



The Refractor

The Bulletin of the Eastbay Astronomical Society

Founded in 1924 at Chabot Observatory, Oakland, California

Volume 73
Number 8
April 1997

The Planetary Atmosphere of the Earth

Saturday, 5 April, 7:30 p.m.

Lecture Room, Chabot Observatory
4917 Mountain Boulevard, Oakland

Dr. Alison Bridger

San Jose State University and NASA Ames

We often forget that the Earth is a planet much like other planets. How often we have marveled at the cloud bands and Great Red Spot of Jupiter, the dust storms, morning haze and polar caps of Mars, and now the Great Dark Spot, "Wizard's Eye", and high stratus on Neptune and then sat back and watched our local weather report, not recognizing that our own planet's weather is just as mysterious and caused by analogous mechanisms? What if we were from another planet and sent a Galileo probe to Earth. How would we explain the mysterious patterns we saw and how would we relate them to comparable mechanisms on our home planet? How many of us can even give a reasonable explanation of why there are jet streams, hurricanes, tornadoes, weather fronts? How many of us assume that these phenomena only occur on Earth and have no analogues on other planets? We have heard explanations of weather on Mars, Jupiter, Venus and Neptune. How does weather work on the "Blue Planet?" Hear a surprising and revealing insight into the mechanisms which we take for granted and yet sustain our existence: the Earth's atmosphere.

Dr. Bridger was born and went to high school in England. She received her BSc in Mathematics at Sussex U. in 1974 and her MSc in Meteorology at Reading U. (both in England) in 1975. She received her Ph.D. from Colorado State in 1981. She has done post-doc work both at the National Center for Atmospheric Research in Boulder and at McGill University in Montreal. She has been on the faculty of the San Jose State Meteorology Department since 1984 and is now a full professor there. In her "spare time" she works at NASA Ames Mars (and Earth) General Circulation Group. Her specialties are looking at tidal motions in Mars' atmosphere, the large-scale atmospheric dynamics of Earth and Mars, and local flow phenomena on Mars and Earth like Bay Area wind flows (Did you realize that the Bay Area is like Mars!). She also keeps busy as a mom with a ten-month old who loves to bring home various diseases from day-care.



Hurricane Fran approaching the Bahamas and the United States in September 1996 as viewed by GOES-8, the Geostationary Operational Environmental Satellite.

Eclipse in Siberia

Carter Roberts reports from the middle of the frozen Ingoda River.
See story on Page 3.



Join us for

DINNER WITH THE SPEAKER

5:28 p.m., Saturday, 5 April, 1997

PEARL OF SIAM RESTAURANT

5498 College Avenue, Oakland (510) 420-8600

Please call Betty Neall at 510 / 533-2394 by Friday, 4 April 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.



Leo, The Lion

Some say that a strange mythological creature, half human and half animal, once represented the summer Sun. Summer was to the Egyptians the most important of the seasons, for the rising of the Nile led to the life-giving floods that in turn led to the promise of bountiful harvests. These people gave over their thoughts to the coming of the season, and their symbolism carried into their astronomy. At this time of year lions from the outlying deserts came down to the Nile Valley to seek relief from the heat. Lions, then, were associated with the coming of summer when the Sun was approaching the constellation we know as Leo. In mid-summer the Sun passed from the stars of Leo and into those of Virgo, the Virgin, representative of the harvest. These two star groups seemed to be in control of the Sun during the most crucial time of the year. And so, as the two signs of summer met, a creature with the body of a lion and the head of a woman was born—the Sphinx.

The stars of Leo were those of a lion to many of the civilizations of ancient times. Not only for the Near East and for the Greeks (whose Leo was the lion who fell from heaven as a meteor, landing in Corinth where he ravaged the land until he was slain by Hercules), but even in the West. These stars were thought to be a puma about to pounce on its prey, according to Peruvian legend. In the middle ages some Christians used this heavenly lion to relate the story of Daniel.

The principal star in the constellation is Regulus, the heart of the lion, or Cor Leonis. This was the first of the four Royal Stars of ancient Persia, with Antares, Fomalhaut and Aldebaran. These stars are separated by about six hours in right ascension, and so they well marked the four quarters of the sky. Regulus is a first magnitude star, although it is surpassed in brightness by 20 other stars. It lies almost exactly on the plane of the ecliptic, so that once a year, on about August 23, it is eclipsed by the Sun. Infrequently it is occulted by the Moon.

Leo serves as the radiant of an important meteor shower, the November Leonids, which are associated with Comet Tempel-Tuttle. The great Leonid shower of 1966 is remembered as having a rate of visible infall in excess of 2000 per minute over



Conrad Jung's photo includes a triangle with galaxy NGC 3628 north of M66 (left) and M65. Each shines with a magnitude of about 9½, and all three are about 30 million light-years away.

a period of a half-hour. There is every reason to expect a particularly strong display from this stream in the year 1999.

There are five Messier objects in Leo, as well as a number of other galaxies and a variety of multiple stars, including doubles Regulus and Algieba (γ -Leonis). A galaxy-hop and a review of double stars are published in separate articles in the current (April 1997) issue of *Sky & Telescope*.

Eastbay Astronomical Society

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Articles and photos for *The Refractor* are encouraged. Deadline for the May issue is April 11, 1997. Items may be submitted by mail to the editor, Ellis Myers, 215 Calle La Mesa, Moraga, CA 94556. Internet e-mail address: emyers@a.crl.com. For further information please call (510) 284-4103.

WorldWideWeb: <http://www.cosc.org> or <http://home.earthlink.net/~jpreston/eas/>

Roberts Rules

By Carter Roberts

With the anticipated enthusiasm for viewing Comet Hale-Bopp, we will be hosting public programs each week on Tuesdays, Thursdays, Fridays and Saturdays until Astronomy Day, April 12. This effort will be coordinated with Planetarium shows devoted to comets. I am asking all EAS members to volunteer their time (and telescopes) to come to the Observatory and help make this a worthwhile learning experience for the public. You are needed for an hour or so after sundown for those evenings, and all day on Saturday, April 12. Please contact Conrad Jung or another of the EAS officers to coordinate your participation.

EAS members and friends are encouraged to come to Chabot to help out on Astronomy Day, April 12th. Comet Hale-Bopp will be an evening object, and binoculars and low-power telescopes are encouraged. The Observatory will be open for Solar and Lunar viewing from 1-5 p.m. We will reopen at 7 p.m. and expect to be open until 11 if weather permits. The Planetarium show "Comets of the Century" will be presented at 2:00 p.m. and at 7:30. The Telescope Makers' Workshop will be open from 7-10 p.m. Tell your friends that there will be a 10% discount for the Planetarium and in the Gift Shop on Astronomy Day.

As we have done several times before, we will have a potluck dinner between 5 and 7 p.m. on Astronomy Day. While this will not be a "public" event, all those participating in Astronomy Day activities are encouraged to bring a dish to share and join us in the Lecture Room in the Observatory. We hope to have a few COSC staff members join us.

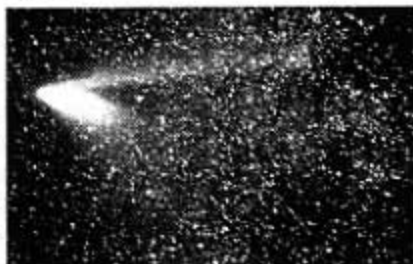
To Siberia in Winter

A small group of eclipse nuts left San Francisco via Aeroflot on Sunday, March 2 for two weeks in Siberia and the Total Solar Eclipse. This group of 6 included EAS members Tinka Ross and Carter Roberts. As expected, the temperature was below freezing for most of the trip.

After a short stay in Khabarovsk we boarded the train for the 42-hour trip to Chita, 5400 miles from Chabot Observatory and only 4388 miles from Stonehenge. Enroute we had a brief, light snowfall. Upon our early morning arrival there, the temperature was down to -19 C. Russia is dramatically different from the Soviet Union that three of us had visited in 1981. Soldiers visiting the Military Museum were happy to have us photograph them. We were no longer apparently invisible to people on the streets. There has been dramatic inflation over the last 16 years. It now costs more to mail a postcard home than it cost for the entire trip in 1981!

A local train took us back to near the Shivanda health "resort" where we stayed for slightly under two days around eclipse day. A brief star party stop on a frozen river about 2 a.m. gave us our first really spectacular view of Comet Hale-Bopp.

Sunrise on Eclipse Day (March 9) found us at our site 51°47.45' North, 115°45.51' East at an elevation of about 700m



Comet Hale-Bopp at 6 a.m. from the Ingoda River, west of Shilka, Siberia.



March 8, 2:15 a.m., taken from the ice in the middle of the river.

slightly west of Shilka, Siberia. As in 1979, one Saros earlier, the snow-covered ground helped create a spectacular eclipse. Faintly visible to those who looked high overhead during totality was Comet Hale-Bopp. By the end of totality the temperature had dropped to -24 C, the coldest we recorded on the entire trip. The Japanese group we were with broke out paper cups and a bottle of vodka for everyone to toast another successful eclipse.

Everyone had been concerned about what the cold temperatures might do to equipment. There were some failures, especially of batteries (lithium batteries seemed to work quite well). A tape recorder pulled out of a pocket just before totality failed to work, as did several cameras, and a GPS unit got cold enough that the display turned gray and when the batteries that were in it failed it was unable to reacquire any satellites even when fed new lithium batteries. The brain seemed to be the thing that had the biggest problem with the cold! Almost everyone forgot something during totality. Everyone agreed that the 1998 eclipse in the Caribbean would be easy compared to this one.

Later we visited Vladivostok where we were free to photograph anything we wanted, including ships of the Russian Navy.



Five of the six of us, as we arrived back in Chita following our excursion to our viewing site.

The Eastbay Astronomical Society

was founded in 1924 to promote a greater community interest in the science of astronomy and in the dissemination of technical and scientific information on the subject and to participate actively in programs to teach the principles of astronomy to children and other organizations in the East Bay metropolitan area. The society also offers technical assistance to the Oakland Unified School District in maintaining the Chabot Observatory & Science Center's (COSC) instruments and equipment.

With these guiding principles in mind, and realizing the changing nature of teaching methods, the Board of Directors recently adopted a resolution to make a contribution to COSC in the form of a multi-media projector. With dynamic, interactive presentations, young audiences more quickly grasp the concepts under discussion. They stay engaged and interested. Teachers and speakers have the opportunity to be more effective and more efficient. With computer technology, as compared to more static teaching materials such as slides and posters, changes can be made quickly and economically to bring presentations up to date—to bring last night's Hale-Bopp photo to tonight's Planetarium show, for example.

A committee is at work to define the exact needs and availability of such equipment. EAS has committed to a budget of up to \$3000 for this acquisition, with the anticipation that matching funds can be found from community sources. Some form of fund-raising enterprise will be needed to reach this goal. Your suggestions in this regard would be welcome, and certainly any contribution you can make to begin this worthwhile effort would be a tremendous boost. This is a positive way for you to participate in providing a strong and complete science education platform for the children of our community.

San Jose Astronomical Association

will hold its 17th annual SJAA/Bay Area Auction on Saturday, April 19, at Hogue Park in San Jose, California.

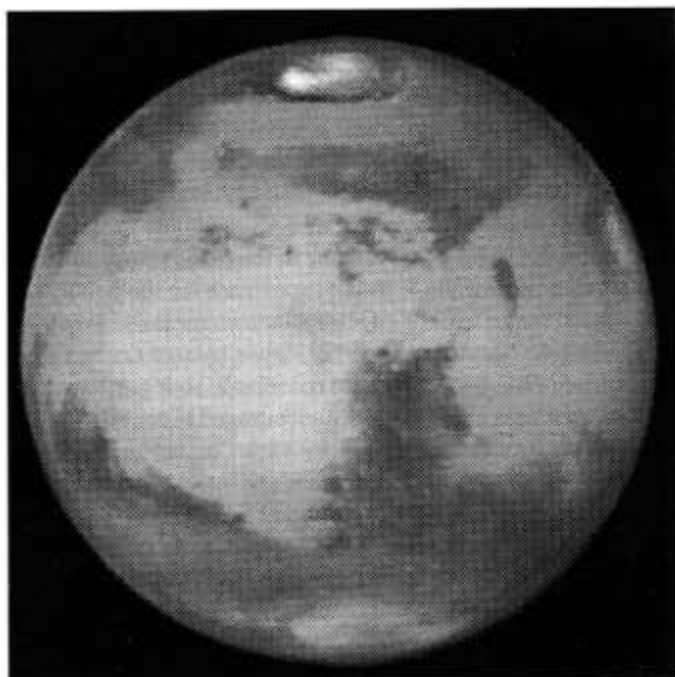
Acceptable merchandise includes most anything relevant to amateur astronomy and telescope-making: telescopes, components, accessories, eyepieces, books, charts, photographic equipment, desktop computers and software.

Doors open and sales start at noon, running until about 3 p.m., when the room will be re-configured for the Auction, to begin at 4, running for perhaps two hours.

Sellers must keep track of their sales, and pay a 10% commission to SJAA, with a cap of \$50 commission for any one item. Sellers set their minimum prices and terms. There are no admission or table charges for the Swap Meet.

Material to be auctioned must be registered during the swap meet, and prior to 3:45 p.m. Participants must have a bidder number, for which a \$1 donation is requested, and permits both sales and purchases. As during the Swap, sellers set the minimum price and the commission is charged only for successful sales. The commissions are tax-deductible, as SJAA is a tax-exempt 501(c)(3) organization. Outright donations are gratefully accepted!

Internet: Jim.Van.Nuland@sjpc.org



The Sharpest View of Mars

ever taken from Earth was obtained by the recently refurbished NASA Hubble Space Telescope (HST). This stunning portrait was taken with the HST Wide Field Planetary Camera-2 (WFPC2) on March 10, 1997, just before Mars opposition, when the red planet made one of its closest passes to the Earth (about 60 million miles or 100 million km). At this distance, a single picture element (pixel) in WFPC2's Planetary Camera spans 13 miles (22 km) on the Martian surface. The Martian north pole is at the top (near the center of the bright polar cap) and East is to the right. This view of Mars was taken on the last day of Martian spring in the northern hemisphere (just before summer solstice). It clearly shows familiar bright and dark markings known to astronomers for more than a century. The annual north polar carbon dioxide frost (dry ice) cap is rapidly sublimating (evaporating from solid to gas), revealing the much smaller permanent water ice cap, along with a few nearby detached regions of surface frost. The receding polar cap also reveals the dark, circular "sea" of sand dunes that surrounds the north pole (Olympia Planitia). Other prominent features in this hemisphere include Syrtis Major Planitia, the large dark feature seen just below the center of the disk. The giant impact basin Hellas (near the bottom of the disk) is shrouded in bright water ice clouds. Water ice clouds also cover several great volcanos in the Elysium region near the eastern edge of the planet (right). A diffuse water ice haze covers much of the Martian equatorial region as well.

The WFPC2 was used to monitor dust storm activity to support the Mars Pathfinder and Mars Global Surveyor Orbiter Missions, currently en route to Mars. Airborne dust is easily seen in WFPC2's red and near-infrared images. Hubble's "weather report" from these images is invaluable for Mars Pathfinder, which is scheduled for a July 4 landing. Fortunately, these images show no evidence for large-scale dust storm activity, which plagued a previous Mars mission in the early 1970s.

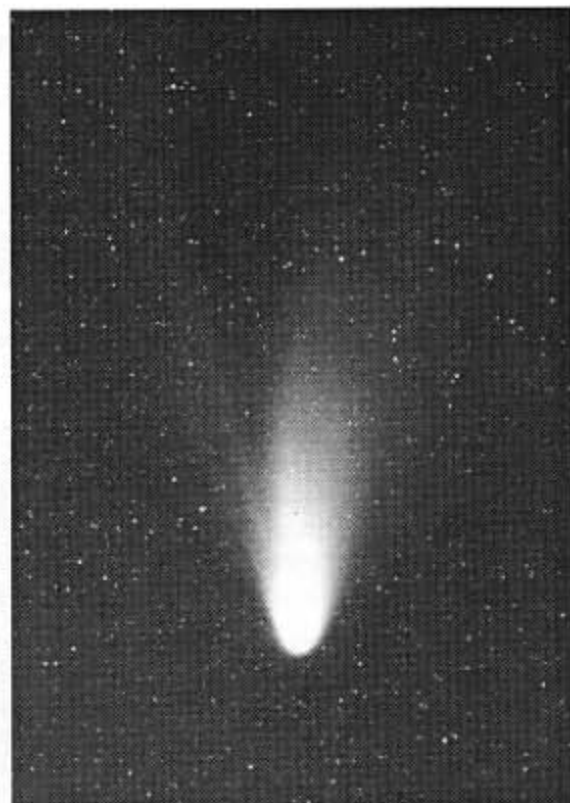
Comet Comments *by Don Machholz*

Comet Hale-Bopp continues to put on a spectacular display. The inner coma shows fountains and hoods while both the gas and dust tails are prominent. By late March the comet is well-placed in the evening sky and no longer visible in the morning sky. The evening viewing season for Comet Hale-Bopp begins with the partial lunar eclipse on March 23 (the moon will be in the evening sky before that date), and continues through the first week of May. Most comet watchers will have their last view of the comet as it slips southward in the western evening sky in early May.

Many astronomy clubs are taking the time to show the comet to the public. Astronomy Day (April 12) provides an opportunity to show the comet and the crescent Moon in the west, and a bright planet Mars in the east.

A few more faint comets have been discovered recently. Comet C/1996 R3 was found on plates taken last autumn; it will remain faint. Comet C/1997 D1 (Mueller) was found by Jean Mueller as she worked on the Second Palomar Sky Survey. It will be closest to the Sun late this year (at 2.24 AU) and may then be visible in amateurs' scopes. The Spacewatch program on Kitt Peak picked up an object first believed to be an asteroid but now showing a coma. Comet C/1997 (Spacewatch) is presently 8.8 AU from the Sun and won't reach perihelion (3.45 AU) until December 1999, nearly three years away. The coma is showing a slight amount of activity, and it is possible that the comet will be visible in amateur instruments deep in the Southern Hemisphere in 1999.

Date (OOUT)	R.A. (2000)	Dec.	Elong.	Sky	Mag.
C/1995 O1 (Hale-Bopp) [Andromeda-Perseus-Taurus]					
03-28	01h10.4m	+45°38'	44°	E	-1.2
04-02	01h57.5m	+44°11'	42°	E	-1.1
04-07	02h38.9m	+41°43'	41°	E	-1.0
04-12	03h13.8m	+38°38'	39°	E	-0.8
04-17	03h42.9m	+35°16'	37°	E	-0.6
04-22	04h07.0m	+31°53'	35°	E	-0.3
04-27	04h27.2m	+28°34'	33°	E	-0.1
05-02	04h44.2m	+25°23'	31°	E	-0.1
05-07	04h59.2m	+22°25'	29°	E	-0.1
46P/Wirtanen [Taurus-Auriga]					
03-28	03h19.9m	+20°10'	46°	E	10.4
04-02	03h41.9m	+22°16'	46°	E	10.5
04-07	04h04.5m	+24°10'	47°	E	10.6
04-12	04h27.6m	+25°50'	47°	E	10.8
04-17	04h51.1m	+27°16'	48°	E	10.9
04-22	05h14.8m	+28°25'	48°	E	11.1
04-27	05h38.6m	+29°17'	49°	E	11.3
05-02	06h02.5m	+29°54'	49°	E	11.5
81P/Wild 2 [Cancer]					
03-28	08h08.2m	+21°54'	112°	E	10.1
04-02	08h15.6m	+21°43'	109°	E	10.1
04-07	08h23.9m	+21°28'	106°	E	10.1
04-12	08h33.0m	+21°07'	103°	E	10.2
04-17	08h42.8m	+20°41'	101°	E	10.2
04-22	08h53.3m	+20°09'	98°	E	10.2
04-27	09h04.2m	+19°32'	96°	E	10.3
05-02	09h15.7m	+18°50'	94°	E	10.3
05-07	09h27.4m	+18°02'	92°	E	10.4



This photo of Comet Hale-Bopp was taken by Conrad Jung on March 6 from a dark-sky location near Livermore. This is a 10-minute exposure at f/2.8, using a 300-mm lens.

Comets of the Century

is a profusely illustrated and engaging lecture-demo about the greatest comets seen over the past 100 years up to and including Comet Hale-Bopp. The comet lecture-demo is followed by a 30-minute look at "The Sky Tonight" in the Planetarium. This new public show at Chabot Observatory is the first to be presented by the new Director of Astronomy, José Oliverez and his staff.

In anticipation of the public interest in viewing Comet Hale-Bopp at its brightest, Chabot Observatory will present extra shows according to the following schedule. Reservations are advised. Call 510 / 530-3480, ext. 36.

Thursday, March 27	6:30 p.m. 7:30 p.m.	Tuesday, April 8	7:30 p.m.
Friday, March 28	6:30 p.m. 7:30 p.m.	Thursday, April 10	7:30 p.m.
Saturday, March 29	6:30 p.m. 7:30 p.m.	Friday, April 11	7:30 p.m.
Tuesday, April 1	6:30 p.m. 7:30 p.m.	Saturday, April 12	2:00 p.m. 7:30 p.m.
Thursday, April 3	6:30 p.m. 7:30 p.m.	Tuesday, April 15	7:30 p.m.
Friday, April 4	6:30 p.m. 7:30 p.m.	Thursday, April 17	7:30 p.m.
Saturday, April 5	6:30 p.m. 7:30 p.m.	Friday, April 18	7:30 p.m.
		Saturday, April 19	7:30 p.m.
		Tuesday, April 22	7:30 p.m.
		Thursday, April 24	7:30 p.m.
		Friday, April 25	7:30 p.m.
		Saturday, April 26	7:30 p.m.

Beginning May 3, and continuing through July 26, the show *When The Sky Falls: Meteors, Meteor Showers, And Meteorites* will be presented in the Planetarium with the assistance of meteorite expert Mike Martinez. Don't miss this lecture-demo about the cosmic debris that falls daily on the Earth from space. You'll learn when to watch for meteor showers and how to identify meteorites. The show also includes "The Sky Tonight."

DATELINE APRIL

- 11 1862 William W. Campbell, born,
Director, Lick Observatory and President,
University of California
- 28 1906 Bart Jan Bok, born, Hoorn, Netherlands
- 12 1961 Soviet Vostok 1, Yuri Gagarin, first man in space
- 3 1966 First space probe in lunar orbit, Luna 10 (USSR)
- 12 1981 Columbia, first Space Shuttle launch, John Young,
Robert Crippen
- 3 1990 Hubble Space Telescope launched
- 1 1997 Comet Hale-Bopp at perihelion.
- 6 1997 Daylight-Saving Time begins.
02:00 PST = 03:00 PDT
- 7 1997 New Moon, 04:03 PDT - 11:03 UT
- 14 1997 First Quarter Moon,
09:60 PDT = 16:60 UT March 16
- 22 1997 Full Moon, 13:35 PDT - 20:35 UT
- 29 1997 Last Quarter Moon, 19:37 PDT - 02:37 UT 30 April

Eastbay Astronomical Society

Annual Banquet

Saturday, May 10, 1997

San Lorenzo Community Church

Dr. Tim Ferris

The Whole Shebang: A State of the Universe

FUTURE CONJUGATIONS

- 5 April. EAS Lecture. Dr. Alison Bridger.
Earth's Planetary Weather.
- 10 April. EAS Board meeting. 8:00 p.m.
Note later time, owing to Hale-Bopp observing.
- 12 April. Astronomy Day.
- 19 April. San Jose Astronomical Auction.
- 26 April. NCHALADA.
Lunar Oddities, John Westfall;
Important Graphs and Charts, Norm Sperling
- 10 May. EAS Annual Banquet.
San Lorenzo Community Church.
- 27 June. ASP 109th Annual Meeting. Chicago.
Expand Your Universe.
- 2 August. Star-B-Que. Fremont Peak.

Rotary-Chabot Planetarium Shows

Fridays and Saturdays, 7:30 p.m.

For information and show schedule, call (510) 530-5225.

Comets of the Century through April 26



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