



SAN FRANCISCO Amateur Astronomers

SHARING THE WONDERS OF THE UNIVERSE

June 1993

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The SFAA Board of Directors meets on the second Wednesday of each month at 8:00 P.M. at the Copper Penny Restaurant, Geary and Masonic. All club members are welcome at Board meetings.

The SFAA Bulletin is a forum in which club members may share their ideas and experiences in astronomy. We encourage you to participate and welcome your letters, sketches and articles on astronomical subjects. Please send your contributions to: SFAA Bulletin Editor, 190 Chilton Avenue, San Francisco 94131. Deadline is the 18th of the month before publication.

More Adventures with the Space Telescope

The San Francisco Amateur Astronomers holds lecture meetings on the third Wednesday of each month at 8:00 P.M. at Morrison Planetarium, California Academy of Sciences, Golden Gate Park. At the next monthly lecture meeting on **June 16**, SFAA member Nancy Cox will be telling us all about her further adventures with the Hubble Space Telescope.

When we last heard from Nancy in August, 1992, her proposal for observing time on the Hubble Space Telescope had just been accepted. Since then, she has visited the Space Telescope Science Institute in Baltimore, Maryland (see her story beginning on page 4); appeared in *Sky & Telescope*; and worked out the details of her observing plan. She has also received much addi-

tional information and many superb photographs from the Space Telescope Science Institute, which she will share with us.

Nancy's proposal uses the Space Telescope's ultraviolet spectrometers to study the wavelengths of the UV emission lines from the Lagoon Nebula. Hopefully, the study will gain new information about the chemical content of star-forming regions.

Nancy is a full-time registered nurse, a dedicated amateur astronomer and an avid naturalist. She is currently working toward a degree in marine biology at San Francisco State. She is a former vice-president of the SFAA and our current AANC representative.

Mount Tamalpais

The next star party at Rock Springs on Mount Tamalpais is on Saturday evening, **June 19**, beginning at dusk. Plan to arrive by 8:30 P.M. to hear William Clemens of UC Berkeley talk about *Mass Extinctions?* in the nearby Mountain Theatre. Gordon Robinson and Irving Hochman are in charge of the June star party.

Astronomy Day

Each year Astronomy Day is celebrated in April. This year, as in years past, the San Francisco Amateur Astronomers set up exhibits at the San Francisco Academy of Sciences. Ray Cash, Art Owens and Bob Levenson had lines at their solar telescopes throughout the day. The weather cooperated most of the time so that nearly everybody had a chance to see some sun spots.

We also laid out a scale model of the Solar System in front of the Academy stretching 350 feet from the Sun to Pluto. Dennis Tye and Tom Kellogg explained to visitors that Pluto was just a .001" speck 353' away from the 1" Sun. Ray Cash had made up some real nice stands on which information sheets and pictures of the planets were presented.

Other members on hand to greet visitors and hand out club information included Mary Anne Levenson, Chelle Beard, Craig Harris and Nancy Cox. A special thanks is due to Norma Zimmer who was our Astronomy Day coordinator and who helped organize the day's events.

All in all it turned out to be quite a successful day. No one kept count of the number of visitors we had, but 100's would be a conservative count, if not 1000+. Next year I'll have

to remember to bring along sunblock—astronomers are not used to being out in daylight—a week later I was still peeling from a good case of too much starlight.

By the time we arrived at Rock Springs at dusk, there was pretty solid overcast. Mike and Liliane Anderson were there, hoping to get *first light* on their new C-8. So were Tom Kellogg, Jim Webster, Bill McLure, Jim Shields, Earl Chin with his family, and Bob Bryne. Altogether there were about 6 or 7 telescopes. The weather probably discouraged a bigger turnout.

This was the first night of the summer lecture series. The speaker was Dr Seth Shostak from the SETI Institute. After the talk, as luck of the Irish or whatever, the overcast did start to break up. At first about all we could see was the Moon, then Jupiter started coming through. That was enough to please most of the crowd. Then we started getting some genuine holes through which, if we were quick, we could catch glimpses of more interesting things.

Jim Shields had finder charts for Supernova 1993J and we were able to get it in view long enough for everyone to see it. That was enough to make the night worthwhile.

It was a strange night. I'd find something to look at and the next person at the eyepiece would say, "there's nothing there!" Sure enough when I looked again the clouds had moved in. It was like that all night. About 11:30 P.M. the clouds got really bad so everyone decided to pack it in. Naturally, after all the cars were loaded, it cleared up again, but we decided to call it a night anyway.

—Dennis Tye

Observing Awards

I don't know about others, but I find that I need some defined goals to give me an incentive when I go out for a night's observing. I find it hard to just go out and *observe*. I guess that's how I got started on the Messier list—110 objects. Now that's a *number* I can shoot for. Only 55 more to go... only 37 more to go ... etc.

After finishing the Messier list I'd been kind of drifting around again as far as observing goals. Then I read Gordon Ridley's article early this year on observing the Local Group of galaxies and it gave me an idea.

Now, the Astronomical League has its Messier Club and its Herschel Club. Why can't the SFAA have some observing awards of its own? So I looked around for some achievable yet challenging observing goals that we could organize.

I came up with a couple that could be fun. First, how many of you have seen *all* nine planets of the Solar System? Not too many I venture to guess, but that's what makes it a worthwhile goal. Like Bingo the first spot is easy - just look between your toes and you've got your first planet, Earth. One down, eight more to go. On most any clear night you can go out and spot Venus, Jupiter, Mars and Saturn, the *third through sixth* brightest objects in the sky. Easy, and you've now got over half of the planets.

Mercury is easy if you know when and where to look. Uranus is an easy binocular object and Neptune is close by. You've now got eight out of nine with no sweat. Pluto is the only challenge—can't make this too easy for you. Pick up this last planet and you can qualify for the new *Planet Observer* award.

After finding all the planets, it should be easy to spot some of the satellites of the planets. Again the first is a freebie—how could you possibly miss our Moon. Mars has a couple of moons that are a bit of a challenge. Jupiter has four that are no sweat. Saturn has seven observable moons of which five are fairly easy. Uranus has two and Neptune has one moon, all of which are not easy, but doable. Altogether there are about ten easy and another five or seven that are a challenge. I'd love to have an award that says, *I've Mooned the Solar System*. We could have maybe three levels of the Moons Award: the first level for 12 moons, next level for 14 moons and super level for 16+ moons.

—Dennis Tye

Yosemite July 9–10

It may not be too late to sign up for the Yosemite Star Party on the weekend of July 9–10. This event is open to SFAA members, their families and guests only. Each member must bring a telescope to share with the general public on both Friday and Saturday nights at Glacier Point.

A basic fee of \$10.00 is charged per adult (children under 18 are free). This fee is fully refundable if you participate on both evenings. If you wish, you may also donate some or all of your fee to the SFAA general fund, since all Yosemite Park entrance and camping fees have been waived for us during our stay.

The total number of adults permitted in the group campsite is strictly limited to 30. To save your reservation, send your check for the correct fee to Treasurer, SFAA, 32 Penhurst Avenue, Daly City 94015. Registration is on a first-come, first-served basis. If you have any questions, please call (415) 584-5756.

Adventures with the Space Telescope

—Nancy Cox

On Saturday afternoon, October 3, 1992, I boarded a plane at SF International Airport to begin the most exciting event in my lifetime as an amateur astronomer—a visit to the Space Telescope Science Institute (STScI) in Baltimore, Maryland. I was one of five amateurs whose proposals had been accepted in 1992 for observing time on the Hubble Space Telescope. The purpose of our initial visit was to be presented to the public, to orient ourselves to the facilities and to meet with the Institute staff and our scientific and technical advisors, and to enter our proposals into the STScI database.

After checking into my hotel, located near the Institute (which is on the campus of Johns Hopkins University), I took a look around. This was my first visit to the East Coast, and I discovered that Baltimore is mostly brick, with the look of a much older city. The natives were very friendly, exhibiting real Southern hospitality.

We were scheduled to meet with the Institute staff from Monday through Wednesday, so I had a free day to explore. I located the famous Institute, which I had seen in slides so many times before. It's a large four-story building nestled in woodland trees. It took my breath away just to be there, gazing upon the silvery space telescope logo on the outside walkway.

The security guard in the front lobby let me in after I introduced myself as one of the Hubble amateurs. In the front lobby hangs a one-third scale model of the space telescope, suspended from the ceiling. There are also display panels showing recent discoveries made

with the telescope and a short history of the Institute. There's also a video screen with a live picture showing the star field where the telescope is currently being pointed, and the instruments being used. Needless to say, my heart was already pounding with excitement—and just wait until the next day!

Orientation

On Monday morning we all met in the Education and Public Affairs Office to begin our three days of orientation at STScI. Prior to our arrival we had received an orientation video explaining space telescope operations, planning and scheduling; instructions for Phase II of our proposals; and the instrument handbooks applicable to our projects. This was my first chance to meet the Institute staff and the other 1992 winners. (See page six.)

That morning the press room was filled with the most excited group of amateur astronomers you would ever want to meet. The Director of the Institute, Dr. Riccardo Giacconi, greeted us and joined us later for a group photograph. It is part of his discretionary time on the space telescope that is being used to create the amateur program. He expects imaginative science and refreshing new questions from the amateurs, from which the whole program can benefit.

That morning we got a complete tour of the facilities, with stops at each department for a short talk by a staff member. This gave us a good overview of the process that each proposal goes through, from planning and scheduling through data entry and guide star acquisition to analysis of the resulting data.

The Institute

The first department we stopped at was the Science Planning and Scheduling Area, where live data comes in 24 hours a day from the space telescope. The operator on duty gave us a brief explanation. The spacecraft itself is controlled from Goddard Space Flight Center in nearby Greenbelt, Maryland, but STScI receives the live scientific data as well, which is available to the principal investigator two days after the observations are made. A nearby computer terminal showed that the telescope was over Africa at the present moment in its 90 minute orbit of the Earth.

Our next stop, exciting because we would be working there later, was the department for Guide Star Acquisition (GASP). The celestial coordinates of a target must be given very accurately for the space telescope to point correctly at the object. In fact, inaccurate pointing is the most important cause of observational failure. In this department the staff can bring up an object on the computer screen and prepare a color photograph with coordinates. It was a thrill to return here later in the week and actually push the buttons to log onto my target object.

The Hubble Guide Star Catalog is based upon the Palomar Sky Survey plates, a set of which is kept in a large dust-free room which we were allowed to visit after donning surgical gowns. With a magnifying loop, a small dot on the plates turned out to be a spiral galaxy!

Another important department we visited was the Science Computing and Research Support Division (SCARS), filled with computer workstations for data analysis. We will be returning here many months from now, after our observations are made, to analyze the data *ourselves*, with assistance from the STScI staff. There are many tasks to be done, including calibrating spectra and removing cosmic

rays from the images (a real reminder that the HST is out in space).

Doing Science

The most important reason for our visit was to prepare our proposals for Phase II: entry into the STScI database. Our proposals were handled in exactly the same way as a program from a professional astronomer, but because we were amateurs, additional technical assistance was provided by the staff.

We spent the next three days meeting with our own assigned scientific and technical advisors. Our scientific advisors helped us formulate our goals, working within our allotted telescope time. The actual observations are planned months in advance, as the scheduling must fit together like a jigsaw puzzle. It is one thing to have an idea for a proposal; quite another to implement it.

It was a fantastic learning experience to see how scientific research is actually done. Our proposals had to be cut and trimmed to fit within the allotted telescope time and the constraints of the instruments. My scientific advisor, Dr. Laura Danly, was most helpful with the scientific aspects of my proposal, such as finding the UV flux of my object, the Lagoon Nebula. My technical advisor, Ken Anderson, will actually enter the details of my proposal into the computer database at the Institute.

My proposal, *The UV Emission Spectrum of an HII Region*, was granted two hours of telescope time. This two hours includes one hour of actual exposure time, and one hour of overhead time—needed to position the telescope, acquire the target, change instruments, filters and gratings, etc. Exposure times with the instruments had to be obtained by getting the UV flux of the target object. For my object, the Lagoon Nebula, this was obtained from the International Ultraviolet Explorer satellite data.

I had originally planned to do UV spectroscopy of three different sites in the nebula—but switching to all three ate up too much telescope time. I had also planned to use the High Resolution Spectrograph, but this too would have required too long an exposure time. Since HII regions are very dusty and I specifically wanted to look for carbon ions, the final decision was to use the Faint Object Spectrograph to obtain one complete UV spectrum of the nebular gas. Even this requires three set-ups, since each grating gives only a portion of the spectrum.

Another goal of my proposal was to image the Hourglass region of the nebula at optical wavelengths. For this part of my proposal the Wide Field Planetary Camera will be used. I really had to pinch myself to believe this was all real, as I sat in a senior staff member's office while he punched up images of Orion Nebula filaments on his computer.

During our stay we were interviewed by a reporter for the *Baltimore Sun* and videotaped for *NASA Network News*. On Monday evening the Public Affairs office had a special dinner for us at the Faculty Club of Johns Hopkins University. On Tuesday we were the speakers for the monthly public lecture in the STScI auditorium.

Everyone on the STScI staff was so nice to us. Special thanks to the Public Affairs staff: its manager, Ray Villard, who looked after us during our stay; Cheryl Gundy, who helped with our lodging arrangements; Ellie Lang, who supplied us with many photos, slides and posters; and staff artist Dana Berry, with his fantastic visuals.

I would also like to thank the San Francisco Amateur Astronomers, with whom I began my exploration of the Universe more than 20 years ago. I've spent so many nights with them on Mount Tamalpais, gazing at the Milky Way with curiosity and wonder. The SFAA was truly my *stellar nursery*. I wore my

SFAA pin proudly during my entire visit to the STScI. My proposal is dedicated to the SFAA and to the memory of the late Herman Fast, one of its founding members.

Other Winners

- ◆ George Lewycky, a computer programmer from New Jersey, is exploring the atmosphere of Saturn's moon Titan, using UV spectroscopy to look for organic molecules.
- ◆ Benjamin Weiss, a college student at Amherst College in Massachusetts, and his partner Winslow Bureson, a student at the University of Texas, are searching for binary asteroids.
- ◆ Jim Secosky, a high school science teacher from New York, and Harold Schenk, a civil engineer from Wisconsin, are looking for evidence of outgassing on certain asteroids that are suspected of having been comets.
- ◆ Dr. Lewis Thomas and Karl Hricko, teachers from New Jersey, are being assisted by two high school students in exploring Markarian 205, a quasar apparently connected by a gas bridge to a galaxy of much lower redshift.

It was such a thrill to be part of the Space Telescope Science Institute for a few days. It was hard to leave, but we'll be returning at least two or three times to analyze our data. (We are also expected to publish our results.) Our travel and lodging expenses are paid for by the Institute.

I returned home on Friday feeling several quantum leaps higher. It took awhile to return to Earth orbit!

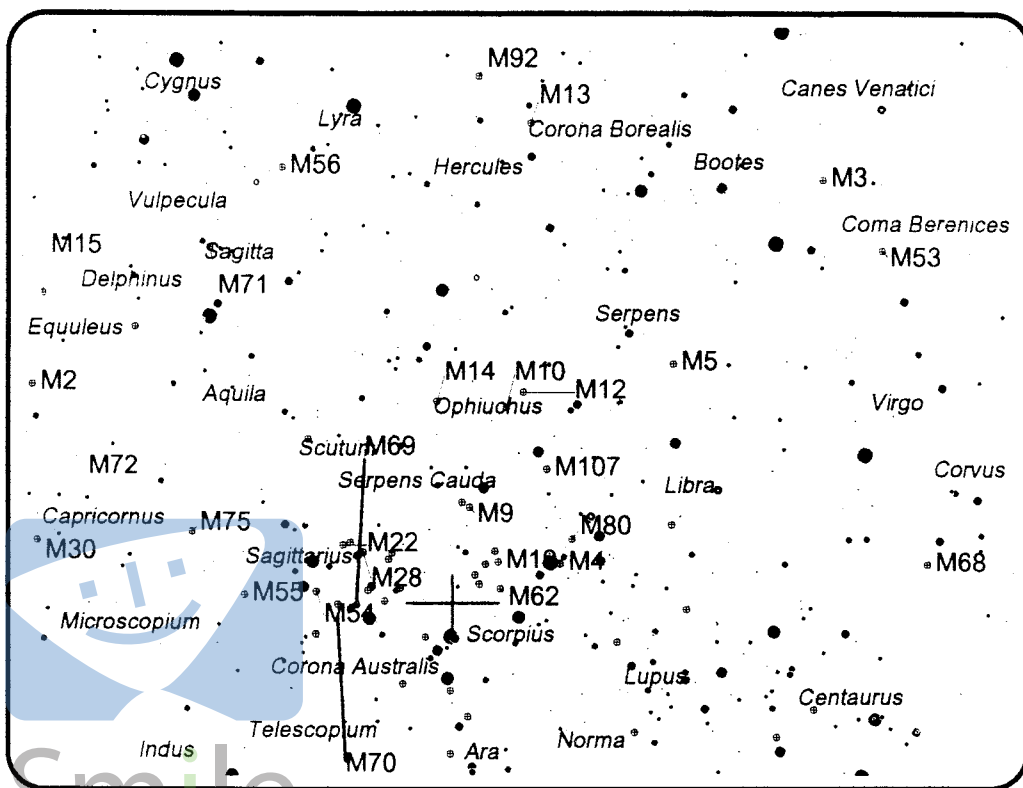
Globulars Everywhere

A few months ago it seemed as if there were galaxies wherever you looked in the spring sky. Now there are globulars everywhere. Why is that?

It's really very simple. In the springtime we were looking out at right angles to the plane of our own galaxy, the *Milky Way*, and right into the heart of the supercluster of galaxies of which we are a part. Our nighttime view changes with the seasons; now we're seeing into the heart of our own galaxy, around which the globular clusters form a circular halo.

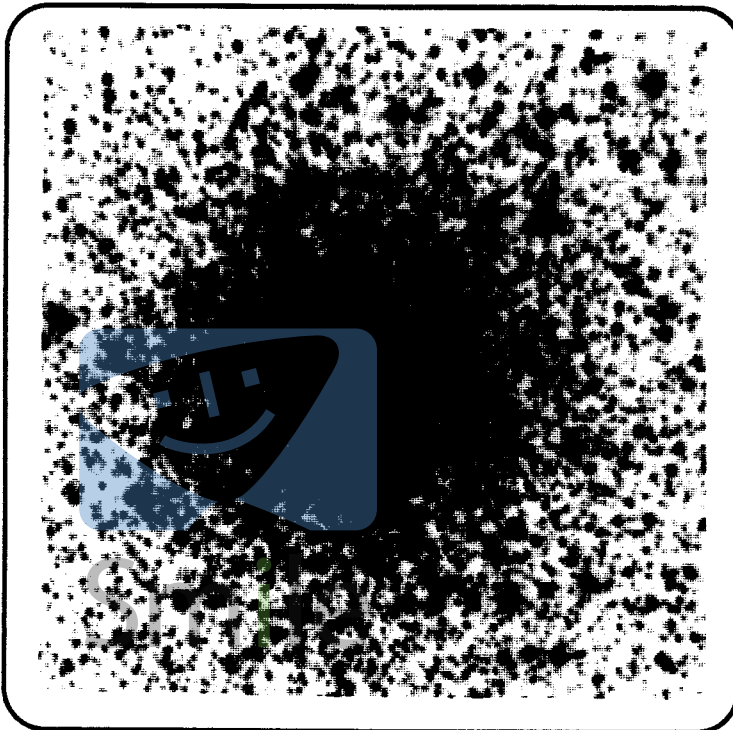
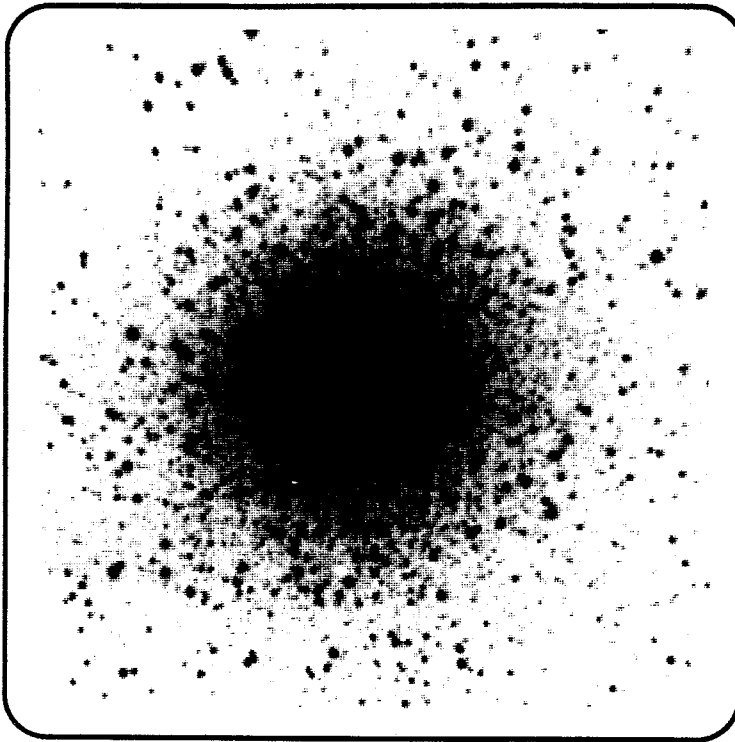
Robert Burnham suggests that our view of the universe might be very different if the Earth were situated within the Hercules Cluster:

The heavens would be filled with uncountable numbers of blazing stars which would dwarf our own Sirius and Canopus to insignificance.... There would be no real night at all on a planet in a globular cluster. Inhabitants of such a planet would probably know nothing of other clusters, of the Galaxy, and of the other galaxies, as their view would be completely blocked by the brilliance of their own skies. To them, the Hercules Cluster would be the Universe.



Of the 29 globular clusters in the Messier Catalog, 28 lie in the summer sky. Harlow Shapley made the first determination of the distance and direction of the galactic center in Sagittarius (marked by a cross above) by studying the uneven distribution of globular clusters.

Globulars Everywhere



Visually, the most interesting thing about globular clusters is their resolvability into stars, which depends upon telescope aperture and magnification, distance and degree of central condensation. Globulars are divided into 12 classes ranging from the most highly compressed clusters (Class I) to the most loosely condensed ones (Class XII). M15 in Pegasus (Class IV; top left) is very condensed compared to M4 in Scorpius (Class IX; bottom left). M15 is much more difficult to resolve in small amateur telescopes.

The impression of incredibly densely crowded stars at the center of a globular cluster is an illusion, says the ever poetical Robert Burnham:

This fact is better understood by constructing an imaginary scale model of the cluster. On such a model the stars would be represented by a million grains of sand., distributed throughout a spherical volume of space some 300 miles in diameter....Even in the most closely packed central mass the grains would still be separated from each other by the greater part of a mile. Thus even the globular cluster, which appears to us as the most densely packed mass of stars to be found anywhere in the Universe, is shown to be, by earthly standards, almost empty space.

—Jim Shields

Jupiter in June

by Fred Sammartino

On June 27, Jupiter will reach *quadrature*. The planet will be directly overhead at sunset as it starts its journey to the far side of the sun. The distance between a moon and its shadows is greatest during quadrature. Make sure to check out a moon enter or exit transit event from the chart below. Jupiter sets just after midnight on June 30, so the observing window, and the number of visible moon events, is rapidly decreasing.

Transit starts are a little easier to see than transit exits, because of the slight oblique sun angle at quadrature. The moons are more distinct hovering above the darker night side of Jupiter, than above the brighter and sharper sunrise edge. The moon takes a good 5 or 10 minutes before they completely detach themselves from the planet.

Here are the moon and shadow transits visible in California. All times are PDT. Look on the *evening* of the day given, all AM times are after midnight that evening.

Moon and Shadow Transits

evening	moon	TransitStart	ShadowStart	TransitEnd	ShadowEnd
Tue, Jun 1	Io	-	9:59 PM	11:02 PM	12:10 AM
Mon, Jun 7	Callisto	over southern pole	at	10:12 PM	
Tue, Jun 8	Io	10:41 PM	11:53 PM	12:53 AM	-
Tue, Jun 15	Io	12:34 AM	-	-	-
Thu, Jun 17	Io	-	-	-	10:27 PM
	Europa	-	-	-	10:53 PM
Thu, Jun 24	Io	-	10:11 PM	11:07 PM	12:21 AM
	Europa	-	10:58 PM	11:04 PM	-
Sat, Jun 26	Ganymede	-	-	-	10:25 PM
Thu, Jul 1	Io	10:50 PM	12:06 AM	-	-
	Europa	10:58 PM	-	-	-
Sat, Jul 3	Ganymede	-	11:49 PM	9:23 PM	-

Look for the red spot where the "missing belt" of Jupiter *should* be up to 1 1/2 hour before or after the times listed below when the spot will be centered on the disk. For the first time in years, it is definitely red in color!

Red Spot near central meridian

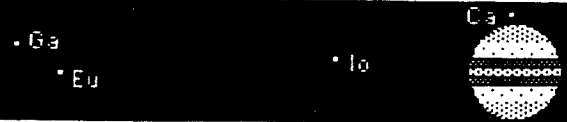
Wed, Jun 2, 12:22 AM	Fri, Jun 11, 10:40 PM	Wed, Jun 23, 10:37 PM
Fri, Jun 4, 9:52 PM	Mon, Jun 14, 12:19 AM	Sat, Jun 26, 12:16 AM
Sun, Jun 6, 11:31 PM	Wed, Jun 16, 9:49 PM	Mon, Jun 28, 9:46 PM
Wed, Jun 9, 1:10 AM	Fri, Jun 18, 11:28 PM	Wed, Jun 30, 11:25 PM

Tue, June 1 - Only 2 moons are visible until Io exits from transit at 11:00 PM (shadow and red spot visible). Then just 10 minutes later, Europa brightens to visibility as it exits from eclipse in Jup's shadow.



Below are some interesting moon configurations to look for during the month. Moons and spot pass right to left in front of Jupiter. Moons not shown are out of the field of view.

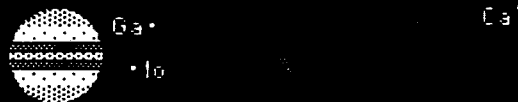
Monday, June 7, 10:05 PM - Callisto directly below Jupiter's south pole



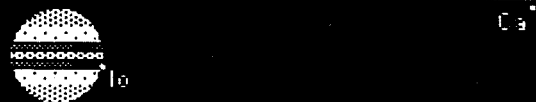
Tue, June 8 - Just about every type of moon event will happen tonight! Start with an occultation disappearance of Europa at 8:40 PM



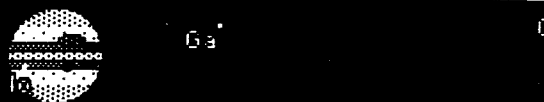
Then starting at 9:55 PM, Ganymede fades into eclipse in Jup's shadow



At 10:40, Io starts transit - only one moon (Callisto) will be visible



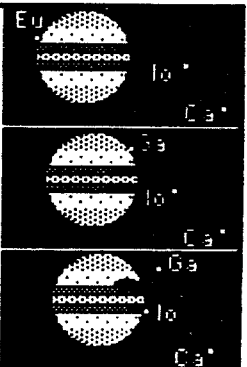
Ganymede slowly returns at 12:30 AM, Io shadow and red spot visible



Finally, Europa returns at 1:45 AM, Io shadow and red spot still visible



Tuesday, June 15 - Here's a nice little moon dance with all four moons near Jupiter all night. At 11:10 PM, Europa is ready to join Ganymede in occultation. Only 2 moons are visible until 11:30 when Ganymede pokes its head out from behind Jupiter. The moons form a diagonal line as Callisto and Io point the exact spot where Ganymede will appear. Finally at 12:30 AM, Io is ready to start transit just as the red spot rounds the corner and becomes visible just south of Io.



Thursday, June 17, 9:15 PM - Io is just emerging from transit as both Io and Europa shadows are visible together near the central meridian



Thursday, June 24, 11:25 PM - exactly one week later, Io and Europa exit transit nearly simultaneously, both shadows visible



Four Years of Great Speakers

It's fun looking back over the list of speakers at our club meetings since I joined the SFAA four years ago. I have learned more in these four years than in the previous 17 years of reading Sky & Telescope. What a treasure it is to have world-famous astronomers address our small group of amateurs and answer our questions. This has helped me develop a firm understanding of current perspectives in astronomy as never before.

But this list doesn't give credit to the man behind the scenes, Irving Hochman, who has been the primary mover in diplomatically making contacts and scheduling many of the speakers listed below. Thank you, Irving, and may you continue for years to come.

—Tom Kellogg

January 1989

Dinner (SF) - Charles Seeger—NASA Ames
Planets & Life Around Nearby Stars

February 1989

Dr. Raymond Jeanloz—UC Berkeley
An Inner Tour of Spaceship Earth

March 1989

Gerard Pardeilhan—Astroptics
Telescope Evaluation

April 1989

Dr. Michael Burton—NASA Ames
IR Astronomy & Interstellar Medium

May 1989

Dr. Joseph Silk—UC Berkeley
A Cosmic Book (Cosmology)

June 1989

Dr. Peter Trower—Virginia Tech
Cold Fusion

July 1989

Dr. David Morrison—NASA Ames
Cosmic Catastrophies

August 1989

Club observation night
Lunar Eclipse

September 1989

Dr. Imke de Pater—UC Berkeley
Jupiter at Radio Wavelengths

October 1989

Earthquake—No meeting

November 1989

Carol Stoker—NASA Ames
The Latest On Neptune

December 1989

Dr. Robert Nason—Consultant
The Earthquake

January 1990

Dinner (SF)

February 1990

Tim Sasseen—UC Berkeley
1987A Supernova - Pulsar?

March 1990

Joel W. Goodman—SFAA
Life In The Universe

April 1990

Kevin Medlock—Group 70, Inc.
Thinking Big - 72 inch Telescope

May 1990

Dr. Terry Mast—UC Berkeley
Construction of the Keck Telescope

June 1990

Dr. John E. Westfall—ALPO
Solar System Observing Techniques

July 1990

John Hewitt—Berkeley
Amateur Astronomers & The HST

August 1990

Larry McCune—Sonoma Amateurs
Striking Sparks

September 1990

Carl Trost—SFAA
The Spector of Mt. Diablo

More Great Speakers

October 1990

Lewis Epstein—SFAA
Thinking Physics

November 1990

Dr. Paul Doherty—SF Exploratorium
Boundaries of Science

December 1990

Nancy Cox—SFAA
Observing From Platform Earth

January 1991

Dinner - San Rafael

February 1991

Dr. W.J. Shiloh Unruh—Lick Observatory
Pulkovo Observatory, U.S.S.R.

March 1991

Dr. Richard Young—NASA Ames
Galileo - Mission To Jupiter

April 1991

Dr. Alex Filippenko—UC Berkeley
The Latest From The HST

May 1991

Dr. Daniel Bershadler—Stanford
Hypervelocity Penetration of Atmospheres

June 1991

Dr. Henry J. Crawford—UC Berkeley
High Energy Gamma Ray Astronomy

July 1991

Douglas J. Mudgeway—NASA Ames
The Galileo Mission To Jupiter

August 1991

John Dillon—Randall Museum
When The Sun Stops Shining

September 1991

Carol Christian—UC Berkeley
Telescopes on Mauna Kea

October 1991

Lewis Epstein—SFAA
Is Physics A Religion?

November 1991

Dan Machak—NASA Ames
Infrared Astronomy

December 1991

Show & Tell

January 1992

Dinner - Daly City

February 1992

Charles Turner—Carina Software
Voyager Demonstration

March 1992

Eric Burgess—Author
Return To The Moon

April 1992

Dr. Christopher McKay—NASA Ames
Terra Forming Mars

May 1992

Timothy Ferris—UC Berkeley
Is The Big Bang In Trouble?

June 1992

Dr. Ken Crosswell—Berkeley
The Milky Way

July 1992

Dr. Christopher Chyba—NASA Ames
Cometary Impacts & Life

August 1992

Nancy Cox—SFAA
The HST

September 1992

Dr. Max Dresden—Stanford
Contrasting Styles - Physicists & Astronomers

October 1992

Joel W. Goodman—SFAA
The New Mars

November 1992

Dr. Jill Tarter—NASA Ames
Search for Extraterrestrial Intelligence

December 1992

Dr. George Smoot—UC Berkeley
Studying the Early Universe

Smile

- ★ Nancy's Exciting Adventure
- ★ New Observing Awards
- ★ Globulars Everywhere
- ★ Jupiter and its Moons
- ★ Four Years of Great Speakers

Features

Golden Gate Park, San Francisco, CA 94118
 California Academy of Sciences
 c/o Morrison Planetarium

San Francisco Amateur Astronomers

SAN FRANCISCO AMATEUR ASTRONOMERS MEMBERSHIP APPLICATION

Name: _____

Address: _____

Telephone: _____

Select one category:



- \$20 enclosed, individual membership
- \$20 enclosed, foreign membership
- \$25 enclosed, family membership
- \$25 enclosed, institutional membership
- \$5 enclosed, youth membership (under 18)

Make checks payable to **San Francisco Amateur Astronomers** and mail to:
 Treasurer, San Francisco Amateur Astronomers, 32 Penhurst Avenue, Daly City 94015.

Founded in September, 1952, the San Francisco Amateur Astronomers (SFAA) is an association of people who share a common interest in astronomy and other related sciences. Our membership consists of people from all walks of life, educational backgrounds and ages. Many SFAA members own their own telescopes; some have been made by hand in local telescope-making classes and vary in size from six to 25 inches diameter.