

BULLETIN

volume 84, issue 2 *February 2010*

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**OUR 84th YEAR OF
ASTRONOMY IN LOS ANGELES**
Los Angeles Astronomical Society
 Griffith Observatory
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 Los Angeles, CA 90027

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Editor's Corner

*a*s we go to press on this issue, the latest Mars Opposition is starting.

We're planning on additional with the 26-inch for the 30th and Feb 6th, both Saturdays, and Thursday Jan 28th. These will be nights where only the 26 -inch will be out, unlike the public star party on the 23rd. The idea is to give LAAS members a chance to look through the 26-inch at Mars, since the Mt Wilson 60-inch is not accessible. Opposition night is January the 27th and closest approach to Earth on the 29th. If you wish to attend, just park in the public parking lot (NOT East Observatory Rd.) and walk up and enjoy the view. We'll try and give LAAS members priority.

We still need more members trained in how to move, setup, and take-down the 26-inch for public star parties. Please consider coming to one of the Griffith star parties and learning. We really can use the help, so we're less dependent on just a few people to do it.

We have a slightly different makeup on the board for this year, including a new President and Vice-President. Pleas join me in thanking the old board for their wonderful work this past year, and wishing the new board good luck in the coming year !

Again, to those that wish to use their telescopes at Garvey Ranch Park on

(Continued on page 3)

Wednesdays that the Tai Chi class that was occupying the front lawn is GONE.

Articles, short news or story items, and photographs and images are welcome as long as they're focused on LAAS interests. Articles need to be 1,500 words or less. Please submit only a few images at one time, and please supply a caption for each. Include such information as camera type, telescope or other equipment used, and exposure times. The deadline for submitting bulletin material is the 10th of each month. If possible, please submit electronically to:

BulletinEditor@laas.org

Material may be sent to the LAAS address listed at the top of the column at left, but timely reception and publication cannot be guaranteed. ✧

David Nakamoto

Outreach Program

We've got a large number of requests despite the Recession and the cutback in school funding.

We especially need people living in the San Gabriel Valley to go to outreach events there. Nearly all of the regular volunteers live in the San Fernando Valley, so the need in the "other" valley is great.

Come on out to the school and show all the enthusiastic kids, parents, and teachers the night sky. They always appreciate it. And if you get WOW's when they look through you scope, you'll feel good. If no scope, come out anyway and help up set up or answer questions from the kids. So, Outreach volunteers, let's pitch in. I'm sure the kids and adults will appreciate our effort.

Thanks !

Outreach@laas.org (818) 891-3087 ✧

(Editors Note: Be aware that often these requests come with very little advanced notice. Therefore, we won't post any events in the bulletin. The best way to get news of these events is to use the Internet and either join the LAAS Yahoo group or access the LAAS website. To join the LAAS Yahoo group, see page 16.)

Don DeGregori

2010 Board Members

Your 2010 officers are :

President : Timothy Thompson

Vice-President : Mary Brown

Secretary : Stephen Dashiell

Treasurer : Herbert Kraus

Your 2010 board members are :

David Sovereign

Don DeGregori

Carla Johns

Herman Meyerdierks

John O'Bryan

Richard Roosman

Michael Rudy

Michael White

David Nakamoto (alternate)

Please join me in giving thanks to the old board for guiding us through 2009, and wishing good luck to the new board for 2010 !

David Nakamoto

Final Destiny

By Timothy Thompson

The story goes that the astronomer tells his audience that the sun will expand into a red giant star, and swallow Earth in about 5 billion years. A nervous member of the audience asks, "When did you say that would happen?" The answer is still 5 billion years. The much-relieved listener responds, "Oh, good, I thought you said 5 million years."

Whether it is 5 million or 5 billion or more is of little consequence to us, but curiosity remains. What will be the final destiny of Earth? Will our home planet survive the ravages of solar evolution, in the far distant future?

Our sun today is a spectral class G2V "yellow dwarf" star. The G denotes a temperature range, from 4900 to 6000 Kelvins. A number in the range 0-9 follows the letter, from hottest to coldest in the class. The 2 for our sun shows that it is at the hot end of the G class, which is indeed true, as it has a brightness temperature about 5780 Kelvins. And finally, V is a Roman numeral, and indicates that the sun is a main sequence star. Main sequence stars are the "ordinary" kind, busy bashing hydrogen atoms together in its core, fusing them into heavier helium. There is only enough hydrogen available in the core region to keep that up for 12 billion years or so, and the sun has been at it for nearly 5 billion years. So, in about 7 billion more years, when the sun runs out of available core hydrogen, things will get exciting around here.

But before they get exciting, they will get hot. Really hot. As the sun continuously eats up its hydrogen, the core becomes continuously polluted with the heavier helium, which causes the core to slowly & slightly compress under its own weight, so that the core is constantly heating up. And that, in turn, causes the outer envelope of the sun to slightly expand, and brighten, so as to radiate away the increasing internal heat energy. If the sun gets brighter, that means Earth gets hotter. Figure 1 on the next page shows how the temperature of Earth will increase as the sun brightens. In about 5 billion years, Earth will be, on average, about 10% warmer than it is now. Today, the global average temperature is about 288 Kelvins, or 59 Fahrenheit. Make the planet 10% warmer, and the temperature jumps to 317 Kelvins or 111 Fahrenheit. The current issues surrounding global warming are all about a rise in temperature on the order of 1% or less. So in about 5 billion years, we can look forward to global warming on steroids. If there is anyone still around in 5 billion years, their lives will be far different

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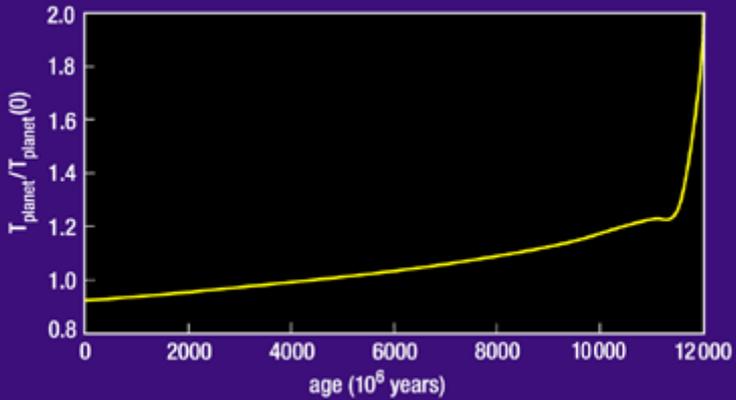


Figure 1

This plot shows the planet temperature as a function of the age of the planet, in response to changes due to the evolution of the sun. At age 4.5 billion years, the ratio is 1.0

Image Copyright Blackwell Publishing, 2001

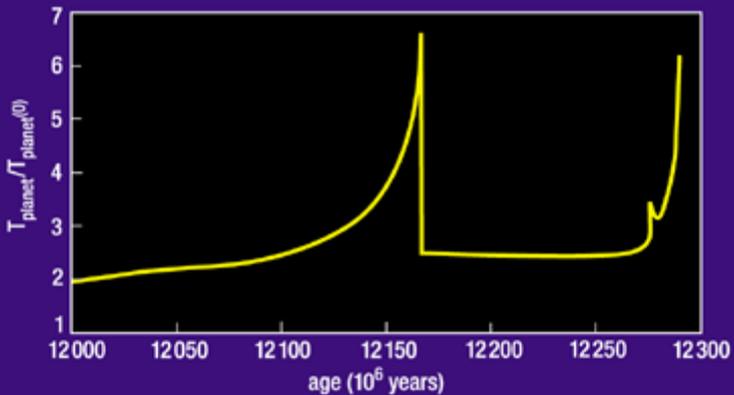


Figure 2

Same as figure 1, but concentrating on expanding the scale to show how temperature changes in detail as the sun becomes first a red giant, and then an AGB star.

Image Copyright Blackwell Publishing, 2001

from ours. And as you can see from figure 1 at left, we can look forward to far warmer temperatures than that. Figure 2 below left expands the temperature scale around the age of 12 billion years, showing planetary temperature, as the sun becomes first a red giant star, and then an asymptotic giant branch (AGB) star. At an age about 12,150,000,000 years the surface temperature of Earth will be about 6 times its current value. That's about 1728 Kelvins or 2650 Fahrenheit. That's far above the melting point for lead, copper, zinc, silver, gold, aluminum, silicon, nickel, iron, titanium, and a host of other materials that we, and our technology, depend on. There will be no life on that Earth.

So there is little doubt but that Earth will get baked, fried, cooked, broiled, and just generally overheated. But will it get gobbled up altogether by the growing sun? Past investigations have tended to say yes. We know that as the sun runs out of hydrogen in its core, it will begin to fuse hydrogen in a shell that surrounds the core. That shell will expand, as the helium core also expands, and continues to heat up. As the core gets much hotter, and the region where fusion occurs expands out from the core, the sun will grow into a red giant star, expanding from its present size, to a diameter about the size of Earth's present orbit around the sun. But we don't know enough to say exactly how big the sun will get, there are too many things we just don't know well enough, and cannot predict precisely enough. But we do know that as the sun becomes a red giant, it will lose a significant fraction of its mass. Since red giants are very big, their surface gravity is very low, and it is easy to boil away lots of mass, in a slow but significant stellar wind. The loss of mass changes the orbits of planets, causing them to move outward from the sun as its mass decreases. And so we have the Great Race. As the surface of the sun reaches out to snatch the planet, Earth moves farther away from the sun in response to its lowering mass. So who wins the race? One answer is in figure 3 on the next page. The unlabeled vertical scale is a logarithmic scale showing the size of the sun as a yellow curve, and the orbit of Earth as the upper green curve. The first spike in the yellow curve is the sun at its maximum red giant size. Then it shrinks again. The next spike in the yellow curve is the maximum radius of the sun as an AGB star. The blue curve at the bottom shows the mass of the sun, on a linear scale. Both the red giant and AGB spikes are accompanied by significant mass loss, and significant changes in Earth's orbit. The first spike in the yellow curve tops out just about 2.35; since it is a logarithmic scale, that means 102.35 or 224, meaning that the sun will then be 224 times its current radius. Earth's orbit is also measured in the same scale of solar radii, and the green curve shows that at both the red giant and AGB spikes, Earth barely escapes the photosphere that is reaching out for it. So Earth may get cooked to well done, but should survive the meal in one piece. Maybe.

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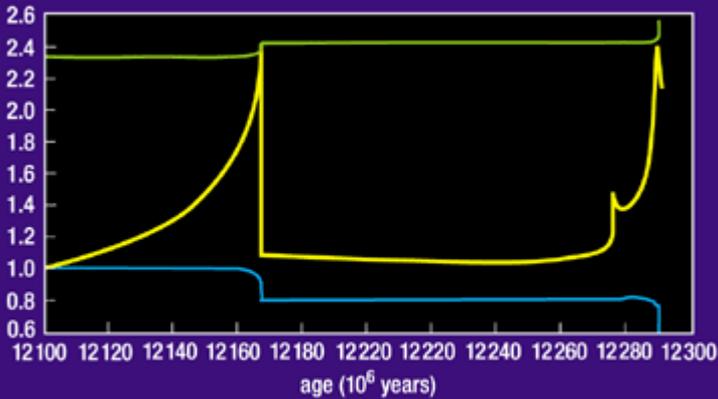
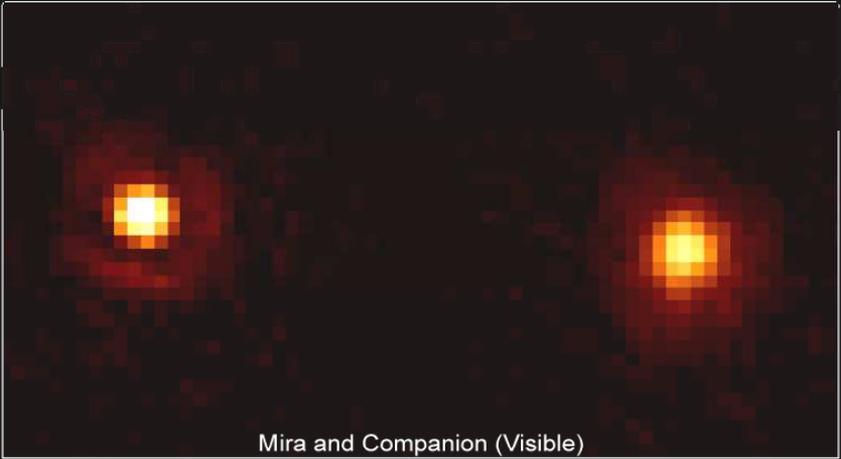


Figure 3

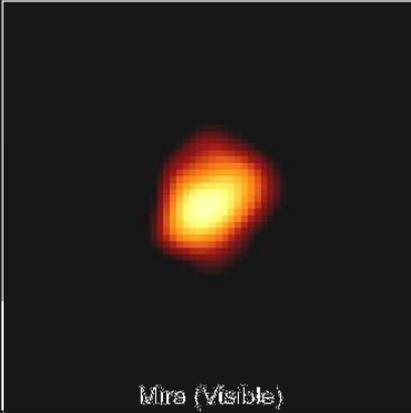
For the yellow & green curves, the vertical axis is a logarithmic scale of distance in present solar radii. It begins at 12,100 million years, at 1.0, indication 101.0 or just 10, showing that the sun (yellow curve) will be 10 times its present radius, while Earth (top green curve) will be about 102.35 or 224 current solar radii away (1 AU). For the bottom blue curve, the scale is a linear scale of solar mass in units of present solar mass. The sun starts out at 1.0 solar masses, drops to 0.8 at the red giant stage, and falls below 0.6 as an AGB star.

Image Copyright Blackwell Publishing, 2001

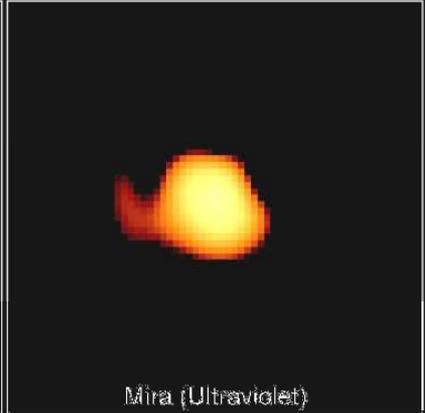
That description of the Great Race comes from a study published in 2001 (Solar Evolution and the Distant Future of Earth; Schroeder, Smith & Apps; Astronomy and Geophysics, December 2001). However, there is a new study, not yet published, but accepted for publication in the Astrophysical Journal: Can Planets Survive Stellar Evolution?, by Eva Villaver & Mario Livio, from the Space Telescope Science Institute. They include the effect of dense stellar winds producing drag that prevents the planets from moving away quite so conveniently from the expanding photosphere. They conclude that any planet less massive than Jupiter, and initially closer than about 3 to 5 AU (hint: Earth now resides at 1 AU), cannot survive the dense winds of the AGB stage of stellar evolution. If they are correct, then there can be no doubt about the final destiny of Earth. It will be destroyed in the dense wind of the AGB sun, and blown away, along with the rest of the sun's outer layers. Eventually, the material that was planet Earth will become visible across the galaxy as a planetary nebula. ✧



Mira and Companion (Visible)

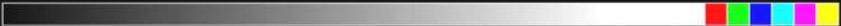


Mira (Visible)



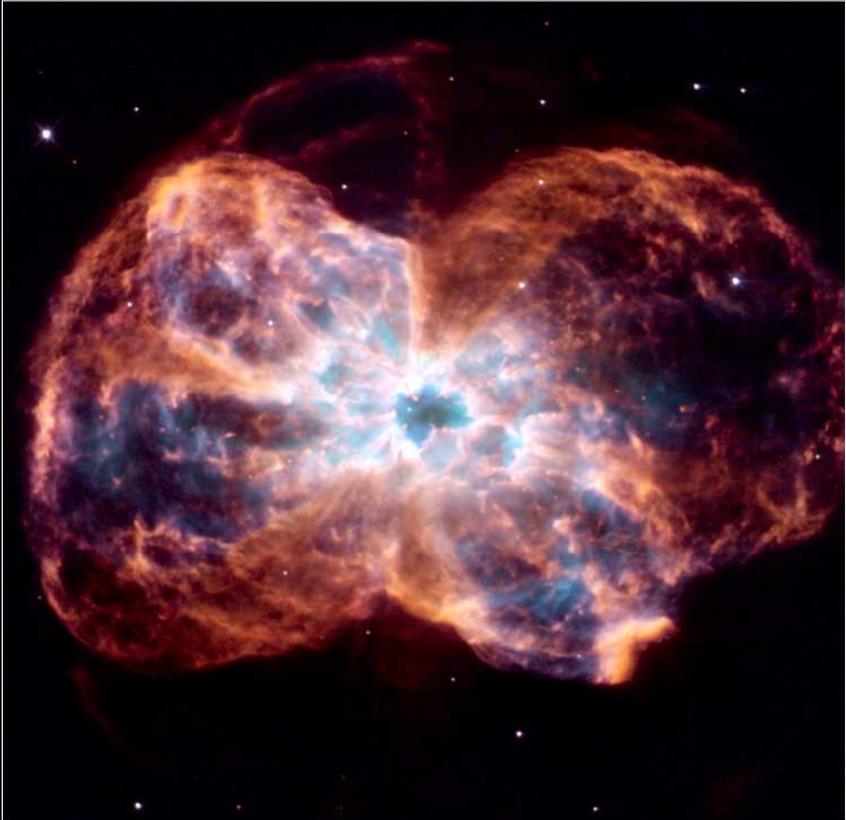
Mira (Ultraviolet)

Mira • Omicron Ceti
Hubble Space Telescope • FOC



PRC97-26 • ST ScI OPO • M. Karovska (Center for Astrophysics) and NASA

Mira, at 1.2 solar masses, is a pulsating red giant star very similar to the eventual red giant that our sun will become.



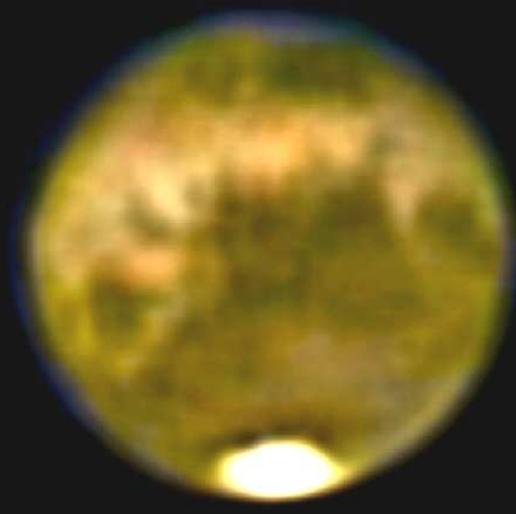
Planetary Nebula NGC 2440
Hubble Space Telescope • WFC3/2

NASA, ESA, and K. Neel (STScI)

© 2010 NASA/ESA

Planetary Nebula NGC 2440, seen in this HST image, was left behind by a star about 1 solar mass. Our sun will eventually make a planetary nebula like this one, the material of which will include the evaporated Earth.

Mars Opposition, a look back and forward



As we go to press, the current Mars Opposition season will be half over, with Opposition on Jan 27th, and closest approach to earth on Jan 29th. The reason for this “discrepancy” is due to the elliptical Martian orbit, the third highest eccentricity after Pluto and Mercury. If you have a program that can show the Solar System from “above”, look down on it and you can see this effect.

Unfortunately for earth-bound observers, this time around Mars is about as small as it can get. The smallest size occurs during the 2012 opposition, but even this year, Mars will be only 14 arc-seconds wide. For comparisons, Jupiter is around 44 arc-seconds, and the lunar crater Copernicus is 40 arc-seconds. The small apparent size of Mars is due, again, to the elliptical Martian orbit, which means that we won't see a Mars opposition even close to the 2003 one until around 2016 or so. Which may be a blessing in disguise, considering the HUGE crowds at the Autry Museum and the Griffith satellite observatory in that year. To say that public interest, the size of the crowds, and the news interest were legendary is an understatement !

But this year's opposition does bring up memories of the year 2003 when Mars was such a news item. For me, 2003 marked the second time I tried to take video images of Mars since the 1995 opposition, and the first time with a color web camera. The best result is shown above. Although it is grainy and ill defined, it's not a bad effort for a 5-inch f/12 Maksutov and a beginner at web

(Continued on page 12)

image processing. The blue haze on the rim was probably due to ice clouds in the Martian atmosphere; if you use blue filters you can see these clouds yourself. The image is centered on the Chryse region, with the “Eye of Mars” towards the left. ✧

Image and Text by David Nakamoto

Griffith Observatory Public Star Party Procedure

Signups are no longer required.

When you arrive, show your LAAS badge or card to the traffic control person at the fork at the top of Vermont road just before you reach the tunnel. You'll be allowed to drive up East Observatory Rd. Once at the top of the road, temporarily park your car on the side nearest to the observatory and unload your equipment. Roger Keen should be available with a cart to facilitate moving your equipment if you need it. Once you've unloaded your equipment at the spot where you wish to set up, Roger will oversee your equipment while you park along East Observatory Rd. Then you can set up your equipment.

You can volunteer for the event **without equipment** to aid those with equipment so they can take breaks, help out with crowd control, et al. We especially need help with crowd control with the 26-inch telescope.

It should be understood by any LAAS member who volunteers their time towards the public star party that the main focus is to be of service to the patrons at Griffith Observatory and show them the delights of the nighttime sky. New Members are not expected to adhere to this policy.

Please check the LAAS website and Yahoo list for changes and updates in any LAAS event, as there are many communication mediums and some are missed.

We still need more members trained in moving the 26-inch, setting it up and preparing it for moving. If you're interested, please attend one of the Griffith public star party events. We normally bring the telescope out around one hour before sunset so we have enough light to do so, weather permitting. We'd like as many members to be trained and comfortable handling the telescope, so that it will always be available for viewing by the public.

Have fun and enjoy! ✧

PJ Goldfinger & David Nakamoto

The 2010 RTMC

This year's RTMC dates are :

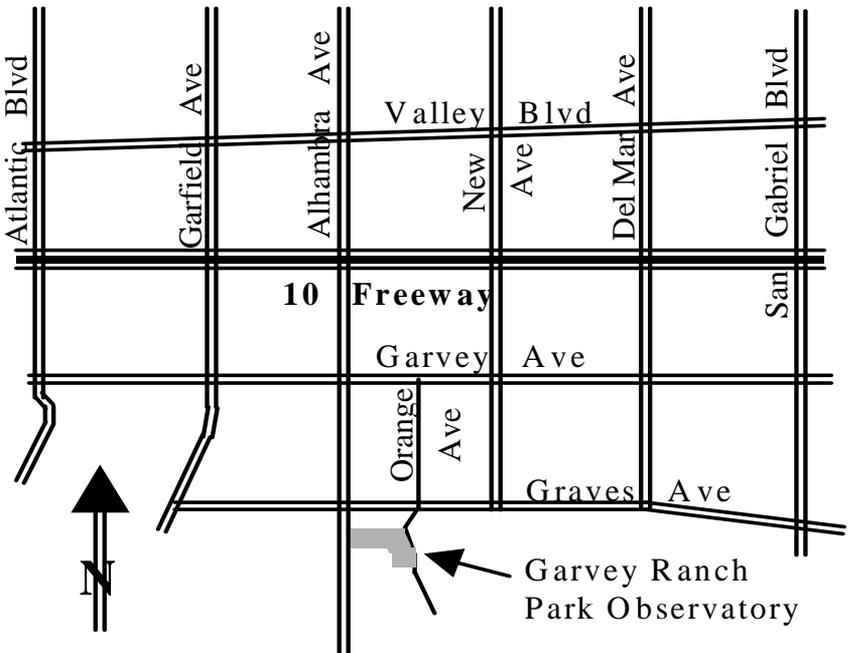
Friday May 14th through Sunday the 16th.

Note that this is a two-week shift in its traditional date of Memorial Day weekend. Make quick plans to attend if you intend to. In the past when I went, local inns and hotels are filled up by January, although since RTMC is not held on Memorial Day as it has in the past, it might be easier to find lodging. Still, don't delay.

David Nakamoto

Map to Monterey Park Observatory

(The place to build your telescope)



LOANER CORNER

There have been some minor changes to the accessories for the instruments in the loaner program. All telescopes are equipped with three eyepieces. Reflectors come with a simple collimation tool and refractors come with a star diagonal.

LAAS-1: 4.5" f/8 Celestron reflector on a Polaris equatorial mount

LAAS-2; 4.5" f/8 upgraded Tasco reflector on a driven Edmund equatorial mount

LAAS-4: 6" f/5 Telescopes reflector on a short Dobsonian mount

LAAS-6: 10" f/4.5 Discovery reflector on a Dobsonian mount. This is the largest telescope in the collection.

LAAS-9: 80mm F/6.25 refractor which has been re-mounted on a heavy-duty Celestron camera tripod. This alt-azimuth style mount is good for this fine Rich Field Telescope.

For more information call: David Sovereign at (626) 794—0646. ✧

David Sovereign

Telescope for Sale !

Nancy Stannard is selling a Meade DS-2000 telescope, 3 years old, but never used! She can be reached at (719) 237 - 6547. Asking \$250 or best offer.

New Members

The new members approved at the January board meeting are:

- Jack Anderson
- Angela and Imre Meszaros
- Haven Renteria
- Spenser Soo Hoo

Welcome to our club, and I hope you'll enjoy your Astronomy with all of us ! ✧

EVENTS CALENDAR

Date	Event	Location and Information
Feb 3rd (Wed)	Board Meeting	Garvey Ranch Park Class Room. 8:00 pm to 10:00 pm
Feb 8th (Mon)	General Mtg	Griffith Observatory, Event Horizon Theater, 7:45 pm to 9:45 pm Member Show and Tell Night, a continuation of January's meeting.
Feb 13th (Sat)	Dark Sky Night	Lockwood Valley
Feb 20th (Sat)	Public Star Party	Griffith Observatory, 2:00 pm to 10:00 pm, See pg 12 for details on how to
Mar 3rd (Wed)	Board Meeting	Garvey Ranch Park Class Room. 8:00 pm to 10:00 pm
Mar 8th (Mon)	General Mtg	Griffith Observatory, Event Horizon Theater, 7:45 pm to 9:45 pm
Mar 13th (Sat)	Dark Sky Night	Lockwood Valley
Mar 20th (Sat)	Public Star Party	Griffith Observatory, 2:00 pm to 10:00



LAAS Home Page: <http://www.laas.org>
 LAAS Bulletin Online: http://www.laas.org/Resources_Newsletter.htm

LAAS Yahoo Group—how to join

The group is private, and therefore does not come up in a search. To join, send email to: LAAS-subscribe@yahoogroups.com. Include your full name so the moderator can verify your LAAS membership. Your full name is necessary so we can check our records to see if you really are a LAAS member. If approved, you will receive further instructions via email. ✧

Sky and Telescope Subscriptions

Sky and Telescope subscriptions renewals should be sent directly to Sky Publishing. To start a Sky and Telescope subscription, contact the LAAS Treasurer (see the contact information on page 2) directly to get the club rates, then thereafter send the renewal bills directly to Sky Publishing. ✧

Astronomy Magazine Subscriptions

For those that subscribe to Astronomy Magazine through the LAAS, the rate is \$34 a year, \$60 for two years. ✧

AmSky *The on-line mega-magazine for amateur astronomy*

www.amsky.com

Bob DuHamel

admin@amsky.com

Membership Annual Dues:

Youth	\$ 20.00
Regular (18-65)	\$ 45.00
Senior Citizen (65 and up)	\$ 30.00
Senior Family	\$ 40.00
Family	\$ 60.00
Life	\$ 500.00

Additional fees:

Charter Star member	\$ 30.00
Star member, with pad	\$ 70.00
Star member, no pad	\$ 60.00
Printed Bulletin	\$ 15.00

(Membership due date is indicated on the mailing label)

HANDY PHONE LIST



LAAS Answering Machine	(213) 673-7355
Griffith Observatory	
Program.....	(213) 473-0800
Sky Report.....	unavailable for now
Lockwood Site	(661) 245-2106
	(not answered, arrange time with caller.)
	Outgoing calls – collect or calling card)
Mt. Wilson Institute.....	(626) 793-3100