



# The Refractor

The Bulletin of the Eastbay Astronomical Society

Founded in 1924 at Chabot Observatory, Oakland, California

Volume 75  
Number 5  
January 1999

## Scientific Study of Mars Since the Invention of the Telescope: Its Impact on Popular Culture

### Chabot Observatory

4917 Mountain Boulevard, Oakland

Saturday, 9 January, 1999

7:31 pm - Public Program • 8:20 - Lecture

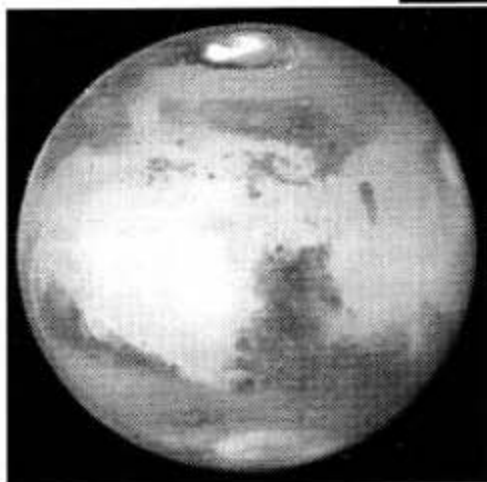
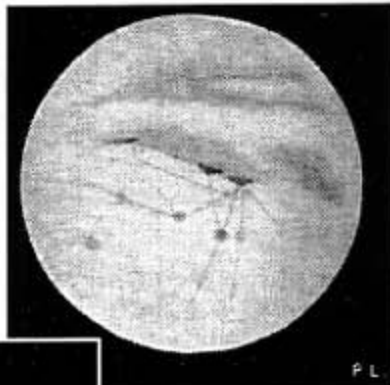
### Dr. Jeff Moore

NASA Ames Research Center

The history of human thinking about Mars has followed a surprisingly tortuous path. After the invention of the telescope and the discovery that the wandering points of light in the sky were planets "like" the Earth, it was assumed that all the planets had life. As further telescopic observation challenged this assumption, one by one the planets fell away as possible homes not only for intelligent life but for any life at all. It is amazing to think that as sophisticated an observer as Herschel thought that the Moon was inhabited! But for one planet, the contrary was true. As telescopes improved, more and more detail was revealed on Mars. As this happened, hopes rose ever higher for intelligent life. First, the polar caps were revealed, indicating the existence of water; then the dark markings which changed seasonally, suggesting plant growth. Then the "canals" of Schiaparelli suggested a hydrological cycle. Finally, Lowell's parallel canals fired the human imagination into envisioning a dying but very advanced civilization.

As the twentieth century progressed, the likelihood of finding advanced life on Mars receded, but ironically enough the scientific perception that primitive life existed on Mars rose to such a certainty that this author's 1963 Encyclopedia Britannica article on Mars states that "...observational evidence from several different sources indicates the presence of life in the maria." Never were scientists more sure that life existed on Mars than in 1963. It was for this reason that the shock and disappointment was so devastating in 1965 when Mariner 4 revealed a barren, Moon-like landscape. It was only the arrival of the Mars orbiters in the '70s that led to a renaissance in hope for life on Mars and which has led, step by step, to a new pinnacle of hope with the Martian meteorite discovery.

*Percival Lowell  
drew this sketch of  
Mars as he observed  
the planet on  
November 6, 1894.  
From Plate XXV, Mars  
by Percival Lowell,  
1895.*



*This stunning portrait  
was taken with the  
Hubble Space Telescope  
WFPC2 in March 1997,  
just as the red planet was  
making one of its closest  
passes to the Earth.*

Now a new set of probes  
are on their way to Mars.  
At this moment Mars Global  
Surveyor is orbiting

Mars, the Mars Climate Observer is on its way, and the Mars Polar Lander is about to be launched. How will these spacecraft change our view of Mars? For the history of this fascinating evolution in mankind's thinking about Mars and the likely impact the upcoming missions is likely to have on that thinking, we have as our guest speaker someone who is intimately involved with all these missions, Dr. Jeff Moore of NASA Ames.

Dr. Jeffrey M. Moore is a Research Scientist with the SETI Institute and based at NASA Ames Research Center in Mountain View, California. He is a Galileo Orbiter Imaging Team Associate

*Continued on page 4*

### DINNER WITH THE SPEAKER

5:27 PM, Saturday, 9 January, 1999

### PEARL OF SIAM RESTAURANT

5498 College Avenue, Oakland (510) 420-8600

Please call Betty Neall at 510 / 533-2394 by Friday, 8 January to confirm your place. Please note the time has been advanced to allow everyone to be able to get to the meeting promptly at 7:31 PM.



## Auriga, the Charioteer

represents Neptune himself, riding across the heavens where the hero Perseus, King Cepheus, and the other characters from the Roman myth also can be found. You will remember that it was Neptune who called up Cetus to ravage the coast in response to the insult the Sea-Nymphs received from the vain Cassiopeia. Neptune ruled the oceans as Jupiter ruled the heavens and Pluto ruled the realm of the underworld and of the dead. All three of these deities were sons of the Titan Saturn.

Some, however, say that the constellation is Erichthonius, son of Athena, who was lame and invented the four-horse chariot in order to move around more freely. The name Auriga is Latin for "charioteer."

Or, so another story goes, the principal star of the constellation, Capella, is Amalthea, the she-goat that nursed the infant Jupiter. Capella, from the Latin for little goat, is known as the "Shepherd's Star." From the earliest times the stars of Auriga have portrayed a charioteer holding his reins while carrying a goat and its two kids. Three small stars southwest of Capella are known today as the "Kids."

Strangely, in China the stars of Auriga were considered the five chariots of the five emperors. These were the star gods whose thrones were in Leo and in Cepheus. The Babylonians also pictured a chariot in this part of the sky.

Capella is the northernmost of all the first-magnitude stars, the sixth brightest of all the stars. It is one of the stars of the asterism known as the Winter Oval or Hexagon, lying between Castor and Aldebaran. It is a yellow giant at a distance of 45 light years and has a luminosity 160 times that of the Sun. It is a spectroscopic binary pair, its components closer to each other than Earth is from the Sun. At a distance of a thousand AU, a pair of red dwarf stars are also a part of the Capella system. In 1995, this stellar system was the first target for a new technology known as COAST, the Cambridge Optical Aperture Synthesis Telescope, a coherent



array of four telescopes operating in the red and near infra-red, using Michelson interferometry on baselines of up to 100m to give images with a resolution down to 1 milliarcsecond. Other methods, such as adaptive optics, when used on existing single telescopes, have limiting resolutions no better than about 10 milliarcseconds.

Of the Kids, the star closest to Capella is Epsilon Aurigae and for a hundred-fifty years it has been one of the most observed and controversial of all the stars. It is an eclipsing binary pair, lying about 4000 light years from us. Only one of the stars is visible. When it is eclipsed by its partner every 27 years, this star remains at a diminished luminosity for a year. Several theories are proposed to explain the mystery of the facts. One suggestion is that the unseen star may be 2000 times the diameter of the Sun; another possibility is that the eclipsing body is not a star, but a vast shell of dust and gas—a prototype star. Other theories also help to keep astronomers bewildered.

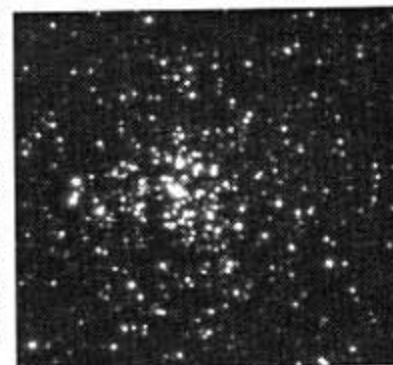
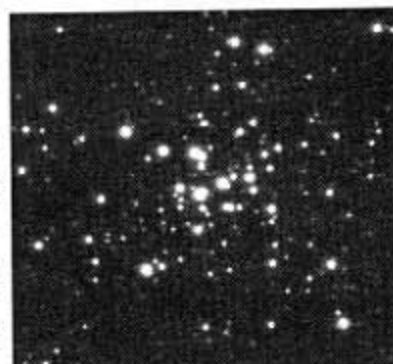
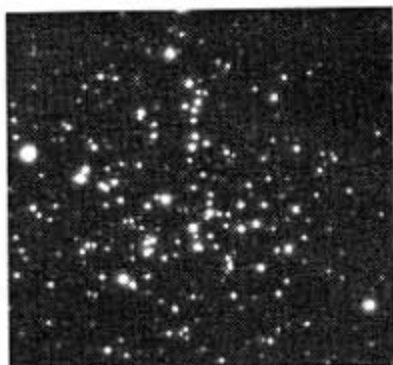
Generally visualized as a large pentagon joined to El Nath, the tip of the northern horn of Taurus, the bull, Auriga boasts of four galactic clusters of stars. Three are Messier objects M36, M37 and M38. There is also NGC 1907, a smaller cluster just south of M38.

M38 lies about five degrees north of El Nath, the bright star that Auriga shares with Taurus. This cluster contains about 100 stars within an area 20 minutes in diameter. It may be barely visible to the unaided eye.

Discovered in 1749, M36 is a compact group of 60 stars. It can be found by looking 1.6° south and 1.5° east from M38.

Then from M36, go 1.7° south and 3.4° east to find M37. This is one of the finest of all open clusters, with perhaps 150 stars down to 12th magnitude. Twelve red giants are among these stars. The cluster is about 200 million years old. This is the largest and brightest of the clusters in Auriga.

Conrad Jung's photos were taken with a CCD camera attached to his 80mm f/5 finderscope. Each image is oriented with north at the top and each exposure was about 45 seconds.



## Comet Comments *by Don Machholz*

With a moderate-sized telescope, you could view a half-dozen comets on most nights during the next few months. As predicted here last month, Comet Linear (1998 U5) outburst by nearly three magnitudes. It, and Comet Linear (1998 M5), both pass north of the Sun and from the evening to the morning sky. Periodic Comet Giacobini-Zinner fades in the evening sky while Comet Williams fades in the morning sky.

Comet Jager and Periodic Comet Harrington-Abell remain within 15° of each other as they pass through opposition on favorable visits through our part of the solar system.

C/1998 W1 (Spahr): Found on November 16 by Timothy Spahr using a 16-inch Schmidt as part of the Catalina Sky Survey, this faint comet will be closest to the Sun next month at 1.7 AU and orbits the Sun every 6.7 years.

C/1998 W2 (Hergenrother): The same Catalina equipment was used to find this comet on November 21. It remains faint.

C/1998 W3 (LINEAR): The LINEAR program found this faint comet on November 25. It has a retrograde orbit and will be closest to the Sun in February 1999 at a distant 4.9 AU.

C/1939 TN (Vaisala-Oterma): A strange case of an object being discovered in 1939 which was treated as an asteroid but long suspected of being a comet. Recent observations show it is diffuse with a short tail; it is now classified as a comet. It orbits the Sun every 9.5 years with a perihelion distance of 3.4 AU.

Comet Hunting Notes: Father Leo Boethin of the Philippines passed away on September 15. He was the discoverer of Periodic Comet Boethin (85P/) on January 4, 1975. That comet orbits the Sun every eleven years.

Date (UT)	R.A. (2000)	Dec.	Elong.	Sky	Mag.
<b>21P/Giacobini-Zinner [Cetus]</b>					
01-02	00h14.3m	-23°55'	74°	E	10.1
01-12	01h00.5m	-22°58'	75°	E	10.7
01-17	01h21.8m	-22°11'	75°	E	11.0
01-22	01h41.8m	-21°16'	76°	E	11.2
02-01	02h18.8m	-19°06'	76°	E	11.8
<b>C/1998 P1 (Williams) [Virgo-Leo]</b>					
01-02	12h45.7m	-03°59'	89°	M	9.3
01-12	12h21.2m	+03°34'	108°	M	9.3
01-17	12h04.7m	+08°13'	118°	M	9.3
01-22	11h44.9m	+13°22'	130°	M	9.4
02-01	10h55.4m	+24°13'	151°	M	9.6
<b>C/1998 M5 (LINEAR) [Lyra-Cygnus]</b>					
01-02	18h57.1m	+41°34'	65°	E	9.4
01-12	19h02.9m	+44°45'	67°	M	9.3
01-17	19h06.2m	+46°41'	68°	M	9.2
01-22	19h09.6m	+48°53'	70°	M	9.2
02-01	19h16.9m	+54°07'	75°	M	9.1
<b>C/1998 U5 (LINEAR) [Pegasus-Delphinus]</b>					
01-02	21h11.1m	+17d34'	53d	E	9.9
01-12	21h08.7m	+15d46'	44d	M	10.3
01-17	21h08.1m	+15d07'	40d	M	10.5
01-22	21h07.6m	+14d37'	37d	M	10.7
02-01	21h07.1m	+13d57'	31d	M	11.1

## José's Observations

*by José Olivarez*

About 30 other people and I observed the annual Geminid meteor shower from Briones Regional Park on December 13, 1998 from 8:30 PM until 11:00 PM. We had some problems with layers of clouds moving intermittently over us, but overall, our meteor watch was a successful one. I counted 42 Geminids during my two and one half hours of watching and the majority of the meteors I saw were of the first magnitude or brighter. The flashing meteors defined the location of the radiant point in Gemini well and a large number of them were seen to shoot towards the north and northwest preferentially. Some of these meteors were seen through the clouds! Despite the intermittent clouds, this was a very fine meteor shower indeed! Prospects are good for a good showing by this meteor shower again next December.

Following are some important astronomical and space events to jot down on your new 1999 calendars:

February 23. Close Conjunction of Venus and Jupiter in the west.

February 27-March 7. The planet Mercury is at its greatest height (and therefore at its best) in the west.

April 24. Opposition of Mars. The planet rises at sunset.

May 1-June 1. The planet Venus is at its greatest height above the horizon as an evening star in the west.

July 14. Venus at its greatest brilliancy in the west.

July 28. Partial eclipse of the Moon visible from the Bay Area.

August 12. The Perseid meteor shower. A good show this year with up to 50 meteors per hour.

September 23. Opposition of Jupiter. Jupiter rises at sunset.

September 23. Mars Climate Orbiter attains Mars orbit.

November 6. Opposition of Saturn. Saturn rises at sunset.

November 15. A rare transit of the planet Mercury across the Sun. Visible from California.

November 17. The Leonid meteor shower. Will it *storm* this year?

December 3. Mars Polar Lander lands on Mars.

December 14. The Geminid meteor shower. A good show after 10 PM. Up to 50 meteors per hour. In 1999, the Geminids may prove to be even more abundant than they were last month, because the parent asteroid, 3200 Phaethon, comes within 1.2 AU of Earth just two months in advance, on October 16.

<b>C/1998 U3 (Jager) [Auriga]</b>					
Date	R.A.	Dec.	Elong.	Sky	Mag.
01-02	06h37.8m	+37d42'	165d	M	10.5
01-12	06h29.3m	+35d44'	160d	E	10.5
01-17	06h25.7m	+34d38'	156d	E	10.5
01-22	06h22.8m	+33d28'	152d	E	10.5
02-01	06h19.3m	+31d05'	142d	E	10.5
<b>52P/Harrington-Abell [Auriga]</b>					
Date	R.A.	Dec.	Elong.	Sky	Mag.
01-02	07h18.6m	+40d45'	161d	M	10.6
01-12	07h12.0m	+39d46'	162d	E	10.5
01-17	07h09.0m	+39d03'	159d	E	10.5
01-22	07h06.4m	+38d13'	156d	E	10.5
02-01	07h03.7m	+36d13'	149d	E	10.6

## The Helen M. Pillans Award

will be presented at the Annual Dinner and Awards meeting in March for contributions to amateur astronomy. In this, Denni Medlock qualifies *summa cum laude*.

Denni Frerichs Medlock, of Oakland, is currently Treasurer of the Fremont Peak Observatory Association, and she was one of the founding members of that group. She was also among the founders of the Amateur Astronomers of Northern California (AANC), and The Large Amateur Telescope Project, Group 70. She has been a member of the Telescope Makers Workshop at Chabot for 30 years; and she has served many times as a judge at the Riverside Telescope Makers Conference (RTMC).

Apart from her interests in telescope design and manufacture, Denni offers her talents to help with organization and secretarial needs. She was Secretary of the EAS from 1970-1972, and has also held offices for AANC, FPOA and Group 70 (where she served as President). In earlier years, Denni Medlock assisted Dr. Helen Pillans, helping students from Mills College observe through the telescopes, and in other ways.

Her husband, Kevin Medlock, was awarded the Helen Pillans Prize last year. He noted that his own contributions to amateur astronomy were in no small part owing to Denni's support, encouragement and expert knowledge.

Please plan to attend the Annual Dinner on March 6 and help us give our thanks to Denni Medlock for her untiring efforts on behalf of amateur astronomy in Northern California.

## Deep Space 2 Twin Probes

In December 1999, two basketball-sized aeroshells will crash onto the Martian surface at a velocity of about 200 meters per second. Shattering on impact, each aeroshell will release a miniature science probe that will punch into the soil to a depth of up to two meters. The twin miniature probes of the Deep Space 2 mission to Mars will be riding piggy-back on the Polar Lander to be launched on January 3, 1999. Their primary science goal is to determine if water ice is present in the Martian subsurface—an important clue in the puzzle of whether life exists, or ever existed, on Mars.

These new Mars explorers need names that will reflect their difficult, first-of-a-kind mission and tie them together as a pair. NASA is sponsoring a contest to pick the best names for the twin miniature probes. To enter the contest, choose two people (no longer living), or choose two places or things that are in some way associated with each other, from history, mythology, or fiction. Describe in 100 words or fewer why your entries would make good names for the probes. The names should embody the spirit of exploration, pushing back the frontiers of knowledge.

All entries must be received by April 30, 1999. In the case of duplicate names, the selection will be based on the essay.

You may submit your entry electronically using an on-line form. Alternatively, submit your entry by regular mail to: Deep Space 2 Naming Contest, Jet Propulsion Laboratory 4800 Oak Grove Drive, MS 301-235, Pasadena, CA 91109-8099

Include your name, telephone number, address, the name of your school (if you are a student), age (if under 18) and the name of your local newspaper with your entry.

and a member of the panel that chose the Mars Polar Lander landing site.

His current research is focused on the evolution of icy satellite surfaces, martian sedimentology and aqueous chemistry. His research has included a range of topics relating to the geologic evolution of planetary landscapes and crustal materials. He has published a number of papers on the geomorphology, stratigraphy, and sedimentology—as well as the roles of impact cratering, volcanology, and tectonism—on terrestrial planets and outer planet satellites. He has conducted extensive laboratory simulation of martian geologic processes. He has over the past several years conducted research on surface volatile migration and landform degradation on Triton, and the nature of lacustrine and hydrological processes on Mars. He has responsibility for oversight of this proposed work.

Dr. Moore was born in Texas in 1953 and was raised in Pauls Valley, Oklahoma. He has both a history and a geophysics degree from the University of Oklahoma. A Lieutenant in the U.S. Army, he had been both a Tank Platoon Leader and a Battalion Staff Officer. And, oh yes, he got his Masters and Ph.D. in Geology from Arizona State University in Tempe. He has spoken several times to EAS about the moons of Jupiter and is always a very popular speaker.

## Harvest Time

Jim Mullaney, former editor at both *Sky & Telescope* and *Astronomy* magazines and staff astronomer at the University of Pittsburgh's Allegheny Observatory has announced publication of "Celestial Harvest: 300-Plus Showpieces of the Heavens for Telescope Viewing & Contemplation." This is a long-awaited sequel to the *Sky & Telescope* series reprint "The Finest Deep-Sky Objects," which has been in use by both amateur and professional astronomers around the world since 1966.

Covered in the book are both solar system and deep-sky wonders visible in typical "backyard" telescopes ranging from 2-inches to 14-inches in aperture.

*Celestial Harvest* contains basic observational data, observing techniques, and thousands of vivid, fascinating and little-known descriptions by classic observers from the past three centuries, in addition to those culled from the author's own visual observations of an original survey working list of over 3,000 objects spanning more than 40 years! Besides its personal use by stargazers, (both for planning a night's observations and at the eyepiece itself), it also provides an ideal guide to the very best celestial wonders for showing at observatory and planetarium public viewing nights, astronomy club star parties, and astronomy course observing sessions.

Those desiring more information about this 100-page spiral-bound observing manual should please contact the author at this e-mail address: Jim Mullaney <jimmullaneyms@msn.com>

Price: \$33, plus \$5 shipping and handling via Priority Mail. To order, please send check or money order payable to: James Mullaney at P.O. Box 1146, Exton, PA 19341.

If you are planning to order the book, please tell Don Stone, (510) 733-6738, who would be able to secure it for a reduced price if ten or more EAS members combine their requests.

# Roberts Rules

By Carter Roberts

Now that you have your 1999 calendars hanging on the side of the refrigerator, please turn to March and mark the little square with the number 6 in the corner—that's the square at the upper right, just under the word "Saturday"—with a red marker pen. That will be the Red Letter Day of the Annual Dinner of the Eastbay Astronomical Society. As in the past two years, the meeting will be at the San Lorenzo Community Church.

Many of you have heard about a proposal to change the name of the Chabot Observatory & Science Center (COSC). This apparently started when the City of Oakland passed a resolution requesting that the COSC Board change the name to the Chabot Observatory & Richard L. Spees Science Center. A task force that looked into this proposal concluded that such a long name would be unworkable. The matter might have ended there had not several others also wanted a name change. A San Francisco consulting firm, Frank Harrison Perez, came up with five alternative names. The names are:

- The Space Science Center
- Space Park
- Skyline Space Science Center
- Galaxium
- Chabot Space Science Center

You will notice that the list does not include the name that is mandated by the Joint Powers Agreement that created the "Chabot Observatory & Science Center."

The advertising firm has begun a public survey of these names but wants replies only by fax and before 4 January. Since most people, busy this time of year, don't have easy and cheap access to a fax machine, conclusions drawn from their questionnaire could only be meaningless. Other aspects of the questionnaire seem to lead to unreliability, as well.

It is revealing to look up the dictionary definitions of some of these words.

**Observatory:** 1: a building or place given over to or equipped for observation of natural phenomena (as in astronomy); also, an institution whose primary purpose is making such observations. 2: a situation or structure commanding a wide view.

**Space:** 1: a period of time; also its duration. 2 a: a limited extent in one, two, or three dimensions: distance, area, volume. b: an extent set apart or available (parking space, floor space). 3: one of the degrees between or above or below the lines of a musical staff—compare *line*. 4 a: a boundless three-dimensional extent in which objects and events occur and have relative position and direction. b: physical space independent of what occupies it—called also absolute space. 5: the region beyond the Earth's atmosphere or beyond the solar system. 6 a: a blank area separating words or lines. b: material used to produce such blank area; especially a piece of type less than one en in width. ... 10: accommodations on a public vehicle. 11: the opportunity to assert or experience one's identity or needs freely.

Both definitions for *observatory* are very relevant and appropriate while only the 5th of 11 definitions for *space* covers some of the programs planned for the Chabot Observatory & Science Center. With less than a year to go before opening, it is far too late to be considering changing the name, in my opinion.

I sent the questionnaire to a few of you by first class mail. I hope most were able to respond. I urge the rest of you to present your views on this matter to Frank Harrison Perez if you can fax to (415) 474-0481. Otherwise (or in addition) send e-mail to Lynn Condit at lcondit@cosc.org or by voice mail to her at (510) 530-3480, extension 13. I would also appreciate copies sent to me, preferably by e-mail to cwroberts@earthlink.net.

This matter will undoubtedly be discussed at the lecture meeting on 9 January and the EAS Board meeting, which will be held one week earlier than normal on 7 January because of a probable conflict with a proposed COSC meeting at LHS.

Those of you who have access to the Internet will be interested in looking for several web sites that have recently been announced as winners in the Shoemaker Communication Awards for 1998. These USGS awards honor Eugene Shoemaker and are given to recognize USGS scientists, writers, and designers who have created communication materials that capture the interest and imagination of a broad spectrum of the American public. Winners include Western Regional Coastal and Marine Geology's web site (<http://walrus.wr.usgs.gov>), Water Science for Schools (<http://water.usgs.gov/droplet>), Volunteer for a Changing World (<http://www.usgs.gov/volunteer>), and Water Quality of San Francisco Bay (<http://sfbay.wr.usgs.gov/access/wqdata>). While you are logged on, you'll find that the COSC site at <http://www.cosc.org> has been significantly revised. And don't forget to visit our own production at <http://chabot.cosc.org/~eas>.

If you have been as busy as I have this holiday season, you'll be thankful for the extra second on December 31st before 1999 begins. The U.S. Naval Observatory will delay the start of the new year by a leap second to keep atomic clocks in pace with Earth's rotation. The 22nd leap second since 1972 will occur at 23 hours 59 minutes and 59 seconds Universal Time, which corresponds to 3:59:59 PM Pacific Standard Time.

## Please welcome the following new EAS members:

Earl and Bonnie Hamlin  
Barbara Johnstone  
Richard Larsen

## Eastbay Astronomical Society

President:	Carter Roberts	(510) 524-2146
Vice President, Secretary:	Phil Crabbe II	(510) 655-4772
Treasurer, Membership:	Don Stone	(510) 733-6738
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Ken Swagerty	(510) 223-6143	
	Paul Zurakowski	(925) 447-6837
Immediate Past President:	Betty Neall, <i>ex officio</i>	(510) 533-2394

Articles and photos for *The Refractor* are encouraged. Deadline for the February issue is January 20, 1999. Items may be submitted by mail to the editor, Ellis Myers, 215 Calle La Mesa, Moraga, CA 94556. Internet e-mail address: [eas@silicon.com](mailto:eas@silicon.com). For further information please call (925) 284-4103.

Internet: <http://silicon.com/~eas> • <http://chabot.cosc.org/~eas>

## DATELINE JANUARY

- 7 1610 Jupiter moons discovered, Galileo Galilei  
1 1801 Ceres, first asteroid discovery, Giuseppe Piazzi  
27 1967 Virgil (Gus) Grissom, Edward H. White, Roger B. Chaffee killed when fire erupted in Apollo spacecraft during pre-launch tests  
31 1971 Apollo 14, third Moon landing, Alan Shepard, Stuart Roosa, Edgar Mitchell  
28 1986 Challenger STS 51-L, Francis (Dick) Scobee, Michael Smith, Ronald McNair, Ellison Onizuka, Judith Resnik, Gregory Jarvis, Sharon Christa McAuliffe, exploded 73 seconds after liftoff
- 1 1999 Full Moon, 18:50 PST = 02:50 UT 2 January  
3 1999 Launch of Mars Polar Lander  
9 1999 Last Quarter Moon, 06:22 PST = 14:22 UT  
17 1999 New Moon, 07:47 PST = 15:47 UT  
24 1999 First Quarter Moon, 11:16 PST = 19:16 UT  
31 1999 Blue Moon, 08:07 PST = 16:07 UT

You are invited to make your own telescope at the

### TELESCOPE MAKERS WORKSHOP

Join our group each Friday evening at Chabot Observatory  
Call Paul Zurakowski for more details (925) 447-6837

## FUTURE CONJUNCTIONS

### January

- 7 7:30 PM EAS Board meeting, Chabot  
9 7:31 PM EAS lecture meeting, Dr. Jeff Moore

### February

- 27 9:30 AM NCHALADA, Chabot

### March

- 6 EAS Annual Dinner and Awards

## Chabot Observatory Programs - January

Closed Friday and Saturday, January 1 and 2

### Star Station One

Friday and Saturday evenings, January 8, 9, 22, 23

For show reservations, phone (510) 530-3480 x36

A presentation about the International Space Station.

"The Sky Tonight" planetarium show follows the presentation.

Telescope viewing is included, weather permitting.

Admission is \$5.00 for adults, \$4.50 for seniors, \$3.50 for children. Chabot Observatory & Science Center members are admitted free. EAS members are admitted free if space is available.

Chabot Observatory telescopes are open for viewing 7:30-10:00 PM on January 16 and 17, weather permitting. Free.

Eastbay



Astronomical  
Society

4917 Mountain Boulevard • Oakland, California 94619

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