The Refractor

The Bulletin of the Eastbay Astronomical Society

Founded in 1924 at Chabot Observatory, Oakland, California

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High-Altitude Astronomy

Saturday, 13 December, 7:31 p.m.
Chabot Observatory
4917 Mountain Boulevard, Oakland

Dr. David Cudaback

Department of Astronomy, UC Berkeley

Under low interstellar temperatures molecules are mostly in low energy levels with many transitions, producing spectral lines, at infrared and millimeter wavelengths. These wavelengths between 1 micrometer and 2 centimeters are absorbed and phase shifted by water vapor in the earth's atmosphere. To overcome that, observations are made (in increasing order of cost and decreasing order of ability to build large apertures and interferometers) from mountain altitudes, aircraft, balloons, and spacecraft. It is worthwhile making a considerable effort to use mountain altitudes up to 5 km, where people can assemble and maintain equipment.

Mental and physical performance and health are severely degraded by hypoxia at these altitudes. Dave will review the rich research literature on this. Similar degradation of health is experienced in bed at low altitude during the hypoxia of sleep apnea. There is an unclear connection between hypoxia and cluster headache.

Dave has been associated with Cal continuously since graduating from high school in 1946, holding positions from lowly lab helper to tenured senior lecturer. He has attempted to improve science education at levels between grammar school and graduate school, especially with astrophysics lab courses for serious university undergraduate students in science and technology. He has initiated research on many topics including radio studies of the moon and interstellar molecules, and optical studies of pulsars. He has been deeply involved in site studies for observatories for millimeter and infrared wavelength work.

Join us for

DINNER WITH THE SPEAKER

5:28 p.m., Saturday, 13 December, 1997

JUANITA'S MEXICAN RESTAURANT

1324 Park Street, Alameda (510) 865-2230

Please call Betty Neall at 510 / 533-2394 by Friday, 12 December to confirm your place. Please be on time to allow ample time for dinner and to facilitate a prompt meeting time of 7:31 p.m.

When viewed from White Mountain, the Milky Way shines as if twin beacons were radiating from Los Angeles, 225 miles due south. This photo was taken by Carter Roberts in July 1997 (11-minute exposure on Pro 400 film, 35-mm lens).

Mars Pathfinder

which brought spectacular images of the "Red Planet" to Earth, will conduct its next mission on the surface of a U.S. postage stamp.

The U.S. Postal Service will issue a $3 Priority Mail stamp commemorating the historic Mars Pathfinder mission. The stamp will be officially dedicated in a ceremony at NASA's Jet Propulsion Laboratory in Pasadena on December 10.

"As one of the most significant achievements in the history of America's space program, it is fitting that the Pathfinder Mission be honored on a U.S. postage stamp," said Postmaster General Marvin Runyon. "When this stamp lands in stamp collections or on Priority Mail pieces nationwide, it will be a reminder of the unmatched ingenuity that leads the world in space exploration."

Continued on page 4

Pisces, the Fishes

swim in the ocean of the sky where also can be found the sea monster Cetus. Nearby to the west along the ecliptic, Aquarius, god of the waters, may be seen as he pours out water to bring the gentle rains without which the Earth would be fruitless. (However, it was he who also caused the flooding of the Nile.) Above the swimming fish and to the west at this time of year look for the flying horse, Pegasus. The Great Square of Pegasus is one of the most prominent asterisms of autumn skies.

In the lore of the sky, these fish started out as gods. To the Greeks, they were Aphrodite and her son Eros. The Romans knew them as Venus and Cupid. A myth describes the mother and son strolling along a river bank. They encountered a terrible giant—Typhon. Startled and frightened, Venus and Cupid jumped into the river and assumed the form of fish. The other gods then elevated the fish to the sky as one of the groups of the zodiac. The stars were known as "Venus and Cupid," in Roman times.

M74 is a spiral galaxy seen "face-on." It is typical of a grand-design Sc galaxy. According to a classification scheme first worked out by Edwin Hubble, the notations Sa to Sd refer to a simple spiral form with a to d indicating increasing pitch angle. This galaxy is at a distance of 30 to 40 million light years and is receding at a rate of 800 km/sec. Along the spiral arms are clusters of blue young stars. The spiral reaches out to cover a region of more than 10 minutes of arc in diameter, corresponding to roughly 95,000 light years, about the same size as our Milky Way galaxy. Discovered in 1780 by Messier's associate P. Méchain, this faint object in Pisces was not determined to have its spiral characteristics until 1848. In smaller telescopes it appears as a fuzzy disk with a brighter center.

The constellation Pisces is a faint, but graceful and pretty pair of delicate streams of stars which come together to form a V. The point of the V is sometimes called the Heavenly Knot. Starlore says it's the knot that ties two fish together by their tails. The two strings of stars diverging from the Knot culminate in the diamond-shaped figure called the Northern Fish, and the Western Fish, an attractive oval of fourth- and fifth-magnitude stars called the Circlet. The Circlet can be easily found below the Great Square of Pegasus.

The Vernal Equinox now lies in Pisces (originally this point where the Sun crosses the plane of the ecliptic was in the constellation of Aries). This is the point from which all right ascension coordinates are measured.

One of the brightest stars in Pisces is Al Rischa at the point where the two fish are tied. In fact, the name comes from the Arabic word for "cord." Al Rischa, α–Piscium, is really a double star—two stars af magnitudes 4.2 and 5.1 that orbit each other once every 720 years or so. It's interesting to note that the two stars whose name means "cord" really are tied together—by the long cord of gravity. With a separation of just 2 seconds of arc, this pair is a challenge for small telescopes, but the rewards justify the effort, for the stars are green and blue, with remarkable contrast.

Within the constellation lies one of our closest celestial neighbors. The faint star known as Wolf 28 is also called Van Maanen's star, named for an astronomer who discovered the star in 1917, Adrian Van Maanen. He noticed that the star appeared to move quickly across the sky relative to other stars, indicating that it was nearby. Van Maanen's Star is only 14 light-years from the Earth. Only a few stars are closer. It's a white dwarf—a star that's used up its nuclear fuel. Our own Sun will become a white dwarf—in another five or six billion years.

First seen in the late 1960s, a bizarre class of objects called gamma ray bursters can outshine the entire gamma-ray sky. For them to appear so bright, they must result from cataclysmic events—although there's no consensus about their nature. The puzzle became even more complicated in February, when the orbiting Compton Gamma Ray Observatory and another spacecraft detected a burst in the constellation Pisces that lasted for an hour and a half—50 times longer than any other burst ever detected. Its energy level was 12 times stronger than any other burster. The burst might have come from matter spiraling into a black hole billions of light-years away or possibly from a collision between two neutron stars. But no one knows for sure.

Beginning in August 7BC there occurred in Pisces a rare triple conjunction of the planets Jupiter and Saturn. Three times in a single year these bright celestial objects appeared close to each other. Could this event have been the Star of Bethlehem?

This month—and throughout 1998—Pisces is host to the planet Saturn. In December, Saturn poses nicely for your viewing. Come look through the Chabot telescopes and marvel again at this beautiful ringed planet and its moons. On the night of December 8 the Moon will pass in front of Saturn, the dark edge masking the planet for nearly an hour beginning about 11:18 PST. The Moon will occult the first-magnitude star Aldebaran four days later, as well. The star will abruptly disappear at 19:52 PST and reappear at 21:04.

EAS Salutes New Members

We are pleased to welcome the following people, who have recently joined the Eastbay Astronomical Society:

Alvin Cheung	Sacramento
Parker Cornell	Oakland
Helene Holbrook	Oakland
James & Debbie Obendorf, Jr.	Oakland
Gabriella Rojas	San Bruno
Charles Collier	Berkeley

Roberts Rules

By Carter Roberts

Please make a special effort to attend the December meeting of the club. It is time for the annual election of officers, and you won't want to miss this exciting affair. Nominees are those who presently hold office. [You can find a list of officers and Board members at the bottom of this page.] In addition, two members are candidates for added places on the Board of Directors. They are Nancy Cox and Dr. Bill Levinson. With this dedicated group of people helping out, the EAS will be well set to continue for another year of providing a place and a program where astronomy amateurs can further their interests. A particular word of thanks is due to our Program Director, Dave Rodrigues, who always comes up with great speakers, as with this month's presentation by Dr. David Cudaback. Come hear his talk.

This is *Bash-the-Architects* month.

We have been presented with what are supposed to be the "100%" plans for the new Chabot. These plans were given to the pre-qualified contractors the day after they were printed without any chance for anyone to check them for errors. This set still has many pages that are blank.

Some of the things that are appearing for the first time are a real shock, such as the 20 by 40 foot water pump station protruding 16 feet above street level that they are proposing to locate where everyone driving along Skyline Boulevard can't possibly avoid seeing it. They finally show the rails that are to be put in the floor of the big dome for the observing platform but have them mislocated despite being given the correct radii over three months ago. They still do not show any details of the floor there despite the need to install part of the floor after the telescope and then have four trap doors to provide access to the alignment screws. It also looks like the floor may rest on the concrete pier for the telescope.

A third surveying company was hired recently to produce a better map of the entrance road. The plans include this new mapping for showing the regrading of the entrance road but fail to use the improved contours in any of the parking areas or for the landscaping plans where tree locations are important.

Once again the architects have failed to correct many of the errors that were pointed out to them two or three sets of plans ago. It is apparent that many expensive change orders will be needed because of the failure of the architects and their subcontractors to understand what is required in an astronomy-oriented science center. COSC should have listened to us almost five years ago when we said that these architects should be rejected because of their lack of observatory experience.

Jennifer Lipyanik Appointed to Planetarium Staff

The Eastbay Astronomical Society welcomes Jennifer Lipyanik as Chabot Observatory and Science Center's new Planetarium Instructor. After receiving her bachelor's degree in Astronomy from U.C. Berkeley, Ms. Lipyanik taught Astronomy and Physics at Lawrence Hall of Science in Berkeley. A long time Bay Area resident, EAS member and avid amateur astronomer, Jennifer looks forward to bringing her skills to Chabot Observatory and the new Chabot Science Center. She will be working closely with the school programs as well as assisting in presenting the public programs at the Chabot-Rotary Planetarium.

When the new facilities open in 1999, a Zeiss Universarium planetarium projector will be technologically superior to any other in the country. José Oliverez, Director of Astronomy, says "The most exciting aspect of this revolutionary equipment is that the reinvention of the planetarium show allows us to reinvent the teaching of astronomy. It will further the Science Center's mission to use people's fascination with astronomy as the basis for teaching science."

NASA Notes

The Sagan Memorial Station on Mars has succumbed to the cold of the red planet's nights. The last full transmission from the Mars Pathfinder lander came in on September 27th; since then only faint, brief signals on October 2nd and 7th have broken the silence. Since the rover Sojourner communicates to Earth via the lander, it too is now out of touch. Still, Mars Pathfinder lasted much longer than its modest one-month goal.

NASA expects no further delays to preclude the January 5th launch of Lunar Prospector, already postponed twice because of delays preparing its new Athena 2 rocket. Prospector will survey the Moon from orbit and search for the presence of water at the lunar poles. Its data will complement the global mapping done in 1994 by the Clementine 1 spacecraft. The Clementine 2 mission, which would have explored several near-Earth asteroids, recently fell victim to President Clinton's line-item veto.

Eastbay Astronomical Society

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Articles and photos for *The Refractor* are encouraged. Deadline for the January issue is December 24, 1997. Items may be submitted by mail to the editor, Ellis Myers, 215 Calle La Mesa, Moraga, CA 94556. Internet e-mail address: eas@silcon.com. For further information please call (510) 284-4103.

Internet: http://silcon.com/~eas • http://chabot.cosc.org/eas

José's Observations

by José Olivarez

With 1998 just around the corner, it is time to let you know what shows are planned for the first six months of next year for the Chabot-Rotary Planetarium. The show titles, presentation dates and brief show descriptions follow:

Star Death—Supernovas, Pulsars and Black Holes. Showing January 9-February 14. As our Sun ages, it will become a red giant and then expire slowly as a white dwarf. But stars many times more massive than our Sun will die spectacularly as supernovas and transform themselves into pulsars and black holes. In this program we will show how these transformations come about and what effect black holes have on space-time.

The Quest for New Planets. Showing March 6-April 11. In our Solar System, the planets Uranus, Neptune and Pluto were discovered. And in the seventies and eighties the Voyager spacecraft discovered many moons. Now, astronomers are using special observing techniques to infer the existence of planets orbiting distant stars. What are these new planets and how far are they from the Earth?

The Search for Extraterrestrial Life. Showing May 1-June 13. The search for the "stuff of life" among the planets of our Solar System continues and so does the quest for an intelligent message from among the stars. In our Solar System, Jupiter's moon Europa may harbor an ocean of water, and Saturn's Titan may mimic the chemistry of an early Earth. In this show we will explore these moons and learn how radio astronomers are listening for messages from the stars.

As you consider your gift-giving this Christmas, pay a visit to the Starry Nights Gift Shop. Here you will find numerous unique stocking stuffers like "rock collection pencils" and "polished stones in a little jar," prisms, astronomical T-shirts and posters and science books that will please both kids and adults.

Also, the Gift Shop has a limited number of signed copies of books by Dr. Timothy Ferris *(The Whole Shebang)*, Dr. Donald Goldsmith *(The Hunt for Life on Mars)*, Dr. Mike Reynolds *(Basic Astronomy Labs)*, as well as the novel by astronaut Buzz Aldrin, *Encounter with Tiber*. You should know that the annual 1998 astronomical calendars are also in stock. These include the *Wonders of the Universe 1998* wall calendar, the pocket *1998 Moon Phases Calendar*, *Sky Watch 1998* by *Sky & Telescope*, and the wonderful Guy Ottewell *Astronomical Calendar 1998*. Finally, also check out the new sets of Finley-Holiday Film Corp. slides and CD ROM Hubble and Mars picture sets at the Gift Shop. The available slide sets include a spectacular set of 20 slides of Mars in 3-D, including 3-D glasses..

Have a very merry and astronomical Christmas!

Mars Pathfinder Postage Stamp

Continued from page 1

Based on the first image received from the Mars Pathfinder after its landing on the Martian surface July 4, 1997, the stamp features the Sojourner rover resting on the Pathfinder with a panoramic view of the Ares Vallis region of Mars in the background. Informational text about the Pathfinder mission is printed on the reverse of the stamp sheet. Fifteen million of the stamps have been printed.

"That first historic image of Pathfinder and the rover sitting safely on Mars ignited worldwide interest in our efforts to explore Mars," said JPL Director Dr. Edward C. Stone. "It is an honor for this mission to be recognized by issuance of this special U.S. postage stamp."

The Mars Pathfinder stamp is the third U.S. stamp subject to incorporate hidden images to prevent counterfeiting, while adding an interesting design element. The hidden text – Mars Pathfinder, July 4, 1997 and the letters USPS –is not visible to the naked eye but can be viewed by using a decoder lens, which is available through the Postal Service's Philatelic Fulfillment Center in Kansas City, MO. The U.S. Air Force and Classic Movie Monsters stamps issued earlier this year also feature hidden images.

Since its Independence Day landing, Pathfinder has returned 2.6 billion bits of information, including more than 16,500 images, as well as chemical analyses of rocks and extensive data on winds and other weather factors.

How to order the first day of issue postmark.

Customers have 30 days to obtain the first day of issue postmark by mail. They may purchase the new stamps at their local post office, affix the stamps to envelopes of their choice, address the envelopes (to themselves or others), and place them in a larger envelope addressed to:

Mars Pathfinder
Postmaster
600 Lincoln Avenue
Pasadena CA 91109-9998

After applying the first day of issue postmark, the Postal Service returns the envelope through the mail. There is no charge for the postmark. All orders must be postmarked by January 9, 1998. The Philatelic Fulfillment Service Center also offers first day covers for new stamp issues and postal stationery items postmarked with the official first day of issue cancellation. Each item has an individual catalog number and is offered in the quarterly USA Philatelic catalog. Customers may request a free catalog by writing to: USA Philatelic Catalog, US Postal Service, PO Box 419014, Kansas City, MO 64179-6014.

The Star of Bethlehem

What might the Star of Bethlehem have been? Join Chabot Observatory & Science Center on a journey back in time to the year 2 BC to view the constellations and the celestial events that took place over Bethlehem. The conclusions reached in this beautiful show will inform, please, and surprise you! A short tour of the magnificent Winter constellations will follow the theater presentation in the Chabot-Rotary Planetarium.

This program opens November 28 and runs through December.
EAS members admitted free on a space-available basis. Please call (510) 530-3480 ×36 for reservations.

Comet Comments *by Don Machholz*

One faint comet has recently been discovered; it was found by Jeff Larson using the Spacewatch equipment at Kitt Peak. It is not expected to become bright. Meanwhile the SOHO satellite picked up two more sungrazer comets falling into the sun.

Several comets are visible to us these nights. Comet Hale-Bopp is quite far south, many Northern Hemisphere observers have had their last view of this great comet. Comet Meunier-Dupouy remains in the north. Periodic Comet Hartley 2 crosses the Milky Way in the evening sky while the beautiful Comet Utsunomiya passes further north. Periodic Comet Temple-Tuttle, responsible for the Leonids Meteor Shower each November, returns after a 33-year absence. Its brightness curve may not be as steep as shown in the ephemeris below.

Comet Hunting Notes: Since January 1975, 48 different individuals have visually discovered comets that now carry their names. What countries do they live in? Twenty-three are in Japan, nine reside in the USA, with four in Australia. Other countries represented are the old USSR, Canada, England, South Africa, Philippines, Italy, New Zealand and Norway. The most discovery events occurred in Japan (33) followed by the USA (30) and Australia (19).

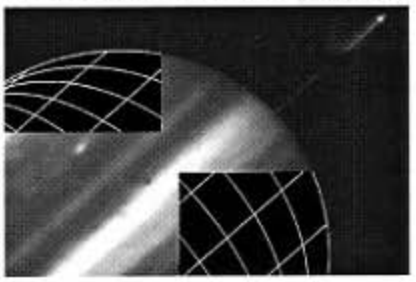
Date (00UT)	R.A. (2000)	Dec.	Elong.	Sky	Mag.
C/1995 O1 (Hale-Bopp) [Vela-Carina]					
11-28	07h35.1m	-59°29′	90°	M	7.2
12-03	07h25.5m	-60°46′	91°	M	7.3
12-08	07h14.9m	-61°52′	91°	M	7.4
12-13	07h03.3m	-62°46′	92°	M	7.5
12-18	06h50.9m	-63°29′	92°	M	7.6
12-23	06h38.1m	-64°00′	92°	M	7.6
12-28	06h25.1m	-64°19′	92°	E	7.7
01-02	06h12.3m	-64°26′	92°	E	7.8
C/1997 J2 (Meunier-Dupouy)					
11-28	17h55.6m	+48°34′	73°	E	11.7
12-03	18h09.4m	+47°22′	73°	E	11.7
12-08	18h22.8m	+46°11′	71°	E	11.7
12-13	18h35.9m	+45°01′	70°	E	11.6
12-18	18h48.6m	+43°53′	69°	E	11.6
12-23	19h00.9m	+42°47′	67°	E	11.6
12-28	19h12.9m	+41°43′	66°	E	11.6
01-02	19h24.4m	+40°42′	64°	E	11.6
C/1997 T1 (Utsunomiya)					
11-28	18h47.1m	+15°42′	52°	E	10.3
12-03	18h46.7m	+13°22′	48°	E	10.5
12-08	18h46.6m	+11°19′	43°	E	10.6
12-13	18h46.8m	+09°30′	39°	E	10.6
12-18	18h47.1m	+07°54′	35°	E	10.7
12-23	18h47.5m	+06°27′	32°	E	10.8
12-28	18h48.0m	+05°09′	29°	E	10.9
01-02	18h48.5m	+03°58′	27°	M	11.0
103P/Hartley 2					
11-28	20h59.2m	-09°27′	69°	E	8.4
12-03	21h18.1m	-09°29′	68°	E	8.2
12-08	21h38.2m	-09°25′	68°	E	8.1
12-13	21h59.4m	-09°14′	68°	E	8.0
12-18	22h21.7m	-08°56′	68°	E	7.9
12-23	22h45.1m	-08°31′	68°	E	7.8
12-28	23h09.4m	-07°58′	69°	E	7.8
01-02	23h34.5m	-07°17′	70°	E	7.9
55P/Tempel-Tuttle					
11-28	12h29.0m	+14°26′	66°	M	17.3
12-03	12h31.4m	+15°16′	71°	M	16.7
12-08	12h33.6m	+16°23′	76°	M	16.1
12-13	12h35.6m	+17°53′	81°	M	15.5
12-18	12h37.1m	+19°57′	86°	M	14.8
12-23	12h38.0m	+22°51′	92°	M	14.0
12-28	12h37.9m	+27°03′	98°	M	13.2
01-02	12h35.9m	+33°30′	105°	M	12.3

Object	*Hale-Bopp*	*Meunier-Dupouy*
Peri. Date:	1997 04 01.1370	1998 03 10.4365
Peri. Dist (AU):	0.914008	3.051015
Arg/Peri (2000):	130.5787°	122.6755°
Asc. Node (2000):	282.4653°	148.8429°
Inclin. (2000):	089.4268°	091.2731°
Eccentricity:	0.995085	1.000760
Orbital Period:	~2500 years	Long Period

Tempel-Tuttle	*Hartley 2*	*Utsunomiya*
1998 02 28.1034	1997 12 22.0242	1997 12 10.0570
0.976639	1.031725	1.359850
172.4930°	180.7240°	095.8952°
235.2568°	219.9547°	053.7059°
162.4861°	013.6191°	127.9898°
0.905507	0.700391	1.0
33.23 years	6.39 years	Long Period (?)

Probing Jupiter's Atmosphere

for the first time, the Hubble Space Telescope's new Near Infrared Camera and Multi-Object Spectrometer (NICMOS) provides a sharp glimpse of the planet's ring, moon, and high-altitude clouds.



The presence of methane in Jupiter's hydrogen- and helium-rich atmosphere has allowed NICMOS to plumb Jupiter's atmosphere, revealing bands of high-altitude clouds. Visible light observations cannot provide a clear view of these high clouds because the underlying clouds reflect so much visible light that the higher level clouds are indistinguishable from the lower layer. The methane gas between the main cloud deck and the high clouds absorbs the reflected infrared light, allowing those clouds that are above most of the atmosphere to appear bright. Scientists will use NICMOS to study the high altitude portion of Jupiter's atmosphere to study clouds at lower levels. They will then analyze those images along with visible light information to compile a clearer picture of the planet's weather. Clouds at different levels tell unique stories.

Besides showing details of the planet's high-altitude clouds, NICMOS also provides a clear view of the ring and the moon, Metis. Jupiter's ring plane is visible as a faint line on the upper right portion of the NICMOS image. Metis can be seen in the ring plane (the bright circle on the ring's outer edge). The moon is 25 miles wide and about 80,000 miles from Jupiter.

Credits: Reta Beebe (New Mexico State University), and NASA

DATELINE DECEMBER

25	1642	Isaac Newton, born
23	1672	Cassini discovered Rhea
15	1857	Edward Barnard, born
7	1972	Apollo 17 launched
6	1997	First Quarter Moon, 22:10 PST = 06:10 UT 7 December
8	1997	Moon occults Saturn,11:18 PST
11	1997	Venus at greatest brilliancy, –4.7
12	1997	Moon occults Aldebaran, 19:50 PST
13	1997	Full Moon, 18:37 PST = 02:37 UT 14 December
13	1997	Geminid meteors peak
21	1997	Winter Solstice, 12:05 PST = 20:05 UT
21	1997	Last Quarter Moon, 13:44 PST = 21:44 UT
29	1997	New Moon, 08:56 PST = 16:56 UT

FUTURE CONJUNCTIONS

11 December. EAS board meeting. 7:30 p.m.

13 December. EAS lecture meeting.
Dr. David Cudaback. High-Altitude Astronomy.
Election of EAS Officers.

5 January. Launch of Lunar Prospector.

8 January. EAS board meeting. 7:30 p.m.

10 January. EAS lecture meeting.

26 February. Total eclipse of the Sun.

✔ Check our our Web Sites at:

http://silcon.com/~eas
http://chabot.cosc.org/eas

You'll find:

✔ The latest copy of *The Refractor* with images in color.
✔ Information about the **Eastbay Astronomical Society**
✔ Great astrophotographs by **EAS** members.

If you have photos you would like to have displayed on our Web page, please submit a .gif file, .jpg file or a color print to the *Refractor* editor, Ellis Myers. Phone (510) 284-4103. We would be happy to include your work.

Rotary-Chabot Planetarium Shows

Fridays and Saturdays, 7:30 p.m.

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

The Star of Bethlehem through December 27

Star Death–Supernovas, Pulsars and Black Holes
opens January 9

Eastbay Astronomical Society
4917 Mountain Boulevard • Oakland, California 94619

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