



The Refractor

The Bulletin of the Eastbay Astronomical Society

Founded in 1924 at Chabot Observatory, Oakland, California

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Neutrino Astronomy

6 November, 8:00 p.m.

Administration Building of Chabot Science Center
4917 Mountain Blvd., Oakland

Dr. Eric Norman, Senior Staff Physicist
Lawrence Berkeley Laboratory

The Sudbury Neutrino Detector: Looking at the Stars from the Bottom of a Mine

Most of what we know about the planets, stars and galaxies that make up our universe has been discovered through observations of electromagnetic radiation, i.e., photons. Our eyes are sensitive to a very narrow band of the electromagnetic spectrum that we call the visible region. To extend our "vision" into regions we can't directly see, astronomers have built radio, infrared, x-ray and gamma-ray telescopes that detect photons of widely different wavelengths. Since photons are easily absorbed by matter, much of the universe is still shrouded from our view. For example, the light that comes to us from the Sun is emitted from its surface, while the sources of the Sun's energy are nuclear-fusion reactions which take place only at its hidden core. However, there is another type of radiation that is produced by many astronomical objects which is much more penetrating than the photon. This object is called the neutrino. Since neutrinos pass through matter so easily, observations of neutrinos allow us to look directly into the centers of stars. In the last thirty years, a new branch of astronomy has developed to study these elusive particles. In this talk, Dr. Norman will review the observations that have already been made in the field of neutrino astronomy and will discuss plans for future neutrino telescopes.

Dr. Norman is a local product, graduated from Skyline High School in 1968. He received his AB at Cornell in 1972 and his SM and PhD from the University of Chicago in 1978. He was an assistant professor at the University of Washington from 1978 to 1983 and at Seattle University 1983-84. Since then he has been a Divisional Fellow and Senior Staff Physicist at Lawrence Berkeley Laboratory where he attempts to molest neutrinos.

Join us for

DINNER WITH THE SPEAKER

prior to the meeting at
5:30 p.m., 6 November

PEARL OF SIAM RESTAURANT

5498 College Avenue (510 / 420-8600)
Oakland (2½ blocks from Rockridge BART)

It would be nice if you would confirm your place at dinner by calling Betty Neall before Friday 5 November at 510 / 533-2394. But come anyway, you'll get a priceless pearl of a meal at a price less than you'd expect.

Galileo: Exhibit, Lecture

A collection of reproductions and some authentic instruments used by Galileo and his contemporaries will be on exhibit at the California Academy of Sciences in Golden Gate Park from now through December 2. The collection is on loan from the Istituto e Museo de Storia della Scienza in Italy.

At 8 pm, Wednesday, 17 November, Lewis Epstein will present a lecture to the San Francisco Amateur Astronomers at the California Academy of Sciences, Golden Gate Park. Was Galileo a scientist or science writer? Was Galileo an experimenter or a theorist? Was Galileo a proselytizer or a researcher? Why was Galileo called The Wrangler? Galileo didn't know the lens equations or even how to ray trace, so how could he explain how his telescope worked? Galileo discovered Jupiter's moons and sunspots. But what did he do in physics? Anyone who attends EAS meetings regularly knows Lew. This will be a very interesting talk.

MEMBERS REPORT

On Saturday, 2 October, the monthly meeting was devoted to presentations from members; and it proved to be as popular as these yearly meetings usually are. **Carl Trost** led off with a number of his slides of various subjects, including photos of the sun setting beyond the Farallon Islands as well as pictures of the monumental sun dial at Hunters Point.

Mark Gingerich included two other large sun dials in his presentation of astronomical scenes of Arizona. These were at Sun City and at Carefree. He also showed us slides of the McMath-Pierce Solar Telescope at Kitt Peak, and we discussed the possibility of using its gnomon-like structure to become an even larger sun dial.

Carlo Anderson, before showing astrophotos of Uranus and Neptune and of various star fields, contrasted September's meeting topic of Polynesian celestial navigation with a description of his own experiences in navigating the waters of the South Pacific during World War II. Carlo was a marine engineer on a tanker before Pearl Harbor and was called upon to take charge of maneuvering landing craft and other small ships along the coasts of New Guinea and the Philippines. Intrigued by his reminiscences, the audience was also interested in the fact that his Kodachrome slides, after 50 years, retained remarkably good color.

Nancy Cox, one of the EAS Hubble investigators, gave us a report on the current status of her project, which concerns the ultraviolet spectra of an H2 region of the Lagoon Nebula in Sagittarius. The Hubble was to have performed her experiment sometime during the week of September 27-October 3, and observations may indeed have been under way as she spoke. Additionally, Nancy announced that she has been accepted to participate in Project Astro of the Astronomical Society of the Pacific (ASP), a plan to bring astronomy into the classroom by uniting amateur astronomers with teachers in a mutual effort.

Carter Roberts presented a travelogue of his trip to the Astronomical League Convention in Madison, Wisconsin. Sites included the railroad museum in Union, Illinois; the Adler Planetarium and other Chicago museums; the Washburn Observatory in Madison, Wisconsin; and Yerkes Observatory.

Alan Gorski showed a series of views of the setting sun as seen with an 800 mm lens from Mount Diablo.

Frank Creese, just returned from Eugene, Oregon, where he attended the convention of the

Pacific Planetarium Association, discussed some of the newer ideas in planetarium techniques. Of particular interest was that the Lawrence Hall of Science has now completed a series of interactive programs, with the latest being developed around the astronomical details of Stonehenge.

Dave Rodrigues announced the upcoming meetings of EAS for November and December; and **Don Falla** gave us the bad news for Southern California astronomy of the recent approval of high-pressure sodium lights for the city of San Diego.

The meeting continued as **Carter Roberts II** offered another tray of slides, including scenes taken at White Mountain and at the ASP meeting in San Diego. He also showed some comparison astrophotos taken with the new Kodak Ektachrome Lumiere 100 and Lumiere 100X films.

Election Update

The Nominating Committee is recommending reelection of all the present officers and board members. As of this time, they have not found someone to assume the role of Secretary which Betty Neall is presently filling on an interim basis. Additional nominations will be accepted at the 6 November lecture meeting after which nominations will be closed. The election will take place at the 4 December meeting. The nominees are:

President: Carter Roberts

Vice President: Phil Crabbe

Secretary: ?

Treasurer: Don Stone

Board members: Glen Bailey, Anne Creese, Franklyn Creese, Alan Fisher, Terry Galloway, Paul Glanville, Conrad Jung, Louise Predovic, Alan Roche, Dave Rodrigues, Norm Sperling, Rich Wood, and Paul Zurakowski. Betty Neall is automatically a member of the Board as the Immediate Past President.

Suggestions Needed on Site for EAS Banquet

Before we know it, it will be time for the EAS Annual Banquet. The last five years have all been at the same location, but at four different restaurants. There is now a fifth restaurant, the Oriental Tea House, at that location near the Oakland San Leandro border!! We will be investigating it to see what the food and service are like under the new management. If you have any other suggestions, please either bring them to the next meeting or send them to EAS c/o Chabot Observatory & Science Center, 4917 Mountain Blvd., Oakland, CA 94619. Thanks.

String of Pearls Comet

The mid-October meeting of the American Astronomical Society's Division for Planetary Sciences in Boulder, Colorado, attracted 570 scientists from around the world. The gathering also marks the organization's 25th anniversary.

High on everyone's list was news about the forthcoming impact of Comet Shoemaker-Levy 1993e, the String of Pearls Comet, with Jupiter next July 21. Theorists are trying to figure out just what will happen when each of the comet's 20-odd separate nuclei plow into Jupiter's atmosphere at 60 kilometers per hour over a 6-day period. The energy released in these events could conceivably exceed a million tons of TNT each. But a big unknown continues to be how big and massive these nuclei are. Unfortunately for us, these explosions will occur on the back side of Jupiter. But even though we will miss witnessing the blasts themselves, there is still some possibility of seeing their aftermath. Astronomers at the meeting said that they are planning a massive telescopic campaign to monitor what they can of the spectacle, which ranks as the largest predicted impact to occur in the history of astronomy. As far as amateurs go, the experts say we will have two chances to see something of this event. First, conceivably the back-side flashes will be reflected in a detectable way on one or more of the Galilean satellites, especially those lying in Jupiter's shadow at the times of impact. Also, much of Jupiter may become blanketed with a pall of gas and dust condensed from these fireballs after they erupt high above the planet's clouds. We may then see these condensates as a general brightening or as reduced contrast in the cloud features. One thing's for sure, many more details and predictions will emerge in the months ahead.

[Editor's note: For an interesting story about this comet and its discovery, including photographs, see *Pearls on a String*, by David H. Levy in the July 1993 issue of *Sky & Telescope*. Levy has been a guest lecturer at EAS.]

Among the many other findings presented at the meeting was observational evidence that the Earth is accompanied around the Sun by a very tenuous ring of dust. The stuff has drifted inward from the asteroid belt and become trapped by the gravitational resonance just outside Earth's orbit. The ring is rather splotchy and not truly complete, with the densest part following close behind us as we orbit the Sun. Such a ring was predicted theoretically in 1987 and was found in data obtained during the 1980s by the Infrared Astronomical Satellite.

*From Skyline News Service
Sky & Telescope, October 22, 1993*

Planetarium Directors Retire

by Norman Sperling*

More than half of Bay Area college planetarium directors are retiring in a three-year span, intensified by a sudden spate of "golden handshakes". A golden handshake is a bonus under a retirement plan, which in effect allows the college to replace high-wage senior faculty and staff with lower-wage junior faculty and staff, or use a temporary part-timer or delay any replacement. Retirement plans are usually separately funded.

Don Warren expects to retire from City College of San Francisco in 1994. **Ken Landon** has taken a golden handshake to retire at Contra Costa College. The Dean, who has some interest in the field, will teach the astronomy sections for a semester or so until they can get approval to hire a full-time, permanent replacement. **Michael Chriss** will leave the College of San Mateo after 28 years of running their planetarium. He has moved to Vancouver Island, British Columbia, to become a school headmaster. His replacement is a young physics instructor. **Bob Searls** told me in 1992 that he would retire from Diablo Valley College in 1994. **Kay Martin** retired there a year ago and was replaced by Mr. Paul Sasse. **Billy Smith** is retiring in 1994 or 1995 from Chabot College. **Lee Bonneau** retired last year at Foothill College (they closed their planetarium years ago). **Charlie Hagar** of San Francisco State University intends to retire in summer 1995.

Bay Area college planetaria that are apparently not changing the guard just now include DeAnza, Los Medanos, UC Berkeley, West Valley and Santa Rosa. Also, non-college institutions such as Morrison Planetarium remain stable.

The largesse of a generation ago now seems to have included a hidden time bomb. The grand era for building college planetaria was the 1960s and early '70s. We are now at the other end of the careers of their founding directors. Planetarium directors of that generation cannot afford not to accept retirement, and several are delighted to make the change. The somewhat bunched timing of the foundings compounded by the current acute budget crunch generates this massive and sudden change in directorships.

* *Norman Sperling is Planetarium Coordinator, Chabot Observatory & Science Center, and Historian, Pacific Planetarium Association.*

Shop at the
STARRY NIGHTS GIFT SHOP
before the Friday and Saturday Planetarium
shows and before the EAS Lectures.

MESSAGES FROM THE BEYOND

The following items are quoted from NASA press releases.

PLANETARY MISSION STATUS

GALILEO: A high-resolution picture of asteroid Ida was successfully played back and was publicly released September 22. Galileo will go into orbit around Jupiter and relay data from a probe in its atmosphere on December 7, 1995. Spacecraft condition is excellent, except that the high-gain antenna is still only partly deployed; the mission team is planning to use the low-gain antenna for the Jupiter mission. Galileo was launched October 18, 1989, flew by Venus in 1990 and Earth in 1990 and 1992 for gravity assists, and flew by asteroid Ida in August, 1993.

MAGELLAN: The spacecraft is now in a gravity-mapping orbit around Venus with altitudes of 197 to 541 kilometers (122 to 336 miles). Magellan's condition is very good, and precision tracking is providing desired data on the planet's gravitational field. Magellan was launched May 4, 1989. It radar-mapped more than 98 percent of Venus's surface from September 1990 to September 1992.

MARS OBSERVER: The spacecraft's location and condition are not known. On August 21 the spacecraft signal was not reacquired after a planned transmitter shutdown, part of the sequence for going into Mars orbit. Commands to the spacecraft have produced no response to date. Mars Observer was launched September 25, 1992, and was scheduled to enter Mars orbit on August 24.

The Mars Observer Balloon Relay transmitter is an independent radio system supplied by the French Centre National d'Etudes Spatiales. The system was specifically designed to gather data as the Observer passed close to Russian instrument packages landed on the Martian surface during a 1995 mission, and relay that data to a Russian orbiter overhead. If the beacon were to be detected, it could not be used in place of the spacecraft's high-gain or low-gain antennas to restore commanding of Mars Observer. Attempts to turn the beacon on were done only to locate the spacecraft in space and verify that it is still operating.

ULYSSES: The spacecraft is in a highly inclined solar orbit, now more than 40 degrees south relative to the Sun's equator, following a gravity assist flyby at Jupiter in February 1992. The spacecraft will make solar polar passages (about 80 degrees south and north) in 1994 and 1995. Spacecraft condition and

performance are excellent, with Ulysses gathering data on the heliosphere—the realm dominated by the solar wind. The Ulysses spacecraft was built by the European Space Agency and launched October 6, 1990.

VOYAGER 1 and 2: The two Voyager spacecraft are continuing their interstellar mission, having recently detected possible evidence of the heliopause, the boundary between the solar magnetosphere and interstellar space. Voyager 1, launched September 5, 1977, is currently 8 billion kilometers (5 billion miles) from the Sun after flying by Jupiter and Saturn in 1979 and 1980. Voyager 2, launched August 20, 1977, flew by Jupiter (1979), Saturn (1981), Uranus (1986) and Neptune (1989), and is now almost 6.2 billion kilometers (3.9 billion miles) from the Sun.

ASP Meeting / Universe '94

The 106th meeting of the Astronomical Society of the Pacific will be held in Flagstaff, Arizona, from June 25-30, 1994, it was announced by Robert Havlen, Executive Director of the ASP. The meeting coincides with the 100th anniversary of the founding of Lowell Observatory and will be held in the campus facilities of Northern Arizona University. Included among the many meeting events will be the weekend Universe '94, a national exposition and fair with public lectures, seminars, and exhibits for all. Close to 100 vendors and exhibitors of astronomical items are expected to attend. The theme of the 1994 scientific symposium is "Completing the Inventory of the Solar System." Other events during the week will include sessions on the history of astronomy, with special emphasis on Lowell Observatory, and a two-day workshop on teaching astronomy in grades 3-12. Contact ASP at Universe '94, 390 Ashton Ave., San Francisco, CA 94112 to be placed on the mailing list for further information.

Deadline for the December issue of *The Refractor* is November 19, 1993. Items may be submitted by mail to the editor, Ellis Myers, 215 Calle La Mesa, Moraga, CA 94556; by fax to (510) 841-1329. Files on disk should be ASCII PC format, for 3.5-inch 1.4M or 5.25-inch 360k, preferably accompanied by hard copy. Please call (510) 841-5702 or (510) 284-4103 in advance if you wish to contribute articles by modem or by e-mail.

Total Lunar Eclipse This Month

Local information for the Total Lunar Eclipse of Sunday night 28-29 November, 1993. Times are given in Pacific Standard Time.

| Time | Event | Altitude | Azimuth |
|------------|-------------------------|----------|---------|
| 7:27 p.m. | Begin penumbral eclipse | 30° | 86° |
| 8:40 | Begin partial eclipse | 45° | 98° |
| 10:02 | Begin total eclipse | 60° | 116° |
| 10:31 | Full Moon | | |
| 10:50 | End total eclipse | 68° | 134° |
| 12:12 a.m. | End partial eclipse | 73° | 189° |
| 1:25 | End penumbral eclipse | 65° | 232° |

This is a very favorable eclipse and we plan to have Chabot Observatory open for it. The altitude is quite high so we can set up telescopes in front of the planetarium. There will probably not be much to see until 8:40 or after 12:12. Most of the public will probably tire of it once totality ends at 10:50 but a few people may want to stay for the whole thing. Volunteers are needed for this event. We need some people to help out in the Observatory and would like to have a few additional telescopes outside in case we get lots of visitors. If you would like to help out, we suggest you call us at Chabot the evening of Friday the 26th or Saturday the 27th. The new inside line there is (510) 530-5894 or 5895.

ET STAY HOME

A House-Senate conference committee has voted to eliminate funding for NASA's biggest search for alien civilizations less than a year after the galactic listening effort began. The final NASA appropriations bill still must be passed by the full House and Senate, but scientists held out little hope that it could be saved. The October 1 action on NASA's fiscal year 1994 budget would provide only enough money to shut down the \$100 million project. The space agency launched its 10-year search Oct. 12, 1992, Columbus Day, by turning on giant radio telescope "ears" in California and Puerto Rico. JPL in Pasadena and NASA's Ames Research Center in Mountain View were coordinating the project. The Search for Extraterrestrial Intelligence, or SETI, sought to answer whether humans are alone in the universe by scanning the skies to detect radio signals that could be sent by distant civilizations. At NASA's Deep Space Network tracking station at Goldstone, about 150 miles northeast of Los Angeles, a 112-foot-wide antenna listened for alien signals among millions of radio frequencies. A 1,000-foot-wide antenna dish at the Arecibo Observatory in Puerto Rico conducted a search for radio signals from any inhabited planets orbiting about 1,000 of the sunlike stars closest to our own solar system. More than 50 small-scale and limited searches for extraterrestrial civilizations have been conducted, dozens of unusual signals were detected, but none proved to be evidence of a technological society on a distant world. Many scientists, including astronomer Carl Sagan, supported the NASA search. They cited a 1972 National Academy of Sciences report that said that "detection of intelligent life elsewhere may, in the long run, be one of science's most important and most profound contributions to mankind and to our civilization."

Journey to the Moon

International Space Enterprises (ISE), a commercial space corporation headquartered in San Diego, will conduct a series of robotic missions to the moon beginning in 1996, in partnership with the Russian space firm, Lavochkin Association, who was responsible for designing and operating the landers and rovers for almost all previous Russian lunar programs. Dr. Garry Rogovsky, the First Deputy Director of Lavochkin's Babakin Engineering Research Centre joined Mr. Michael Simon, President of ISE in San Diego to announce that the two companies have formed a joint venture company (ISELA) to market their regularly scheduled transportation to the Moon. "We are here today to announce that preparations are underway for our first mission in July of 1996 and tickets are going on sale", said Mr. Simon.

ISELA has planned a series of eight missions to lunar orbit and the lunar surface through the year 2000. The first mission will deliver various scientific instruments and a communication satellite into lunar orbit to aid in transmitting data and communications from future missions. This satellite will be essential for returning data from missions where scientific instruments such as telescopes have been located on the far side of the moon. The volume, capability and flexibility of the ISELA system will reduce the cost of lunar exploration by an order of magnitude, bringing it well within reach of universities, scientists and commercial companies.

ISE is presently negotiating with 22 major U.S. corporations representing both traditional markets such as telecommunications, geology, mapping and astronomy and non-traditional participants such as automobile, consumer electronics, and entertainment firms. Mr. Simon stresses that low cost access to the Moon will promote private sector investment in science and technology programs vital to U.S. competitiveness; will channel capital into high-wage, high-skill jobs; will produce technology spin-offs that will create new science and business markets; and will reinvigorate our children's interest in science and technology by enabling students at all levels to actively participate in lunar and astronomical science projects.

DATELINE NOVEMBER

- 11 1572 Tycho Brahe observes De Nova Stella in Cassiopeia
- 8 1656 Edmund Halley, born
- 15 1738 William Herschel, born Hanover, Germany
- 2 1885 Harlow Shapley, born
- 20 1889 Edwin Hubble, born Marshfield, Missouri
- 3 1957 Soviet Sputnik 2 launched, first dog in orbit, Laika
- 15 1988 Green Bank, West Virginia, radio telescope collapsed

- 6 1993 Mercury transits Sun, Australia, Asia
- 6 1993 Last Quarter Moon, 22:36 PST = 06:36 UT 11/7
- 8 1993 Venus 0.4 degree north of Jupiter
- 13 1993 New Moon, 13:34 PST = 21:34 UT
- 14 1993 Mercury 0.7 degree north of Venus, 05:00 PST
- 17 1993 Leonid meteor shower peaks
- 20 1993 First Quarter Moon, 18:03 PST = 02:03 UT 11/21
- 28 1993 Total lunar eclipse, totality begins 22:02 PST
- 28 1993 Full Moon, 22:31 PST = 06:31 UT 11/29

- 3 1994 Total solar eclipse, South America

UPCOMING EVENTS

6 November, EAS Lecture: **Neutrino Astronomy** by **Dr. Eric Norman**, Lawrence Berkeley Laboratory

12 November, EAS Board Meeting

17 November, Galileo Lecture. See story, page 1.

28-9 November, Total Lunar Eclipse visible from Chabot. Totality will be from 10:02 to 10:50 p.m. Sunday night. We will be open for the public.

4 December, (rescheduled from August) EAS Lecture: **"What's at the Edge of the Solar System?"** by **Dr. Jane Luu**, Stanford University.

10 December. EAS Board Meeting



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