

LOS ANGELES ASTRONOMICAL SOCIETY

BULLETIN

volume 82, issue 7 *July 2008*

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**OUR 82nd YEAR OF
ASTRONOMY IN LOS
ANGELES**

Los Angeles Astronomical Society
Griffith Observatory
2800 East Observatory Road
Los Angeles, CA 90027

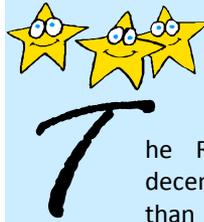
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**Editor's
Message**

The RTMC event had a decent, although lighter than usual crowd due to the unseasonable cooler and wetter weather. Members Jack Eastman and Richard Roosman give their reports of the event later in this bulletin. Please, if you have any images, please submit them for the August bulletin ! See below to find out how to do this.

Please remember that if you attend one of the summer public star parties, you might have to take an alternate route to get to the Observatory. A map of the alternate route up Ferndale is on page 11.

My thanks to all who have contributed to the success of the bulletin. Please consider writing or submit images. Please keep articles to 1,500 words or less. For images, submit only a few well-chosen images, with captions if possible. The deadline for submitting bulletin material is the 10th of each month. Please if possible submit electronically to BulletinEditor@laas.org, or to dinakamoto@yahoo.com.

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. ✧

Griffith Observatory

Public Star Party Procedure

PJ Goldfinger handles our Griffith Observatory Public Star Party List. As patrons may drive up freely and reservations are no longer needed, we will continue to keep a sign up list for this event. Please note changes may occur in future PSP events and to read the policy below each month.

LAAS Members must still sign up on time - Deadline is no later than the Tuesday night prior to the Saturday GO Public Star Party each month. The list information required is:

- Your name, any LAAS Members and Non members in your car.
- Bring Telescope y/n.

NOTE: Those attending without a telescope as a favor will be required to be of some assistance if asked, needed and able.

It is primarily the main focus of any LAAS member who attends this event to be of Public Service with their telescopes in showing the patrons of Griffith Observatory the delights of the nighttime sky. New Members are not expected to adhere to this policy. Please feel free to come up and enjoy the event given you are signed up.

Parking will be on the east side of the Griffith Observatory Hill designated for GO employees. A guard will be stationed with the LAAS GO PSP list. It is always wise to have one's LAAS name badge and/or club ID on them just in case. Unloading telescope and equipment will remain the same procedure as well, with a drive up , drop off and park down hill routine.

The list currently has been updated to 30 spots for LAAS members. First come, first serve.

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.

To sign up for the Griffith Observatory Star Party the email address is: laas.starparty@gmail.com. Attendance is only granted once a confirmation email has been received. Most important though is to have fun and enjoy! ✧

PJ Goldfinger

Astronomy Equipment for Sale

Backyard Observatory
Meade EXT-80AT Telescope - New
in the Box with tripod, backpack, self
guiding electronics

Retail \$300. Offered at \$240

Sunspotter The safe way to view the
sun. - Brand New

Retail \$350

Offered at \$275

Celestron Skyscout Personal
Planetarium

Retail \$399
Offered \$310

Coronado PST Personal; Solar
Telescope

Retail \$500
Offered \$500

Celestron Giant 20x80 binoculars
Retail \$348

Offered at \$150

Celestron Tripod
\$40

Paul Wicker – TheGalileoGuy
310 546-1437

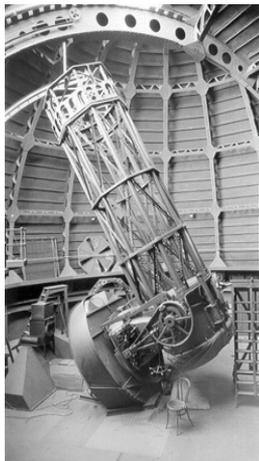
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Increased LAAS Membership Dues

Last year, the LAAS spent about \$5000 more than it gained from its various income sources, and a similar deficit in is projected for 2008. Due to this, the governing board has made a decision to increase some of the dues.

Effective in May 2008, the dues for membership in the LAAS will be increased to \$45.00 a year for regular members, \$30.00 a year for senior members ages 65 and over, \$40.00 a year for senior family members, and \$60 a year for family memberships. In addition, members who require that printed copies of the bulletin be mailed to them, rather than access it from our website, will be charged an additional \$15.00 a year to cover the costs for that service. Youth memberships will remain at \$20.00 a year, and there are no changes in in our fees for star members.

As before, the benefits of regular and family memberships include subscriptions to the ***Griffith Observer***. Other members may obtain a subscription to that publication through the LAAS for \$15.00 a year. All LAAS members still have the opportunity to subscribe to the magazines Astronomy and Sky and Telescope at our reduced club rates, currently more than 20% below the regular subscription rates for both publications, and amounting to less than 50% of the prices for individual issues at the newsstand. ✧



Mt Wilson 60" Nights

We're in the process of arranging this year's schedule of Mt Wilson 60-inch telescope nights.

August 29th, Friday, full night
September 26th, Friday, full night

Only LAAS members are allowed to sign up. If there is still room two (2) weeks prior to the date, paying guests will be permitted. Everyone who shows up, whether family member, friend, or guest, will have to pay in order to be allowed to be in the 60-inch telescope observatory.

Herbert Kraus has taken over the responsibility of coordinating the effort and being the contact person. He can be reached at:

Herbert Kraus

P.O. Box 56084

Sherman Oaks, CA 91413

When we start accepting reservations, please remember that it's first come, first served.

Any LAAS member who has not been to a 60 inch night at Mount Wilson should consider it as an opportunity to visit astronomy history. To see the location and equipment used by giants such as Wilson and Hubble, will add to your appreciation of their contributions.

The scope belongs to LAAS all night except for those nights designated as half-nights, when it will be available only until midnight. We mutually agree upon which objects to view. Often, a member is the operator, so it is a very comfortable environment. (Do bring a coat, however) The viewing is without a doubt the best you are likely to see in your lifetime.

The cost is \$75 per person for the full night. You must sign up and pay for the full night if that is the night you're reserving. No half night reservations on a full-night outing.

Send your check payable to LAAS. Please send to the LAAS Treasurer at P.O. Box 56084, Sherman Oaks, CA 91413. ✧

The BIG BANG !

By Timothy Thompson

Proud of their knowledge and confident of its final truth, the members of a society pity the ignorance of their ancestors and fail to foresee that their descendants will also pity them for their ignorance.

Edward Harrison in “Cosmology: The Science of the Universe”; Cambridge University Press, 2000 (2nd ed).

Where were you at 18:30 UT on 28 March 1949? That’s when BBC radio began its program The Nature of Things. During this program the British astronomer Sir Fred Hoyle (1915-2001) coined the phrase “Big Bang” in reference to the cosmology of an expanding universe. It may have been an effort at humorous derision, or perhaps simply an effort to make things easier for his listeners to understand. Whatever his reason, it stuck. The science of cosmology today goes by that title: Big Bang Cosmology.

There are few things you can think of that are more ambitious than cosmology. Some astronomers study stars, some study planets, some study galaxies, some study clouds of dust & gas. But cosmologists seek to reconstruct the physics and history of the entire universe. One can hardly imagine a science of broader scope, a science that studies literally everything. Indeed, there are still plenty of people who do not even agree that cosmology should be considered a science at all.

For millennia the people understood the universe only in the context of magic & myth. Since knowledge of the universe was so limited, people could fashion models of the universe at large that fit their favorite prejudice. The long story of the history of cosmology is beyond the scope of a short article. So, along those lines, I recommend the book *Masks of the Universe* by Edward Harrison (Cambridge University Press 2003, 2nd ed). Harrison also wrote *Cosmology: The Science of the Universe* (Cambridge University Press 2000, 2nd ed), which I also recommend as the book most likely to be accessible to both amateur & professional cosmologists.

The modern science of cosmology is dominated by the fundamental idea that the universe is expanding, and was therefore smaller, hotter & denser in times past. The obvious conclusion is that the universe had a beginning, came into existence in a state of extreme temperature & density, and has been expanding ever since. This is how the phrase “Big Bang” comes about. But it is crucial to understand that the Big Bang is not a single scientific theory. Rather, it is a metaphysical principle, which we require our cosmological theories to adhere to. There are a zillion Big Bang cosmologies and we choose between them in the classical way scientists have always chosen theories: The theories which are most consistent with observation are the ones most likely to be correct.

There are three major observed properties of the universe which lead us to the conclusion that the Big Bang principle is valid for our universe: (1) the redshift distance relationship for galaxies, (2) the relative abundances of light elements, and (3) the cosmic microwave background (CMB). Let's look at them in turn.

Redshift and Distance. In 1929 Edwin Hubble demonstrated a correlation between independent measures of distance & redshift for a collection of 33 galaxies out to a distance of 2,000,000 parsecs or 6,520,000 light years (A Relation Between Distance and Radial Velocity Among Extra-Galactic Nebulae; Edwin Hubble, Proceedings of the National Academy of Sciences of the United States of America, volume 15, issue 3, pages 168-173, March 1929). That's a small number of galaxies, a small maximum distance, and the scatter in the data is substantial. Nevertheless, it is a real correlation, and decades of observation since then have verified the correlation (i.e., A critical review of techniques for measuring extragalactic distances; George H. Jacoby, et al., Publications of the Astronomical Society of the Pacific, volume 104, number 608, pages 599-662, August 1992). The obvious interpretation of such a relationship is that the universe is expanding. Ironically, Edwin Hubble himself never accepted that interpretation, and thus never supported Big Bang cosmology. But since then the alternative explanations have fallen away and the expansion of the universe is the last explanation standing.

Light Element Abundances. One second after the Bang, the temperature of the entire universe is about 10,000,000,000 degrees. Early advocates of Big Bang Cosmology thought that the high temperature sea of neutrons, protons, electrons and other particles would, as it cooled, form all the elements of the periodic table. But in an effort to derail Big Bang Cosmology, the team of Margaret Burbidge, Geoffrey Burbidge, William Fowler & Fred Hoyle proved that the heavy elements could all be accounted for by stellar nucleosynthesis, in one of the most important studies ever published in all of astrophysics: Synthesis of the Elements in Stars; Burbidge, Burbidge, Fowler & Hoyle, Reviews of Modern Physics, volume 29, issue 4, pages 547-650, 1957. But we still need the Big Bang to account for the relative abundances of deuterium (D), ^3He , ^4He and ^7Li . The observational part of this problem is about as hard to accomplish as it gets. But the state of research so far, both theoretical and observational, shows that theory and observation agree within the scope of the observational uncertainties. See chapter 20 of the Review of Particle Physics, published biannually by the Particle Data Group, and available from their website: <http://pdg.lbl.gov/> .

The Cosmic Microwave Background (CMB). A key idea of Big Bang Cosmology is that the early universe was very hot, and that the entire universe should cool as it expands. That idea leads to a natural prediction, namely that we should be able to measure the temperature of the universe. The first predictions of the temperature we should measure now, which showed up in the late 1940's, were necessarily uncertain, due to the liberty of setting free parameters in the cosmological models, and ran as high as 50 Kelvins. In 1965 Arno Penzias and Robert Wilson accidentally discovered a microwave background radiation

consistent with a temperature about 3 Kelvins, and each received 1/3 of the 1978 Nobel Prize in physics for this discovery (the other 1/3 went to Russian Pyotr Kapitsa for his unrelated work in low temperature physics). But a key prediction is that the background must be thermal in a strictly defined sense recognized in physics by conforming to the Planck Law for blackbody radiation. This was not in fact observationally demonstrated until appropriate measurements were made by the Far Infrared Absolute Spectrophotometer (FIRAS) instrument on the Cosmic Background Explorer (COBE) satellite, and published in 1994 (Measurement of the cosmic microwave background spectrum by the COBE FIRAS instrument; J.C. Mather, et al., *The Astrophysical Journal*, Part 1, volume 420, no. 2, pages 439-444). We now know that the CMB has a measured Planck Law temperature of 2.726 +/- 0.010 Kelvins, averaged over the sky, which is consistent with a key requirement of Big Bang Cosmology.

These are the main reasons why Big Bang Cosmology stands as the consensus cosmological principle today. But I do want to add a paragraph on the Bang. The almost legendary Stephen Hawking earned his PhD by proving that, in general relativity, the expanding universe always has to start as a singularity. That is jargon from mathematics that does not mean “unbelievably tiny”, or anything of the sort. Rather, it means, quite literally undefined. This means we cannot confidently say anything at all about how the universe began, nor in fact can we even say confidently that it began at all. The Bang could be a true beginning of the universe, or simply a transition from one state to another, there is simply no way to tell. So, having begun with a quote from Edward Harrison, I will close with a quote by Brian Greene:

A common misconception is that the big bang provides a theory of cosmic origins. It doesn't. The big bang is a theory, partly described in the last two chapters, that delineates cosmic evolution from a split second after whatever happened to bring the universe into existence, but it says nothing at all about time zero itself. And since, according to the big bang theory, the bang is what is supposed to have happened at the beginning, the big bang leaves out the bang. It tells us nothing about what banged, why it banged, how it banged, or, frankly, whether it ever really banged at all.

Brian Greene, in “The fabric of the Cosmos”; Vantage Books, 2004. ✧

Report From RTMC *(Riverside Telescope Makers Conference)* *By Jack Eastman*

I survived the 2008 RTMC, Here's a quick look.

RTMC was a blast in spite of the weather and all. Astronomically, I grade it a D-. Cold, Snow Hail some wind and a low Friday night of 19°. Low Saturday 10°, and Sunday, 11° as recorded by a Max-Min thermometer in top of my

car. A sucker hole opened up Friday night, with a seriously black sky, maybe contrast with the clouds, but more likely the clouds were over the Desert and L.A. basin, squelching the light pollution. It did clear up Saturday and Sunday nights, but it was bitter cold. Gastronomically, D+. First dinner, A+ plenty of grub and hot (thermally), Last dinner, also quite good, but all the ones in between were awful or worse, small portions and cold. The hamburgers one of the lunches could have been old hockey pucks. Argh! Talks, swap meet and such, B+ Somewhat subdued, due, I think, in a large part to high gas prices and evil weather. Meeting and Greeting folks, old (and new) friends, A+. This is what it was all about for me, at least! Several excellent talks, more on this in another report. Steve Sanchez had some excellent pictures of some of the frost covered telescopes and the snow covered ground. Maybe Steve could sent them to you folks, as I don't think this thing will forward attachments to the lists. Real highlight was the landing of Phoenix on Mars. A picture perfect entry and landing, with images coming in very soon after touchdown. As the ad says, Trip, \$350, Meals, lodging \$180 Getting with all you folks from the recent (and distant) past, Priceless. ✧

Report From RTMC

By Richard Roosman

Why do people go to the Riverside Telescope Makers Conference? A lot of people go for the Saturday night door prizes. This year, because it was cold outside, the annex (two rooms) next to the main hall was opened up, so more people could get inside where it was warm. There were still a few hardy souls out front and out back. There were lots of prizes, but few winners from LAAS. Jack Eastman from LAAS won one of the door prizes.

Lots of people go to RTMC just on Saturday. Many people stay for the Sunday night door prizes. Enough people stayed to fill the main hall and overflow into the annex. Door prizes were delayed this year. They were delayed by the Phoenix Mars landing. We watched the proceedings at JPL on the big screen. Drawing for door prize tickets began about 7:30. Norm Vargas from LAAS won a Telrad.

Many people go to RTMC to shop. The weather forecast was for cold, with a chance of rain or snow. Maybe that's why there were less people at RTMC. Less people usually means less sales. To encourage sales, some booths gave ten percent off and did not charge sales tax.

Some people go to RTMC to view the night sky. Saturday and Sunday nights were clear, but cold. Speaking of cold, it either hailed or snowed Friday. But it melted. The weather did not keep people from viewing through their telescopes.

People go to RTMC for the speakers. One of them was Tim Thompson from LAAS.

Another reason to go to RTMC is to mingle with other amateur astronomers. It's great to see people from LAAS. But we also get a chance to talk to people from other astronomy clubs.

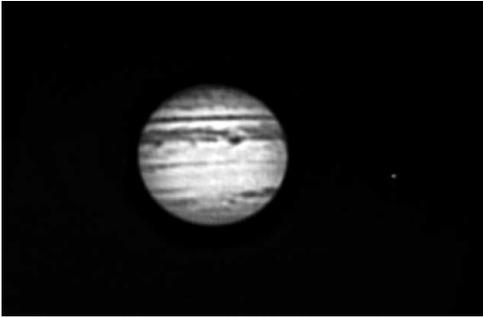
RTMC will be at Camp Oakes again next year, Memorial Day weekend, 2009. Plan to go. ✧

This Month in the Sky

By David Nakamoto

In July this year, Jupiter finally starts making an appearance just as the Sun sets, rising in the East at the same time.

Jupiter is 1/60th the size of the Moon. It's slightly smaller than the largest craters on the visible Moon. This puts a premium on telescope aperture, a long focal length, and magnification if you're going to see anything other than a band or two on the planet, and see anything happening with the satellites.



Jupiter's features are of low contrast. Don't expect to see gaudy images like those from Voyager or Galileo, even in relatively large instruments. The colors you see are due to image processing, as my own efforts show. Even faint and hard to see features are easier to "see" using imaging, as my black and white image at left shows. You'll need patience, and a willingness to learn

how to recognize faint features on a bright disk surrounded by blackness. Some tips include not staring too long, but move your eye around the planet. Try and be in a relaxed position when observing; avoid bent over or other stressful positions. The more comfortable you are observing, the easier and longer you can observe, and the quality of your observing also improves. This of course applies to all observing, and not just astronomical observing.

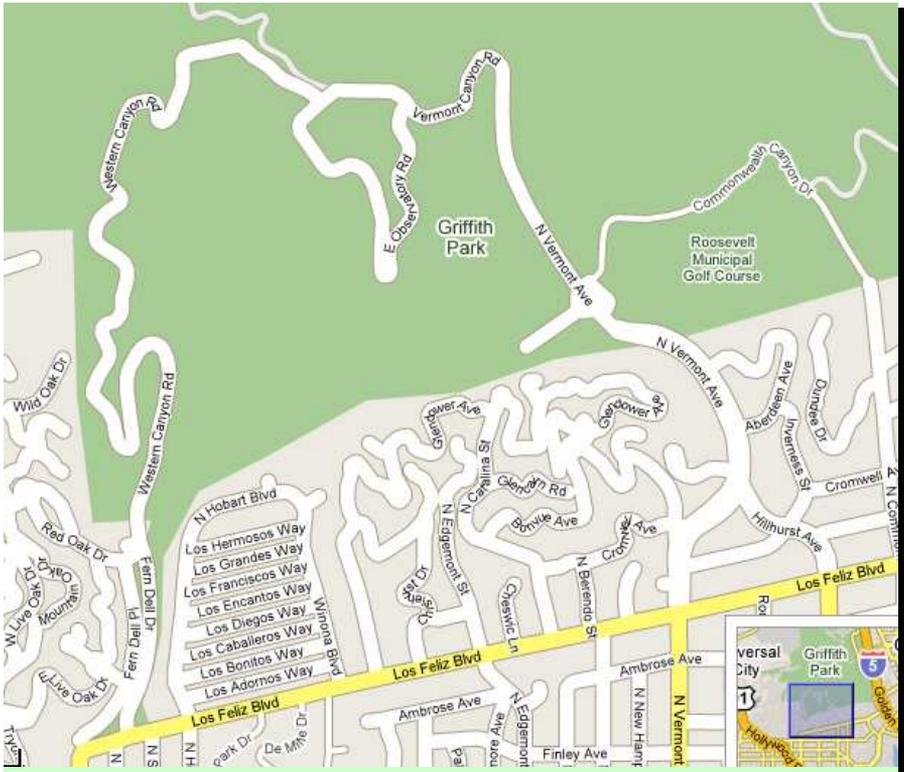
As with all the planets, the keys in a telescope are large aperture with fine optics, a long focal length, and high powered eyepieces. All the optics, from the objective to the eyepiece, must be first rate, because any imperfections are going to be amplified by the need for high magnification. This is why the classical f/15 focal ratio refractor, despite the long tube which can make it a bit unwieldy, is still regarded as one of the best telescopes for planet viewing. The Maksutov probably comes in second, along with a long focal length Newtonian or classical Cassegrain design. You'll need aperture, not so much for increasing brightness, although this is a necessity for seeing the much fainter satellites on the other three gas giants. But to see fine details, you need aperture to separate them out of

the background. A telescope with a long focal length is needed to get more magnification. And of course high powered eyepieces are essential for this. I prefer those with long eye relief, which simply means that you don't have to put your eye right up against the eyepiece to see what's going on, especially if you're like me and you prefer to keep your eyeglasses on when observing.

There are always changes to the appearance of Jupiter. There are, of course, the cloud features, which you can see in the black and white image. There is a report of three red spots on the planet, the Great Red Spot along with two much smaller ones. But as the four major satellites orbit around Jupiter, they do a dance where they disappear behind the planet, often emerging out of thin air when they emerge out of the shadow of their giant master, or they cast their own shadows on Jupiter. Io and Europa are the usual suspects, due to their tighter orbits and shorter orbital periods. Occasionally the timing is right and Ganymede casts a shadow on Jupiter, but those of Callisto normally have to wait until its orbit is lined up along the line between Jupiter and earth. Remember that the tilt of the satellite orbits is the same as the giant planet itself, around 3° , so years when Callisto shadow transits happen occur at 6 year intervals. Programs such as Starry Night™ give these events for any day of the year.

In large telescopes, not only do you see more features on the planet, you begin to see features on the satellites. Not much beyond shadings, but consistent reports of a polar hood on Io and markings on both it and Ganymede are frequently reported, and sometimes photographed, especially with web cameras of high sensitivity and special imaging processing software such as Registax to align and stack the images to improve both contrast and fine detail discrimination.

As for imaging, any camera that can be fitted with an eyepiece extension tube so it's held firmly to the telescope can be used as long as it is sensitive enough, and it doesn't unbalance the telescope with its weight. Remember that in rebalancing the telescope you add weight to it, which is a problem small telescopes face, but it happens with all sizes. As for the, "how sensitive I enough?" part, all I can say there I say is, "do not gage the performance of any camera by typical night scenes or even the Moon". Both are much brighter than any planet, as you can tell by simply comparing how much you squint or not when you view the Moon as compared to any planet. Unless the telescope is large enough to compensate for the low light levels you'll find with all the planets imaging is going to be easy to tough. Jupiter is certainly in the range of a small telescope and a CCD-based web camera. My images for this article were taken with a 5-inch SCT for the black and white image, and a 127mm Maksutov for the color image, both using a 2x to 3x Barlow projection but no eyepiece. And with Jupiter, that's also enough to get the Galilean satellites, although not enough to show detail in them. ✧



Greek theater events cause closure of Vermont Ave. to through traffic. Please save this map for future reference. I will post it in the bulletin from June to September, and then not for the rest of the year.

Use Ferndale, which changes into Western Canyon Road. Ferndale is about 1 mile further west on Los Feliz than either Hillhurst or Vermont. Ferndale becomes Western Canyon Road once you enter the park. Western Canyon Road is very windy, so drive carefully. You will have to go through the tunnel at the top of the road and turn right onto East Observatory Road. ✧

Outreach Program

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 ✧

Don DeGregori

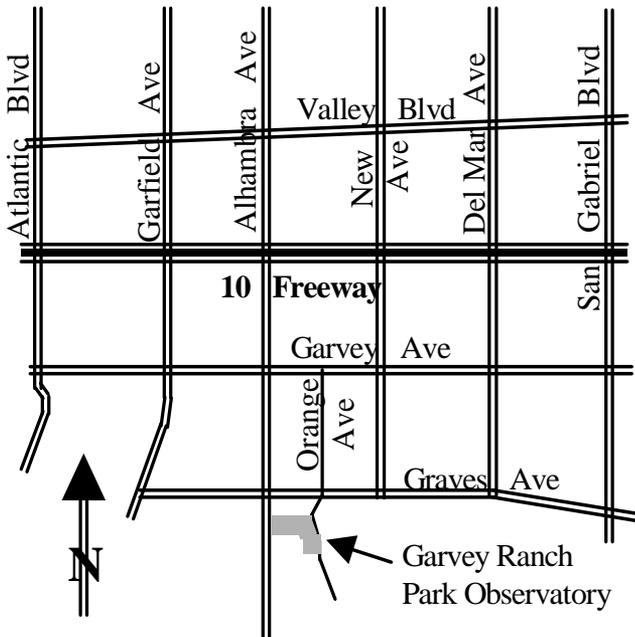
FOR SALE: Vintage Questar 3.5-inch Telescope

Your L.A. Astronomical Society is selling a 1971 standard 3.5-inch Questar (Serial No. 1-CV-4546-BB) that was donated to us by a generous friend. But this telescope is not well suited for use at LAAS' public star parties and other outreach activities or as a loaner scope for our members, and it is too valuable to languish in our shop. It's an excellent instrument that was fully reconditioned this year by Questar Corp. and is in pristine condition. Its premium features include a Cer-Vit mirror for increased reflectivity and broad band coatings to reduce light loss, and it comes with all the standard Questar components and accessories of its era, including two "Erfle" eyepieces (26 mm and 12 mm), an off-axis sun filter, a synchronous drive AC motor, and a cowhide leather carrying case with a luggage cover. It is being offered for sale at \$2,300. Contact the LAAS treasurer at treasurer@laas.org or by mail at P.O. Box 56084, Sherman Oaks, CA 91413.



Map to Monterey Park Observatory

(The place to build your telescope)



LOANER CORNER



It might not look like it, but the spring and summer star parties are just around the corner. Now is the time for new members and existing members that would like to try out something new to check out one of the LAAS loaner telescopes. At the present time there are several available. All are fully equipped with a set of eyepieces. A simple collimating tool is included with all reflectors and a star diagonal is included with refractors.

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



LAAS-2: 4.5" f/8 Tasco reflector on an Edmund equatorial mount with a clock drive. This telescope has been upgraded with a 1.25" focuser and 6x30 finder.

LAAS-4: 6" f/5 Telescopic reflector on a Dobsonian mount.

LAAS-6: 10" f/4.5 Discovery reflector on a Dobsonian mount. This fast telescope is also equipped with a Tele View Paracorr to correct off axis coma common with fast paraboloids.

LAAS-4

LAAS-7: 80mm f/15 Meade refractor on an Orion Sky View Deluxe equatorial mount. This is an excellent instrument for the Moon and planets.

LAAS-2

LAAS-8: 80mm f/11.4 Selsi refractor on an equatorial mount.

LAAS-9: 80mm f/6.25 refractor with University Optics objective on an equatorial mount. This fine Rich Field Telescope is good for going through the Messier Catalog.

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

David Sovereign

EVENTS CALENDAR

Date	Event	Location and Information
July 5th (Sat)	Dark Sky Night	Lockwood Valley
July 12th (Sat)	Public Star Party	Griffith Observatory. See pg 3 for details on how to attend.
July 14th	General Mtg	Griffith Observatory Dr. Jason Rhodes on dark energy and dark matter.
Aug 2nd (Sat)	Dark Sky Night	Lockwood Valley
Aug 9th (Sat)	Public Star Party	Griffith Observatory. See pg 3 for details on how to attend.
Aug 11th (Mon)	General Mtg	Griffith Observatory Speaker to be announced.
Aug 30th (Sat)	Dark Sky Night	Lockwood Valley

The board meeting is held at 8pm on the Wednesday night prior to the general meeting, at Garvey Ranch Park. The Monday general meetings start at 7:30 pm unless otherwise noted. See each month's bulletin for updates.



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@yahoo.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 has gone up to \$34 a year, \$60 for two years. ✧

New Members Corner

Welcome to the Los Angeles Astronomical Society! Right now, we have lost our previous New Members Coordinator to college, so we're looking for someone to take over this position. If you're interested, please contact one of the board members on page 2. ✧

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