The Refractor

The Bulletin of the Eastbay Astronomical Society

Founded in 1924 at Chabot Observatory, Oakland, California

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1995: A Space Odyssey, Galileo's Arrival at Jupiter

Saturday, 8 April

Social 5:30 p.m.; Dinner 6:00; Lecture 7:30 p.m.
Oriental Tea House
604 MacArthur Boulevard, San Leandro

Dr. Richard E. Young

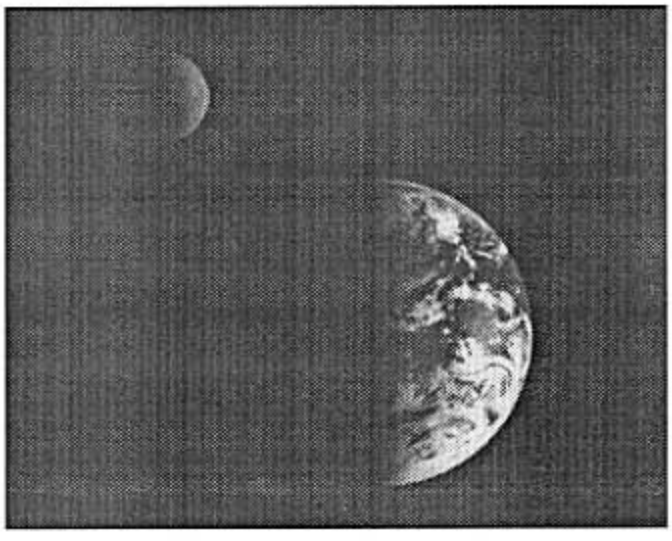
Galileo Probe Project Scientist
NASA Ames Research Center

We consider it a great honor, privilege and special opportunity to welcome Dr. Richard E. Young as our speaker for the 1995 Annual Banquet of the Eastbay Astronomical Society. Dr. Young is a preeminent scientist in the Galileo program and he will describe for us what should be the most newsworthy event to occur at Jupiter since last July. Scientists are looking forward to capturing exquisite photographs of the surfaces of the several Jovian moons as Galileo whips around the planet. The optical systems are expected to yield average resolutions of 20 to 50 meters, compared to the 1-kilometer resolution achieved by Voyager. It has been said that the smallest discernible object the Voyager cameras saw was the width of the Grand Canyon. Galileo should be able to identify a semi-trailer truck, should there be one parked on Io.

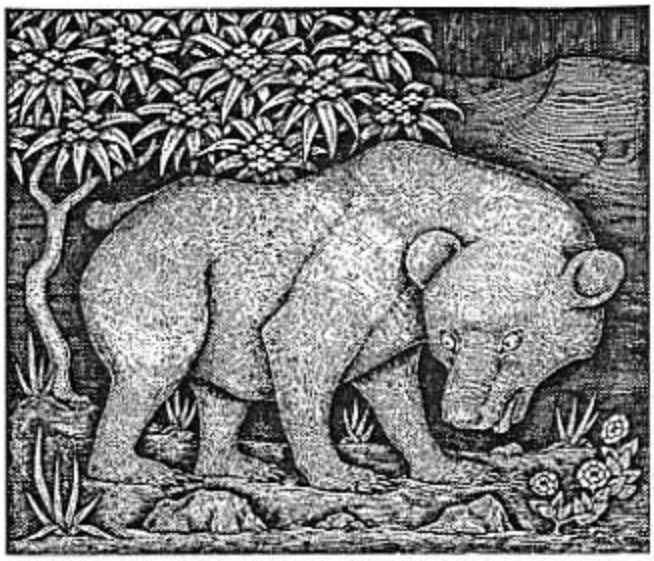
But it is the atmospheric probe that Dr. Young is most anxious to follow during its short moment of history. The probe's sampling is the key to Galileo's enormous promise. The presence and composition of any water vapor clouds are among the factors to be observed. Other questions Rich Young lists as crucial topics for the probe include the mechanics of atmospheric winds. What are the parameters of speed and direction, temperature and heat transfer, as a function of the various layers and depths as the probe descends? All this science, and more, will make for a very meaningful final hour of the spacecraft's six-year lifespan.

As of March 1, Galileo was nearly 500 million miles from Earth, with another 90 million miles to go before reaching its destination. It was sending data at a rate of ten bits per second to NASA's JPL Deep Space Network. Round-trip communication time is 1½ hours for signals to control spacecraft activities. New software was loaded and checked aboard Galileo during March. These instructions will command the deployment of the atmospheric probe, the approach to Jupiter, the Io flyby, capture and storage of probe data during the atmospheric descent, as well as the subsequent transmission to Earth of probe data.

You will certainly want to attend this presentation, the feature of the EAS Annual Banquet and Awards Meeting. If you cannot come for the dinner, you are welcome to attend the lecture, without charge. Please see the attached flyer for more information.



In December 1992, Galileo turned its camera to look homeward before heading off on its course that will take it to Jupiter next December. This image was recorded in December 1992, two years after the October 1989 launch, three years until a rendezvous with Jupiter. In this view, the Moon lies between Earth and the spacecraft.



For Your Eyes Only

Let's get this straight! Ursa Major and Big Dipper are not synonymous. And Ursa Major doesn't mean Great Bear, either. Well, not exactly. The Latin word "major" (or "maior") is the irregular comparative adjective formed from the positive "magnus", meaning "great". Therefore, in the constellation of the Great*er* Bear, there is an asterism of seven brighter stars that most people know as the Big Dipper. But that's not entirely true, either, for the common name in Britain is the Plough, and in much of Europe it is seen as the Wain (Charles's wagon, in honor of Charlemagne, Carolus Magnus). And now we're back to that "magnus" word again.

Each of the stars of the Big Dipper has a name: starting from the pointer star nearest the pole and moving around the bowl and along the handle, we have in turn Dubhe (α), Merak (β), Phecda (γ), Megrez (δ), Alioth (ε), Mizar (ζ), and Alkaid (η). Mizar is perhaps the most notable of double stars, its companion fourth-magnitude Alcor. This pair enters into many stories in sky lore, many based on their being a test of fine eyesight. If a man's eyes were good enough to see Alcor, he was judged to have acuity keen enough for the Arabian army. Other stories dealt with their common bonds, as in an Arabian tale that gave them their names: Mizar means the Horse, and Alcor the Rider. An American Indian legend tells of a young girl [Mizar] and her baby brother [Alcor].

This optical double is important in astronomy history, as well, for in 1650 the Italian observer Riccioli made the discovery that Mizar itself was a double star, the first one ever to be identified as such. Later it became the first binary star to be photographed. This was in 1857 at Harvard College Observatory. Later yet it was determined that each of Mizar's components were spectroscopic binary stars, the first discovered; and Alcor proved to be also a binary. There is evidence of another, unseen star as a member of this group. In all, then, there are seven stars belonging together. You should be able to see three of them with a small telescope–Mizar and its twin are 14 arcseconds apart, with Alcor 12 minutes away.

Undoubtedly the most recognizable and best known pattern of stars in the sky, the Big Dipper stars have been at the center of sky lore in all cultures. Many of these stories are linked to a bear, possibly because the bear is an animal of the north as the constellation is also of the north. A story of a different nature is told by the Snohomish, whose native land was the area east of Puget Sound. In the days when the world was new, the sky was so low that tall people could climb trees and go to Sky Country whenever they wished. But some found it hard to get back. Others were bumping their heads against the sky. Something had to be done. The wise men from each tribe got together and agreed that the people should push up the sky. Because the sky was so heavy, though, it was necessary that all the people–and all the animals, too–cut long poles from fir trees to serve as sky-lifting poles. When all was ready, they pushed their poles up against the sky. As the wise men shouted encouragement and led the effort, the sky began to move up a little. Again and again they pushed as hard as they could until finally the sky reached a height where no one might bump their head. And from that time no one has climbed into Sky Country. But–as even today–some people just don't get the word. Three hunters had been out chasing elk, and just as the sky lifting began they were at a place where the sky touched the land. The elk jumped up into the sky with the hunters close behind, Soon they turned into stars and you can see them tonight, three hunters following four elk around the northern sky.

Seven Messier objects are located in the constellation Ursa Major. Five of these are spiral galaxies, with M 81 being rather easily found with binoculars about midway from the pointer stars to Polaris. Just a half-degree away is M 82, dimmer but also visible in binoculars. M 81 and M 82 (also known as NGC 3031 and NGC 3034) are members of a small group of galaxies about 10 million light years away. Contrast this distance with that of the stars of the Big Dipper. The Dipper stars (except Dubhe and Alkaid) are part of a nearby cluster of stars, moving together in the direction of Sagittarius. They are about 75 light years away from the Solar System, the nearest star cluster to us.

The beautiful M 81 has thin spiral arms marked by clusters of young, blue stars that can be discerned with larger telescopes. The galaxy is perhaps not unlike our Milky Way. In contrast, M 82 appears to have an elongated shape. Its features of filaments and dust lanes, and its strong source of radio energy are not fully understood. M 101 is one of the largest galaxies. Find it with a small

One of the most brilliant and beautiful galaxies of those listed by Charles Messier is M 81 in Ursa Major. It is seen in this view (at the bottom) which also includes nearby M 82. The photo was taken by Conrad Jung, using an 800 mm telephoto lens piggy-backed on Leah, the 8-inch refractor at Chabot. The exposure was 45 minutes on Ektachrome 200 film.

telescope a few degrees following Mizar, above the Dipper's handle: Good binoculars on a good night will show M 101 as a disk nearly the size of the full Moon, with several faint stars involved. At least three supernovae have been observed in this galaxy during this century, most recently in March 1993, when the star suddenly brightened to magnitude 10.5.

Also in Ursa Major are the Owl Nebula, M 97, and, at magnitude ten, the elongated galaxy M 108. These are both near Merak, the second of the pointer stars. Aside from the Messier list, there are a number of interesting deep-sky objects in Ursa Major. Two of the brighter galaxies are NGC 2841 and NGC 3184. These are away from the Big Dipper, but easily found near the stars of the Three Leaps of the Gazelle, the asterism comprised of three pairs of third magnitude stars to the south of the Dipper's bowl. In myth, the dark sky between Leo and Ursa Major was thought of as the Pool, and the gazelle left his tracks as he escaped from the threat of the Lion.

Ursa Major is a circumpolar constellation, so that it is visible throughout the year, but it is perhaps best followed during April, May and June when it is above Polaris during evening hours. Below the stars of the Greater Bear lies the Land of the Bear, from the Greek word for bear, *arktos*, the arctic.

Please welcome the following new EAS members:

Hugo Garcia **Richard Bolocek**

President Carter's Corner

Conrad Jung, Don Stone and I stayed long after the March EAS meeting and we were treated to a superb view of Jupiter. After the downpour that occurred during the meeting it was a welcome relief that the clouds broke at the end of the meeting, permitting planetary viewing. Between 4 and 5 a.m. Jupiter was near the meridian and seeing conditions were excellent. Viewing was done with Leah at medium power. As usual, the Northern Equatorial Belt was the most prominent feature on the planet. It showed considerable detail including two prominent knots of material along the northern edge. There were many more belts visible than normal and one new feature–a sort of smoky gray band where the pieces of SL-9 impacted last July. Jupiter bears watching the next few months on those rare occasions when conditions are good enough.

Astronomy Day this year will be Saturday, 6 May. The planetarium show at Chabot that night will be "The Sky Tonight" and tickets will be half price. (Of course, EAS members are entitled to free admission at any of these planetarium shows.) The Starry Nights Gift Shop will have a 10% discount that night in addition to any membership or teachers discount. We urge all EAS members to come to Chabot to help out (we could use a few additional telescopes); or perhaps you could find somewhere in your own community to set up a telescope. Astronomy Day is a day to bring astronomy to the public–it's an unequalled opportunity to tell others, especially young people, that astronomy is an exciting, challenging, and worthwhile activity. If you will be setting up a telescope somewhere and want to be included in the AANC press release, please send information to the AANC Astronomy Day Coordinator–which just happens to be me! Send to 5 Highgate Court, Berkeley, CA 94707.

Watch for the next issue of *The Refractor* for further information about times and locations for EAS activities for Astronomy Day. Urge your friends to visit Chabot Observatory that day.

By Carter Roberts

Articles and photos for *The Refractor* are encouraged. Deadline for the May issue is April 26, 1995. 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, for 3.5-inch 1.4M or 5.25-inch 360k. Internet e-mail address is emyers@crl.com. For further information please call (510) 284-4103.

Magellan Images of Venus Presented

Newly processed global views of Venus showing its rich and varied landscape have been released by scientists associated with NASA's Magellan mission, which concluded last October after mapping more than 98% of the planet with imaging radar.

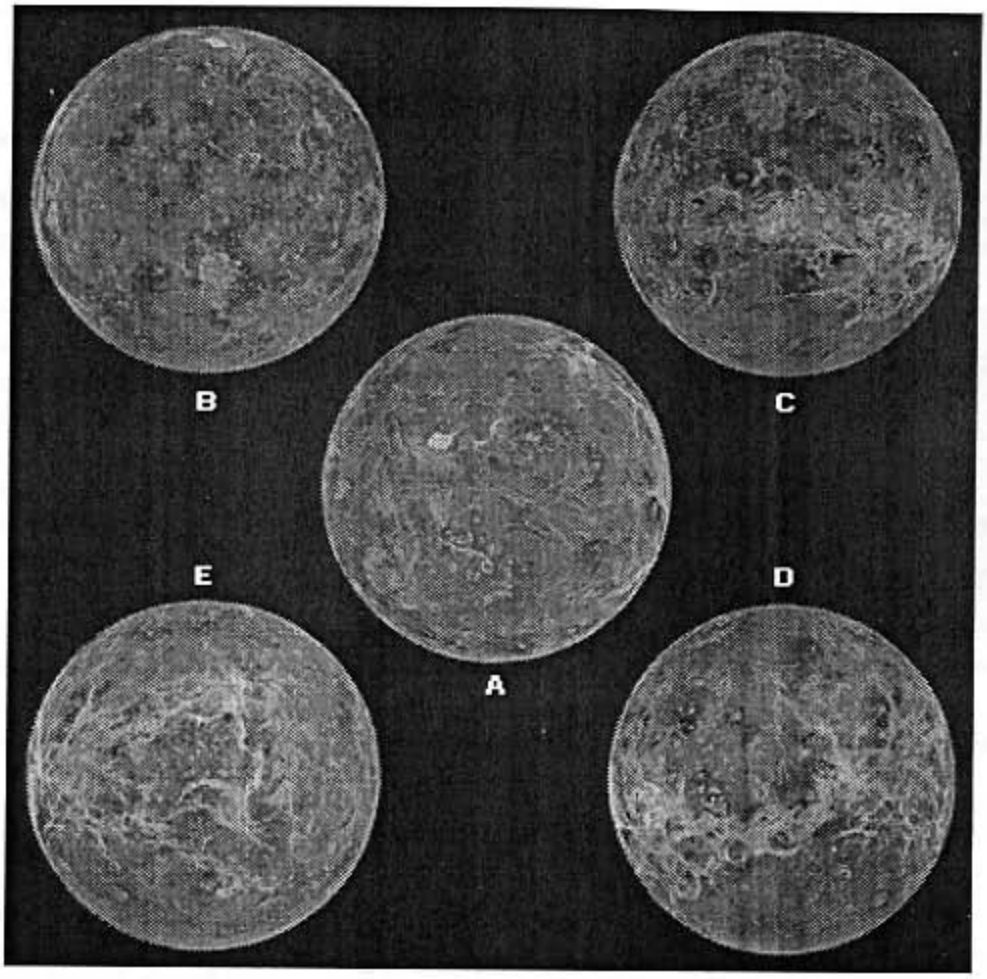
"These images will form the basis for all future scientific studies of Earth's sister planet, and will provide the necessary maps for all future Venus missions," said Magellan Project Scientist Dr. R. Stephen Saunders of NASA's Jet Propulsion Laboratory, Pasadena, CA.

The images–mosaics collected from data gathered during Magellan's orbital mission–were released at the Lunar and Planetary Science Conference in Houston, where scientists gave presentations based on the new imagery database.

The Magellan spacecraft was commanded to plunge into the atmosphere of Venus last Oct. 12 after performing a final aerodynamic experiment. Mission activities officially ended in mid-February of this year, but some science tasks will continue through fiscal year 1996.

The Magellan spacecraft was launched aboard space shuttle Atlantis in May 1989 and began mapping the surface of Venus in September 1990. It continued to orbit Venus for four years, returning high-resolution images, altimetry, thermal emissions and gravity maps of the surface. Magellan operations ended on October 12, 1994, when radio contact was lost with the spacecraft during its controlled descent into the deeper portions of the Venusian atmosphere.

Scientists at the conference presented papers on the geology, atmosphere, climate, volcanoes and tectonic processes of Venus, based on the vast Magellan data set.



These images are composites of the complete radar image collection obtained by the Magellan mission.The surface of Venus is displayed in these five global views. The center image (A) is centered at Venus's north pole. The other four images are centered around the equator of Venus at (B) 0 degrees longitude, (C) 90 degrees east longitude, (D) 180 degrees and (E) 270 degrees east longitude.
Magellan synthetic aperture radar mosaics are mapped onto a rectangular latitude-longitude grid to create this image. Data gaps are filled with Pioneer-Venus Orbiter altimetric data, or a constant mid-range value. The bright region near the center in the polar view is Maxwell Montes, the highest mountain range on Venus. Ovda Regio is centered in the (C) 90 degrees east longitude view. Atla Regio is seen prominently in the (D) 180 east longitude view. The scattered dark patches in this image are halos surrounding some of the younger impact craters. This global data set reveals a number of craters consistent with an average Venus surface age of 300 million to 500 million years.
The image was produced by the Solar System Visualization Project and the Magellan science team at the Jet Propulsion Laboratory's Multimission Image Processing Laboratory.

EAS Officers

President: Carter Roberts	(510) 524-2146
Vice President: Phil Crabbe II	(510) 655-4772
Secretary: Kevin Cox	(510) 528-2181
Treasurer, Membership: Don Stone	(510) 376-3007

Comet Comments

By Don Machholz

No new comets have been discovered recently, but I'm including the positions for Periodic Comet d'Arrest for those wanting the challenge of finding a faint comet. By midsummer it should be visible in binoculars.

This is the 200th issue of *Comet Comments.* This column began in May 1978 as an addition to the San Jose Astronomical Association newsletter *Ephemeris,* and has run as a regular monthly feature since September 1978. Add to these the several special editions of *Comet Comments* and you get 200 issues.

My original idea was to provide comet information and positions to fellow club members. Within two years I was also sending it to two other club newsletters. Presently it is mailed to twenty astronomy clubs, plus interested individuals around the world. Most English-speaking comet discoverers receive it. It is also circulated in China and in the Philippines. It remains available on an exchange basis to club newsletters and for SASE to individuals.

The first *Comet Comments* were handwritten. A manual typewriter served until 1982. Then came a Commodore 64 computer with a variety of printers. Finally, last year I converted to an IBM 286 computer.

Electronic Bulletin Boards now carry *Comet Comments*. The Kingmont BBS has it on Area 44 at (916) 652-5920. The Tri-Valley (Livermore, CA) BBS carries it on directory 33. It can be reached at (510) 443-6146. America On Line displays it in their Astronomy (Keynote: "Astronomy") department. And I understand that it can be found in other areas of the Internet. It appears on these boards, and in the mail, about three weeks before the intended month.

For the past five years I have tried to keep *Comet Comments* to one full page. This fits well in newsletter formats. Through the years it has varied from ten lines to two and one-half pages. Often I would add what has turned out to be popular "fillers": a paragraph or two highlighting famous comets, comet hunters, Halley's Comet or comet discovery statistics.

I continue to enjoy writing *Comet Comments* each month and the readers continue to find the information useful. It also keeps me in touch with many of the comet observers around the world. I plan to keep writing it for a long time to come.

Date	R.A. (00UT)	Dec. (2000)	Elong.	Sky	Mag.
Comet 6P/d'Arrest					
03-29	18h22.9m	–00°17'	92°	M	14.5
04-03	18h33.3m	+00°23'	94°	M	14.2
04-08	18h43.8m	+01°05'	95°	M	13.9
04-13	18h54.3m	+01°49'	97°	M	13.7
04-18	19h05.0m	+02°35'	99°	M	13.4
04-23	19h15.7m	+03°23'	100°	M	13.1
04-28	19h26.5m	+04°11'	102°	M	12.9
05-03	19h37.5m	+05°00'	103°	M	12.6
05-08	19h48.6m	+05°49'	105°	M	12.3
05-13	19h59.9m	+06°36'	106°	M	12.0

Reflections of Venus

In a March 17 news release, *Sky & Telescope* announced that a new theory might explain why the highest mountains on Venus are very efficient reflectors of radar pulses from the Magellan spacecraft and ground-based antennas. Scientists suggest that a metallic "frost" may cover the peaks. Compounds of halides and chalcogenides are released as gases in volcanic eruptions on Earth and may be expected to be similarly deposited on Venus. It is theorized that the gases slowly condense out of the Venusian atmosphere as a kind of metallic frost. Over a period of perhaps 10 million years a layer could build up to a thickness that would possess the puzzling reflective properties, which were first detected in the 1970s.

AANC Workshop a Success

The Telescope Performance Workshop conducted on March 18 was attended by about 80 participants who were intent on learning more about fine tuning of Dobsonian and Newtonian telescopes. Keynote speaker for the event was Chuck Dethloff of the Rose City Astronomers in Portland, Oregon, whose title was "Modern Dobsonians: A Better Choice". EAS members Paul Zurakowski, Bob Schalck and Alan Gorski were among the instructors. An unforgettable feature of the workshop was the appearance of John Dobson, a favorite with the participants, as was his telescope design.

The Planets in April

Mercury	Aquarius-Pisces	Conjunction
Venus	Aquarius	Before dawn
Mars	Cancer-Leo	All night
Jupiter	Ophiuchus	After midnight
Saturn	Aquarius	Before dawn
Uranus	Capricornus	After midnight
Neptune	Sagittarius	After midnight
Pluto	Ophiuchus	All night

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
12	1981	Columbia, first Space Shuttle launch,
3	1990	Hubble Space Telescope launched
2	1995	Pacific Daylight Time begins, 02:00 PST = 03:00 PDT
7	1995	First Quarter Moon, 10:34 PDT = 05:34 UT April 8
15	1995	Moon occults Spica, 02:43 PDT
15	1995	Full Moon, 05:09 PDT = 12:09 UT Partial lunar eclipse
16	1995	Easter Sunday
21	1995	Last Quarter Moon, 08:18 PDT = 03:18 UT April 22
29	1995	New Moon, 07:37 PDT = 17:37 UT

Amateurs may use the Hubble Space Telescope for research. Proposal packets are available from HST Package, AAVSO, 25 Birch Street, Cambridge, MA 02138. Deadline for submission of proposals is by postmark before 30 April 1995.

UPCOMING EVENTS

8 April. EAS Annual Banquet.
Dr. Richard E. Young
1995: A Space Odyssey. Galileo

13 April. EAS Board meeting.

6 May. National Astronomy Day.

13 May. EAS meeting.
Dr. Donald Osterbrock. The Birth, Near Death, and Resurrection of an Astronomical Research Institution: Yerkes Observatory 1892-1950

26-29 May. Riverside Telescope Makers Conference

22-28 June. Astronomical Society of the Pacific, College Park, Maryland

24 October. Total solar eclipse. India, Thailand, Cambodia

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