.99 for children's sizes and \$11.99 for adults. Another fun item is a Nut Bug, a clever little carved walnut shell that opens to reveal an animated caricature of a beetle. Just \$5 for two. In the mineral group, there are octahedron fluorite crystals for \$2.99 and chunks of ulexite, nature's own fiber-optics crystal, for \$2.49. These may be something you haven't seen before! There are book marks, note cards, and tumbled stones, as well as posters, books, and coffee mugs—and a whole lot more.

If you're dreaming of making your own telescope, the shop now has Pyrex mirror blanks, ranging from \$39.95 for a 5.6-in. disk to a 12-in. size for \$234.95. Prices are well below what you'd pay elsewhere.

The store is also the place to get snacks and drinks when you are at the observatory. Come in during the times of the public programs at the Planetarium, Friday and Saturday evenings, from about seven o'clock on.

DATELINE JULY

- 4 1054 Chinese record supernova, precursor to Crab Nebula
- 6 1687 Isaac Newton published Principia
- 18 1921 John Glenn, born Cambridge, Ohio
- 20 1969 First Moon landing, Apollo 11, Neil Armstrong and Edwin Aldrin, with Michael Collins
- 20 1976 Viking 1 landed on Mars
- 4 1996 Jupiter at opposition, magnitude -2.7, 4 PDT
- 7 1996 Last Quarter Moon, 11:55 PDT = 18:55 UT
- 15 1996 New Moon, 09:15 PDT = 16:15 UT
- 15 1996 Venus at brightest, magnitude -4.5, 12 PDT
- 23 1996 First Quarter Moon, 10:49 PDT = 17:49 UT
- 30 1996 Full Moon, 03:35 PDT = 10:35 UT

UPCOMING EVENTS

- 6 July. EAS lecture meeting. Carl Trost.
- 11 July. EAS board, 8:15 p.m. (*Note time*)
- 3 August. EAS lecture meeting.
- 8 August. EAS board meeting, 7:30 p.m.
- 10 August. Fremont Peak Star-B-Que.
- 20 August. Star Party, East Bay Regional Park District, Bort Meadow, 7-11 p.m.
- 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.

The Dark of Night
The Sky Tonight
Convicted by the Sun,
Acquitted by the Moon

July							August	
5	6	12	13	19	20	26	27	2

The place to be on Friday evenings

TELESCOPE MAKERS WORKSHOP

Chabot Observatory

Call Paul Zurakowski for more information
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