



San Francisco Amateur Astronomers

The Randall Museum
199 Museum Way, San Francisco, CA 94114

President:	Bob Levenson	468-3592
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BULLETIN FOR MARCH 1991

Date: WEDNESDAY, MARCH 20
Time: 8:00 PM
Place: THE RANDALL MUSEUM
Speaker: DR. RICHARD YOUNG
NASA - Ames Research Center
Topic: GALILEO - Mission to Jupiter

Dr. Richard E. Young is a project scientist for Galileo Probe, Galileo Mission to Jupiter. His interests are in Dynamic meteorology (Earth and Planetary atmospheres). His interests and responsibilities also include Planetary mission experiment design, data interpretation (Galileo, Cassini). He is a member of the American Meteorological Society and the American Astronomical Society, Division of Planetary Sciences.

In 1972 Dr. Young received the NASA Special Achievement Award and in 1982 was co-recipient of the H. Julian Allen Award, Ames Research Center. In 1987 he received a NASA Group Achievement Award.

After graduation from the University of California Berkeley in 1966 with a B.S. in Engineering Physics he was with NASA-Ames Research Center as an Aerospace Engineer. In 1972 Dr. Young completed a Ph.D. in Planetary and Space Physics from UCLA and spent a year as a Postdoctoral Fellow in Boulder, Colorado with the National Center for Atmospheric Research. From 1973 to 1976 he was a Research Geophysicist at UCLA.

Since 1978 Dr. Young has been a Research Scientist at NASA-Ames Research Center, Moffett Fields, California.

NEXT SFAA STAR PARTY MARCH 16

The club's next star party at Rock Springs on Mount Tamalpais is on Saturday, March 16, beginning at dusk. Dress warmly and bring along your binocs, scope, family and friends to enjoy Jupiter, Mars and the Winter Milky Way.

The star party may be cancelled if there is bad weather. Save yourself a possibly wasted trip by calling the star party hotline (468-3592) on Saturday afternoon before you leave home.

ANNUAL BANQUET A BIG SUCCESS - by Jim Shields

About 30 SFAA members and their guests enjoyed good food and good company at the club's annual awards banquet January 26 at San Rafael Joe's. Officers and directors received certificates of appreciation for their contributions to the club during 1990. Later everyone shared anecdotes and memories about getting started in amateur astronomy.

Congratulations to this year's Herman Fast Memorial Award winner, Steve Gottlieb, who was guest of honor at the banquet. Steve has been teaching math in the East Bay for the last 18 years and, on the side, has found the time and energy to make himself a world class performer in both frisbee throwing (!) and deep sky observing. In the 1970s he held two world records in frisbee competition, toured Japan with the U.S. frisbee team, and performed at Warrior, 49er and Giant's games.

Steve started observing in 1976 with a small refractor he found in his father-in-law's garage. He says that he first really "discovered" the deep sky with his 6" reflector on camping trips throughout the Southwest in the late 70s. He confesses that, the first time out with his new scope, he didn't realize that the finder wasn't aligned with the main scope and, as a result, had a lot of trouble finding the Moon!

Steve's come a long ways since then. At last count he'd observed around 4,000 galaxies, nebulae and clusters from the Revised New General Catalog (RNGC) and more than 300 planetary nebulae, many of them recently discovered by professionals on photographs and never observed visually before. His articles and observations have been published in Sky & Telescope, Astronomy, Deep Sky, the Observer's Guide, the Webb Society Quarterly Journal and several local newsletters, including the SFAA Bulletin. (The Bulletin editor owes him a special word of thanks!) Steve's recent achievements include:

- * Helping to "clean-up" the RNGC by researching and reporting dozens of identification errors in the catalog.
- * Publishing the results of a massive visual survey of several hundred known planetary nebulae.
- * Compiling the database, from personal observations and research, used by Lumicon's "Sky Vector" - a computerized digital setting circle which guides the observer to some 1,500 deep sky objects.

Steve is currently working on expanded databases for more advanced computerized devices.

"1991" S.F.A.A. SPONSORED TOURS

PAGE 3

B? BOB LEWENSON

WE HAVE BEEN SUCCESSFUL, AGAIN THIS YEAR, IN ARRANGING GROUP ASTRONOMICAL TOURS FOR OUR CLUB. DUE TO THE POPULARITY OF THESE TOURS, ONLY A S.F.A.A. MEMBER AND HIS/HER GUEST MAY PARTICIPATE; ONE GUEST PER MEMBER, PLEASE:

1) LICK OBSERVATORY, SAN JOSE - SAT. JUNE 8TH

THIS IS AN EXCLUSIVE TOUR OF THEIR FACILITY, FROM 7:00PM TO MIDNIGHT. THE S.F.A.A. WILL BE PERMITTED TO HAVE A STAR PARTY AFTER MIDNIGHT. REFRESHMENTS & SNACKS WILL BE SERVED THROUGHOUT THE NIGHT (JUST LIKE LAST YEAR). CLEAN BATHROOM FACILITIES WILL BE AVAILABLE. SLEEPING ARRANGEMENTS ARE LIMITED TO SLEEPING BAGS & TENTS OUTSIDE OF THE BUILDING(S).

A) \$5.00 REGISTRATION FEE/PERSON IS REQUIRED.

B) TOUR IS LIMITED TO 50 PERSONS MAX.; 1ST COME, 1ST VIEW.

2) YOSEMITE, GLACIER POINT - FRI. AUG 2ND & SAT. AUG 3RD

The purpose of the Star Party is to provide an interpretive program on astronomy to the park visitors, please be prepared to answer questions, give explanations, and otherwise provide to the park visitors an introduction to astronomy. There will be problems of light pollution from flashlights as these visitors are not used to moving around in near total darkness. The club members are asked to be tolerant of persons who feel the need to use their flashlights. The clubs may wish to provide red plastic covers and rubber bands for the visitor's flashlights. After midnight when the program is over, the astronomers may request all flashlights off and they may then feel free to take photographs and observe for the rest of the night.

Bridalveil Campground: The group campsite should be reserved for you. Check with the campground host for camping site assignment. The Host's word is final. A maximum of 30 persons will be able to stay without charge on Friday and Saturday night. Each club will be asked to mail in a list of those who will be staying without charge. This list will be given to the campground host and referred to as people check in upon arrival. As a rule of thumb, the Park Service would like to have between 10 and 20 telescopes present at the Star Party.

Persons in excess of 30 will need to purchase campsites on a space available basis (first come first served, sorry no reservations). It may be advisable for a member of your group to come a day early to hold extra campsites at Bridalveil Campground. These sites must be paid for at prevailing rates. Individual campsites have a 6 person / 2 car limitation per site.

A) \$4.00 REGISTRATION FEE/PERSON IS REQUIRED.

B) EACH MEMBER IS REQUIRED TO BRING 1 TELESCOPE, MIN.

----- CUT HERE -----

TO: CHELLE BEARD, 32 PENHURST AVE. DALY CITY CA. 94015

FROM:

LICK OBSERVATORY,
YOSEMITE, GLACIER PT.,

PERSON(S) @ \$5.00 EACH =
PERSON(S) @ \$4.00 EACH =

A CHECK TO S.F.A.A.,

THE VOLCANOES OF IO

Joel W. Goodman

Last month we considered the fascinating planet Jupiter and its retinue of four bright satellites, probably the most entertaining cadre of objects in the Solar System for the amateur observer. Now let us home in on Io, the innermost of the Galilean satellites, made famous by the appearance of volcanism discovered on Voyager images in 1979. Indeed, as many as 8 active vents were detected by Voyager, making little Io the most volcanically active body we know of in the Solar System. The surface of Io is covered with lava from frequent eruptions of the numerous volcanoes. However, Io's lava is very different from Earth's, consisting of liquid sulfur and sulfur dioxide, the former being responsible for the striking orange-red coloration of the satellite. The extensive white areas on the surface are probably comprised of sulfur dioxide "snow".

The remarkable pictures sent us by Voyager were our first revelations of Io's volcanoes, but it may come as a surprise that they continue to be observed using ground-based observatory telescopes. This is all the more surprising when we consider that Io's disk never subtends an angle greater than 1.2 arc seconds, about the limit of resolution of a 4-inch telescope. Although theoretical resolution is proportional to aperture, the sad truth is that the potential resolution of large telescopes is never realized in practice due to limitations imposed by atmospheric turbulence. Therefore, no telescope on Earth, regardless of size, has ever resolved surface detail on Io.

What makes detection of Io's volcanoes possible is a specialized technique called disk-resolved infrared imaging. This method uses an infrared array camera to detect thermal hotspots. Taking advantage of the excellent atmospheric stability at Mauna Kea on Hawaii, an infrared array camera has been used since 1989 in conjunction with the 3.2 meter NASA Infrared Telescope Facility (IRTF) at the observatory. This electronic system achieved a remarkable image scale of 0.136 arcsec/pixel (a pixel being an individual element of which an electronic image is composed), permitting detection of at least 3 hotspots corresponding in location to known volcanoes on Io. Infrared imaging of Io is most sensitive when the satellite is eclipsed by Jupiter's shadow, because at such times the contrast between the hot volcanoes and the unlit background is greatly enhanced. The hotspots have varied in intensity, indicating changes in activity of the volcanoes. This approach will permit routine monitoring of location, size and temperature of major hotspots on Io from ground-based observatories.

Ain't technology grand?

Smile

Jupiter in March

by Fred Sammartino

Jupiter continues to dominate the night sky in March. It is high in the sky after sunset for easy viewing all evening. As the earth travels closer to Jupiter's equatorial plane, the number of satellite mutual events increases. Here are times (PST) for moon close conjunctions visible locally. The moons will actually touch in the ones indicated by "*".

Moon Close Conjunctions

(Eu=Europa, Ga=Ganymede, Ca=Callisto)

Eu-Ca: Sat, Mar 2, 11:08 PM	Io-Eu: Wed, Mar 13, 2:04 AM *
Eu-Ga: Sun, Mar 3, 11:43 PM	Io-Eu: Sun, Mar 17, 10:21 PM
Io-Eu: Tue, Mar 5, 11:54 PM *	Io-Eu: Mon, Mar 25, 12:26 AM
Io-Eu: Sun, Mar 10, 8:18 PM	Eu-Ga: Fri, Mar 29, 8:49 PM
Ca-Ca: Sun, Mar 10, 8:42 PM	Io-Eu: Sat, Mar 30, 7:33 PM *
Eu-Ga: Mon, Mar 11, 2:33 AM	Io-Ga: Mon, Apr 1, 8:07 PM

Have you noticed any changes in the red spot or equatorial belts? Chances are that Jupiter will return to its normal symmetric appearance before its next opposition, so now is the time to look for subtle changes in the details and color of the cloudtops and spot. The red spot should be visible for about an hour and a half before and after the times listed below.

Red Spot at central meridian (PST)

Sat, Mar 2, 10:38 PM	Tue, Mar 12, 8:54 PM	Sun, Mar 24, 12:58 AM
Tue, Mar 5, 12:17 AM	Thu, Mar 14, 2:41 AM	Sun, Mar 24, 8:49 PM
Mar 5, 8:08 PM	Thu, Mar 14, 10:33 PM	Tue, Mar 26, 10:28 PM
Thu, Mar 7, 1:55 AM	Sun, Mar 17, 12:11 AM	Fri, Mar 29, 12:07 AM
Thu, Mar 7, 9:46 PM	Sun, Mar 17, 8:02 PM	Fri, Mar 29, 7:58 PM
Sat, Mar 9, 11:25 PM	Tue, Mar 19, 1:50 AM	Sun, Mar 31, 1:45 AM
Sun, Mar 10, 7:16 PM	Tue, Mar 19, 9:41 PM	Sun, Mar 31, 9:37 PM
Tue, Mar 12, 1:03 AM	Thu, Mar 21, 11:19 PM	Tue, Apr 2, 11:15 PM

Here are some interesting moon configurations for March. The red spot and moons move right to left in front of Jupiter and left to right behind Jupiter in these pictures. Moons not shown are out of the field of view. All times are PST.

Sunday evening, March 10 - Multiple moon conjunctions

7:30 PM - Io exits transit, shadow under red spot

8:18 PM - Io and Europa in close conjunction

8:43 PM - Ganymede passes above Callisto

2:33 AM - Europa passes under Ganymede

Thursday, March 14 - Now you see it, now you don't!

11:18 PM - Ganymede, having suddenly emerged from occultation appears as a diamond on Jupiter's dark limb

11:34 PM - only 16 minutes later, Ganymede fades into invisibility in Jupiter's shadow. The red spot is also visible

Sunday, March 17 - Jupiter's moons form a double-double star

9:16 PM - Io emerges from transit, Io shadow visible near central meridian, red spot visible.

10:06 PM - Io & Europa and Ganymede & Callisto form a similar pairing on either side of Jupiter (shades of Epsilon Lyrae!)

Tuesday, March 26 - Europa and Callisto play hide and seek

8:06 PM - Callisto disappears in occultation behind Jupiter

8:56 PM - Europa enters transit, and is hard to see in front of Jupiter, red spot visible

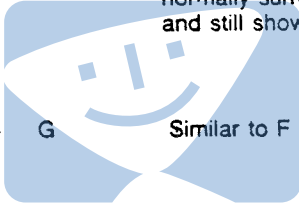
11:51 PM - Europa exits transit, having beaten the red spot in a race across the face of Jupiter. Europa shadow visible. Callisto still hidden behind Jupiter.

12:56 AM - Callisto finally emerges from occultation. Europa shadow visible just past central meridian.

Sun is really active these days as our jam jar lid sketch shows tremendous regions crossing the disk. After the high sunspot count of a year and eight months ago, we are now experiencing a second peak of this sunspot cycle #22.

These pictures below show us the various types of sunspot regions which are classified as letters "A" through "J". Officially known as McIntosh Designations, the Solar Division (of the Space Environment Service in Boulder, Colorado) assigns one of these letters to each numbered region each day. For example, a region may be designated as a type "A" one day, only to be reclassified as "C", "D", "E", on each of the next three days. Perhaps by the time it has been on the disk five days, it will have become a gigantic "F" - like some of those rare visible-to-the-naked-eye (through a dense filter, remember!).

<u>Class</u>	<u>Description</u>	<u>Example</u>
A	A small spot, or spot group with no surrounding penumbra	
B	Similar to A, but spots showing definite association with one another, or they are symmetrically patterned (bipolar), but with no surrounding penumbra.	
C	A bipolar group in which the largest members are surrounded by one penumbra.	
D	A bipolar group in which major spots exhibit a penumbra.	
E	Very large bipolar group, larger than 10° across; the major spots exhibit very complex penumbra, between which are smaller spots many of which (or all) exhibit penumbra.	
F	The largest bipolar groups, 15° or larger, normally surrounded by complex penumbra and still showing random small spots.	
G	Similar to F but having no random spots.	
H	A large spot surrounded by penumbra with small random spots nearby; larger than 2.5°.	
J	A single spot (polar) with a penumbra.	



Smile

(Note There is no "i")

LEPUS, THE HARE - By Gordon Ridley

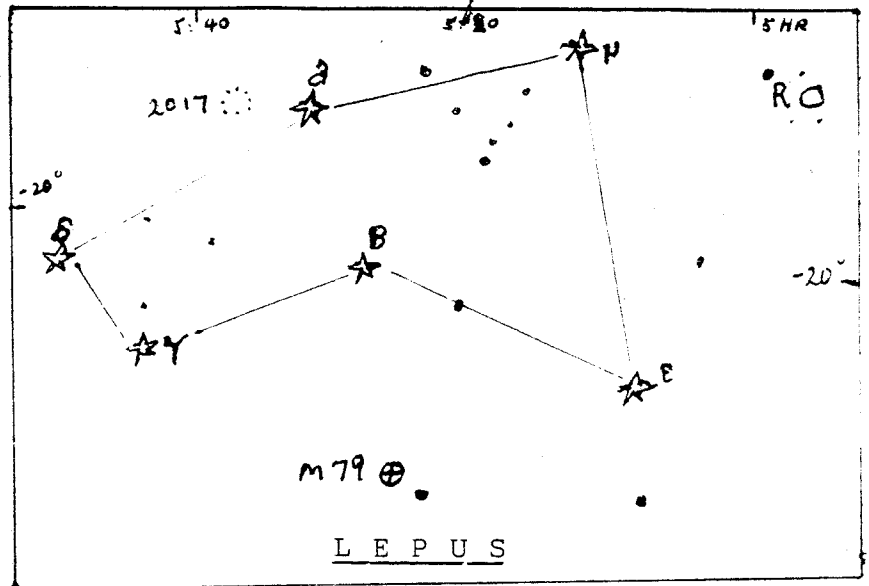
Because it is so close to the bright stars and stunning Messier objects in Orion and Canis Major many amateurs forget Lepus, the Hare, sitting right below Orion and adjacent to his dog Canis Major. Nevertheless Lepus has a lot of beauty and interest in its own right. Historically with the ancient Greeks in Sicily, which country was noted in those days for the great devastation of being overrun with hares, out came the fanciful story that Lepus, the Hare, was placed in the heavens near its hunter Orion. This

story perplexed much of the ancient world for many could not understand why Orion, the Mighty Hunter, and his dog should pursue this most timid of creatures.

A close examination will reveal much of interest in this constellation, particularly the following: Gamma Leporis, a wide double star with a pleasing color contrast, an appealing object for even the smallest telescope. With magnitudes of 3.59 and 6.18 it has been variously described as yellow and garnet, pale green and garnet, and yellow and orange. It makes a beautiful low power object in a field of many stars. What does it look like to you?

Second: "R" Leporis, also known as Hind's Crimson Star, is a famous long period pulsating variable. Discovered by J. R. Hind in London in 1845 it is described as an intensely smoky red, resembling a glowing coal, a ruby, or as Hind himself describes it "like a drop of blood on a black field". It has been said that the colors of Antares and Betelgeuse were "mere pale shades" when compared to the wine-red hue of "R" Leporis. Even E. J. Hartung in 1968 mentions it gleaming "like a crimson jewel in a field sprinkled with stars". An interesting point in connection with this star is that the fainter it gets the redder it becomes. And lastly, M79, a globular cluster discovered in 1780, with a magnitude of 8.4 and diameter of $7\frac{1}{2}'$, about 54,000 light years away. While M79 is not as well known as M5 or M13 it is still worth a good look. M79 is described as pretty large, extremely rich and compressed, and well resolved into stars.

Give all three of the above a look==you will be glad you did!



BOARD MEETING

The next meeting of the SFAA Board of Directors is on Wednesday, March 13, at 8:00 pm at the Randall Museum. All club members are invited to attend Board meetings. Bring along your ideas and suggestions.

MARCH LIST OF MESSIER OBJECTS by Dennis Tye

This month there are eleven objects listed - eight open clusters and one globular, a reflection nebula and a supernova remnant. It's cleanup time for open clusters. The only globular is not particularly spectacular; most of the better ones appear in the summer sky. The nebula and supernova remnant are more difficult objects to find, but have a look for them now, anyway. If you're not successful, try again next winter when you've got more experience under your belt.

NGC#	MES	RA	DEC	Mag	TYP	SIZE	DIST	CON	DESCRIP
2168	035	06 05.7	+24 20	05.3	OCL	040'	0790	GEM	A rich bright cluster with about 120 members. Should fill up the entire field of view at moderate magnification.
2287	041	06 44.9	-20 42	05.0	OCL	030'	0760	CMA	Large cluster with many bright members.
2323	050	07 00.5	-08 16	06.9	OCL	016'	0800	MON	Smaller cluster, maybe visible in finder with many members.
2422	047	07 34.3	-14 22	04.5	OCL	025'	1150	PUP	Very bright cluster, visible to naked eye. Contains stars as bright as 5.7 mag. Look for different colored stars.
2632	044	08 37.5	+19 52	03.7	OCL	095'	0158	CNC	Praesepe The "Beehive" cluster. As many as 350 stars mag 17 or brighter in a field greater than 1 deg. Use your lowest magnification here.
2682	067	08 48.3	+12 00	06.1	OCL	015'	0830	CNC	A tight cluster of about 150 stars. Nice at higher magnification. An older cluster with rust, orange, gold and yellow stars.
1904	079	05 22.2	-24 34	08.4	GCL	003.2'	013K	LEP	Here's our first globular, unfortunately not too large or spectacular. Good training for you to find and recognize. These small, faint globulars look like "dewed" stars. Can't resolve any of the members. More like it to come.
2437	046	07 39.6	-14 42	09.2	OCL	024'	1820	PUP	Just 5 min. in RA off M47. A rich open cluster with about 200 members. Taking up almost a full degree field. See if you can spot NGC 2438, a small planetary nebula close by the center of this cluster.
2447	093	07 42.4	-23 45	06.0	OCL	025'	1100	PUP	A large open cluster containing about 60 members
1952	001	05 34.5	22 01	08.4	SNR	005'		TAU	CRAB This was tough to find. I finally spotted it - a faint cloud of gas without visible structure.
2068	078	05 46.7	00 03	09.0	DIF	007'		ORI	Another difficult object, north of the belt of Orion. A pair of stars encircled by faint haze.

THE MESSIER MARATHON - by Tom Hoffelder

All of the Messier objects can be seen during the course of a single clear, moonless night near the first day of spring in mid-March. This challenge, known as the Messier Marathon, does not allow time for detailed study of the objects, but it does provide a unique and interesting project that will sharpen your observing skills.

The right angle sweep is the easiest way to locate more than 100 objects in one dusk-to-dawn period. This method uses sweep distances and directions for each object from an easily identifiable star that lies nearby or from the object previously located. After the appropriate star is centered in the eyepiece, the telescope is moved north or south, then east or west, the required distances. (While an equatorial mount is recommended, these movements can be approximated on Dobsonian mounts with good results.) The distances are measured by observing background stars as they cross the field of view, so the sweep is simplified by the use of a one-degree true-field eyepiece.

(Whether you observe ten Messier objects at the March star party, or a hundred, the right angle sweep is fun and will help you get better acquainted with the sky. Shown below are sweep distances and directions for this month's selected Messier objects. If you'd like the complete list, call Tom at 726-7491 in Half Moon Bay.-ED.)

M35 - 1.1°N, 1.1°E of 1 Gem	M67 - .1°S, 1.8°W of Alpha Cnc
M41 - 4°S, .4°E of Sirius	M79 - 3.8°S, .9°W of Beta Lep
M50 - 3.7°N, 2.1°E of Theta Cma	M93 - 1°N, 1.1°W of Xi Pup
M47 - 1.2°N, 8°E of Gamma Cma	M1 - .9°N, .7°W of Zeta Tau
M46 - .4°S, 1.1°E of M47	M 78 - 2°N, 1.5°E of Zeta Ori
M44 - Beehive Cluster (naked eye)	

NEW ASSOCIATE EDITOR

With this issue we welcome Elizabeth Carden as Associate Editor of the SFAA Bulletin. She'll be working with Jim Shields to help make future issues even better. (We hope you've enjoyed the many interesting contributions by club members recently.) Send your letters, sketches and articles on astronomical topics to SFAA Bulletin, C/O Jim Shields, 190 Chilton Avenue, San Francisco 94131. The deadline remains the 18th of the month.

SFAA MEMBERSHIP BENEFITS

The club now offers three kinds of membership, with annual dues as follows:

REGULAR membership - \$20
FAMILY membership - \$25
JUNIOR membership - \$ 5 (for astronomers under 18)

SFAA members receive the monthly Bulletin and free admission to club activities including monthly lecture meetings and star parties, field trips and the annual picnic. In addition, they may subscribe to various astronomy magazines at greatly-reduced rates. For more information, contact Chelle Beard, 32 Penhurst Avenue, Daly City 94015. Telephone 878-4965 evenings.

Scaling Hubble's Troubles
Lewis Carroll Epstein
Physics Dept., San Francisco City College

Popular astronomers are fond of inventing stories to scale things. Like if an atom were as big as this lecture auditorium its nucleus would be as big as a house fly, or if the earth were as big as this apple how big would the sun be? Stuff like that. Here is a story to scale the Hubble Space Telescope's troubles, but you won't see it recited in too many official popularizations.

Suppose a junior high school hotshot decided his science project would be to photograph the Andromeda galaxy, which is visible to the naked eye on a clear dark night. If just a smudge could be recorded on the film that would be counted as a success--no fancy stuff like spiral arms expected. Suppose the young genius even got a federal Future Scientists of America Excellence in Education grant to buy a tripod and film and whatnot. And as people spending other people's money often do, he spent a lot more than necessary on the project. For instance he bought a chrome-plated tripod with shaky legs.

Anyway, the kid, who is supposed to be sharp, gets the project in real late. But, overdue or not, does it work? No. The set up won't photograph Andromeda. Well, will it photograph anything? Yes it will. It is only a partial failure. Well, well, what will it photograph? Rigel and Betelgeuses, the brightest stars in the constellation of Orion, are the faintest things it will photograph!

These stars are about three magnitudes brighter than the Andromeda galaxy. At the 20 December 1990 Lawrence Radiation Laboratory Research meeting, Professor Ivan King of the University of California at Berkeley Astronomy department reported the space telescope's limiting magnitude was about 24 rather than the designed for, intended and expected 27. A difference of three magnitudes.

Another dramatic illustration is the size and cost difference between star atlases differing by three in limiting magnitude. A magnitude is a factor of approximately 2.5 in brightness. So a loss of three magnitudes means the faintest things which the telescope can see must be about fifteen times brighter than what the telescope intended to see.

The brightness of a 24th magnitude star can also be visualized by scaling. The brightness ratio between a 24th magnitude star and Sirius, which is the brightest star in the night sky, is about equal to the apparent brightness ratio between Sirius and the sun. In both cases the ratio is about one to ten billion. (For comparison the ratio between a single dollar and the S&L bailout cost is one to \$600 billion.)

So what happened to the hotshot junior high kid? Next semester the government kicked in more money for the same kid to do another project.

WHAT PHYSICISTS DO

"Physics is what physicists do late at night"

FORTY-FIRST SERIES SPRING 1991

Mondays at 4:00 p.m.
Darwin Hall, Room 108

Coffee at 3:30 p.m.

- MARCH 11** **NEARBY STARS WITH CIRCUMSTELLAR MATERIAL**
Dr. Dana Backman of the NASA Ames Research Center will discuss infrared observations made with space and ground-based telescopes that yield indirect evidence of planetary formation.
- MARCH 18** **MORE HEAT THAN LIGHT**
Dr. Helen V. Gourley of the System Sciences Group, San Francisco, will discuss why you should call a physicist when your optical system begins to smoke, smolder and sizzle.
- MARCH 25** **THE BEGINNING AND END OF TIME**
Dr. Joel Primack of the University of California, Santa Cruz, will explain how the universe might have begun, what might have come before, and how it might end.
- APRIL 8** **HIGH RESOLUTION IMAGING FROM THE GROUND**
Dr. Carol Christian of the University of California, Berkeley, will discuss current instrumentation and techniques for obtaining sharper astronomical images.
- APRIL 15** **IS PHYSICS A RELIGION?**
Dr. Lewis Carroll Epstein of the City College of San Francisco will discuss a question often contemplated in private but seldom discussed in public.
- APRIL 22** **COMPARISON OF ENERGETIC THIN FILM DEPOSITION PROCESSES**
Dr. Bryant Hichwa of Optical Coating Laboratory, Inc., Santa Rosa, will describe how Rutherford backscattering experiments can be used to determine the density and composition of thin films.
- APRIL 29** **X-RAY DIFFRACTION AT SSU**
Dr. John Dunning of Sonoma State University will present insights gained during the first eight months of operation of the new Rigaku X-ray diffractometer and explain why X-ray diffraction is the analytic technique of choice for many crystalline materials.
- MAY 6** **DO TRANSISTORS CONSERVE CHARGE?**
Dr. David E. Root of Hewlett-Packard, Santa Rosa, will discuss the controversy involving conservation laws and the implications of symmetry for modeling the nonlinear behavior of microwave transistors.
- MAY 13** **WHAT WE TEACH AND WHAT IS LEARNED - CLOSING THE GAP**
Dr. Lillian McDermott of the University of Washington will describe some recent investigations of student difficulties in physics and will discuss how the results can be used to guide instruction.



MAR	8	8:00 - 10:00	Jupiter, Orion Nebula
APR	19	9:00 - 11:00	Moon, Praesepe cluster
MAY	10	9:00 - 11:00	Galaxies, Venus
JUN	7	9:00 - 11:00	Hercules cluster, galaxies
AUG	30	9:00 - 11:00	Ring Nebula, Saturn

Observatory

Friday Evenings

The Observatory is inside the football field at the SE corner of the campus, East Cotati Avenue and Petaluma Hill Road, 2 miles east of U.S. 101 at Cotati. Follow signs from the freeway to the campus. Call before coming if it appears likely that clouds may force cancellation. (707) 664-2267

Smile



SONOMA STATE UNIVERSITY

Department of Physics and Astronomy, Sonoma State University, Rohnert Park, CA 94928 (707) 664-2119

San Francisco Amateur Astronomers

The Randall Museum
199 Museum Way, San Francisco 94114



WHAT'S UP IN 1991

- | | |
|---------------|---|
| April 20 | Astronomy Day |
| May 5 | San Jose Auction (tentative) |
| May 12-19 | Texas Star Party |
| May 24-26 | Riverside Telescope Makers' Conference |
| June 8 | SFAA Field Trip to Lick Observatory |
| June 21-27 | Astronomical Society of the Pacific
conference at Laramie, Wyoming |
| July 11 | Solar Eclipse Day !!! |
| August 2-3 | SFAA Field Trip to Yosemite |
| August 5-9 | Astronomy Week at the Sierra Nevada Field
Campus in the High Sierras |
| August 17 | Star-B-Cue at Fremont Peak |
| September 7 | SFAA Annual Picnic at Mount Tamalpais |
| September 7-8 | AANC Star Party Weekend at Grant's Ranch
on Mount Hamilton |