

BULLETIN

volume 85, issue 9 *September 2011*

Inside this issue

Contact Information	2
Editor's Corner	2
Pacific Astronomy & Telescope Show	3
The First Planet Emeritus	4-10
LAAS on Night Sky Network	10
Family Night Group Portrait	11
Outreach Program Information	12
Garvey Ranch Park Facility Map	12
Mt Wilson 60-inch Telescope Nights !	13
Public Star Party Information	14
Website information	14
Events Calendar	15
<u><i>Sky & Telescope</i></u> & <u><i>Astronomy</i></u> subscriptions	16
Membership Information	16

**85 YEARS OF ASTRONOMY IN
LOS ANGELES**

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Editor's Corner

For informative and genial conversations, mirror polishing, or looking through an 8-inch high grade refractor, head on over to Garvey Ranch Park Observatory in Monterey Park on Wednesday evenings between 7:00 and 10:00pm.

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 a time, with a caption for each. Include such information as camera type, telescope or other equipment used, and exposure times, where pertinent. The deadline for submitting bulletin material is the 10th of each month. If possible, please submit through email 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. ✧

PATS, the Pacific Astronomy And Telescope Show

will be held on September 17-18, 2011.

Richard Roosman and Mary Brown both have tickets for sale for all LAAS members. If you would like to purchase tickets which are \$10.00 each (they're \$20 at the door), please contact Mary at 626-791-2740 or write to Richard at richardinwalnutpark@msn.com.

Bill Nye, The Science Guy and John Dobson will be a two of the featured Speakers!

The tickets will also be available at all upcoming LAAS events such as the public star parties, Garvey Ranch, Lockwood, etc.

Be part of the most exciting astronomy and telescope show on the West Coast.

Browse dozens of manufacturers and dealers of astronomical equipment, software, and accessories, all under one roof. Company representatives and, in some cases, owners will be available to answer your questions. Check out all the telescopes and discover the one that's right for you. While there will be many which are suitable for beginners, there'll be plenty that are aimed at intermediate and advanced amateurs. See astrophotography products from the industry's leading camera, mount, video camera, and software manufacturers. Examine books, star charts, and astronomical accessories across a range of prices. Find bargains and pick up the product you always wanted. Enjoy indoor events including talks by scientists, observers, and a very talented artist. Outdoors you will find an array of specialized solar telescopes offering breathtaking views of the Sun (for many, this alone is worth the trip). Tour Mt. Wilson and observe on the sixty inch telescope Pasadena, at the foot of historic Mt. Wilson.

Calling all LAAS volunteers! We need our members to help us setup, tear down and work the booth at PATS this year. You can volunteer for an hour or stay as long as you like. Hanging out at the booth is always fun!

Please call Mary at 626-791-2740 to volunteer! ✧

The First Planet Emeritus

by Timothy Thompson

Does it seem like five whole years have passed since the International Astronomical Union decided to change the status of Pluto from “planet” to “dwarf planet”? Well, the deed was done on 24 August 2006, so it has been that long. I wrote “*The Ninth Planet*” for the June 2006 LAAS Bulletin, before the IAU rendered the title factually incorrect. But whether we call it the ninth planet or the first planet emeritus, Pluto is still Pluto and it’s worth a revisit.

Pluto rolls around the sun in a most peculiar orbit, inclined 17 degrees above the average plane of the solar system (much more than any other planet), and so eccentric that Pluto was regularly dethroned by Neptune as the farthest planet from the sun, back in the old days when Pluto was still a “planet”. This last happened during the 20 year span 7 February 1979 to 11 February 1999, when Neptune was farther from the sun than Pluto. But the orbits of Pluto and Neptune never actually cross, Pluto being in a far more highly inclined and eccentric orbit. Also, Pluto and Neptune are locked in a 3:2 resonance, meaning that for every 3 orbits Neptune makes, Pluto completes 2, so Neptune is always a long way away from Pluto whenever Pluto is near perihelion.

Pluto last reached perihelion, its closest approach to the sun, on 5 September 1989 at a distance of only 29.65558 AU. It will reach aphelion, its greatest distance from the sun, on 19 February 2114 at a distance of 49.31895 AU (1 AU = 1 “astronomical unit” and is the average distance between Earth and the sun; that’s 92,959,672 miles or 149,597,870.7 kilometers). Furthermore, Pluto’s axis of rotation is tilted 120 degrees from its orbital plane (for Earth the axis is tilted 23.4 degrees), so Pluto lies on its side much like Uranus does. These two conditions combine to have a big effect on the little atmosphere that Pluto has, and an interesting effect on the visibility of Pluto’s moons. Pluto takes about 247.92065 years to make one orbit around the sun.

Pluto weighs in with about 1.3×10^{22} kg or 2.9×10^{22} pounds (1 kilogram mass = 2.2046341 pounds weight at one Earth gravity). That’s 29 billion trillion pounds. Our own Moon weighs over 5 times

(Continued on page 5)

more. Pluto is about 1430 miles across. Our own moon is about 1.5 times larger. Pluto is smaller than our own moon, and several other moons are also larger than Pluto. One might argue that Pluto was “lucky” to have such a long run at planethood.

Formally exiled from the ranks of Planet, the official designation is now 134340 Pluto, the 2nd most massive of the dwarf planets, behind 136199 Eris. On 1 September 2011 at 9 PM PDT Pluto will be 31.6356959852694 AU from Earth and 32.087420275230 AU from the sun, with an apparent visual magnitude 14.10. Look for it at J2000 RA & DEC 18^h 20.134^m & -19° 3.405' in Sagittarius, against the Milky Way, not far from the M24 star cloud.

Planet X

In the early 1900's astronomers had determined that the orbital motions of Uranus and Neptune appeared to be disturbed by the presence of another, as yet unseen, massive planet. The search for that planet at Lowell Observatory led to the discovery of Pluto in 1930 by Clyde Tombaugh. But Pluto turned out to be a very small object, not a massive planet. So the search went on for Planet X. But in 1993 the JPL Solar System Dynamics Group brought the search to a screeching halt. Precise tracking of the Voyager spacecraft past all of the large planets allowed for a new and more precise determination of the masses of Jupiter, Saturn, Uranus and Neptune. Once those new masses went into the old equations, the entire disturbed look of the Uranus and Neptune orbits, meaning all of the evidence for Planet X, vanished. It was all just observational uncertainty (“Planet-X: No dynamical evidence from the optical observations”, E. Myles Standish, *The Astronomical Journal* 105(5): 2000-2006, May 1993).

Pluto & Charon

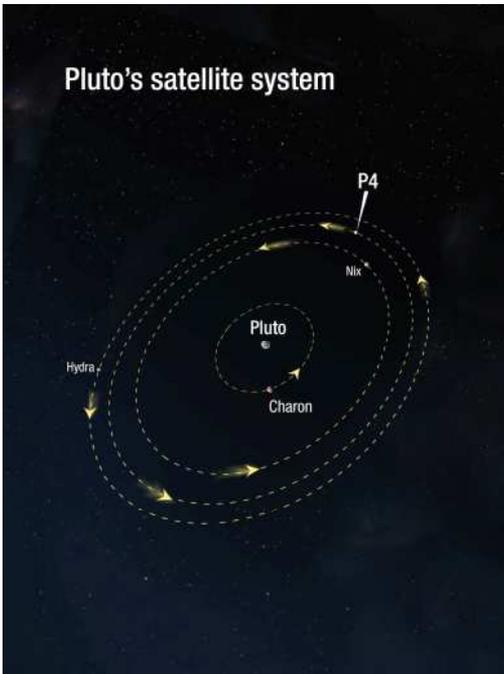
Charon was discovered by James Christy at the US Naval Observatory in Flagstaff, Arizona, in plates made on 2 July 1978. Charon revealed itself as a bump on the side of Pluto, as they were too close to each other to be resolved individually from the ground. But the discovery came at a fortuitous time, when Pluto was still heading towards its 1989 perihelion.

Pluto was too far away for even the largest ground based telescopes to resolve any detail. However, soon after Charon was

(Continued on page 6)

discovered, astronomers realized that from about 1986 to 1991, Pluto and Charon would eclipse each other as Charon went around Pluto, the best alignments being in 1988. This happens because of Pluto's 120 degree obliquity, so Charon's orbit cuts across our line of sight to Pluto (and vice-versa) as Pluto rolls around the sun. Precision photometry during these eclipses allowed astronomers for the first time to make crude maps of bright & dark patches on the surface of both Pluto & Charon.

Pluto & Charon are mutually tidally locked. The same side of Charon always points towards Pluto, much as our own moon always shows us the same side. However, in the case of Pluto & Charon, the effect is mutual, the same side of Pluto always faces Charon. It takes Pluto 6.3872 Earth days to make one Pluto day, and that's also how long it takes Charon to complete one orbit around Pluto. This would eventually happen to the Earth-moon system, but it would take tens of billions of years, by which time the red giant sun will have put a stop to such things by simply gobbling up the Earth-moon system altogether. But it happens to Pluto & Charon fairly quickly, in astronomical terms, because Charon has about 13% of the mass of Pluto, making it by far the largest "moon" in the solar system, compared to its host "planet". Pluto & Charon are really more like a binary system than a planet & moon.



The Other Moons of Pluto

As of today, we are being mooned by a mere dwarf planet. Yes, Pluto now has more moons than all of the 4 inner planets combined: Charon, discovered in 1978, Nix & Hydra, discovered together in 2005, and P4, discovered in 2011 is too new to have a name yet.

Nix & Hydra are tiny; Nix is probably about twice as massive as Hydra, but they both weigh in at about 100,000 times less massive

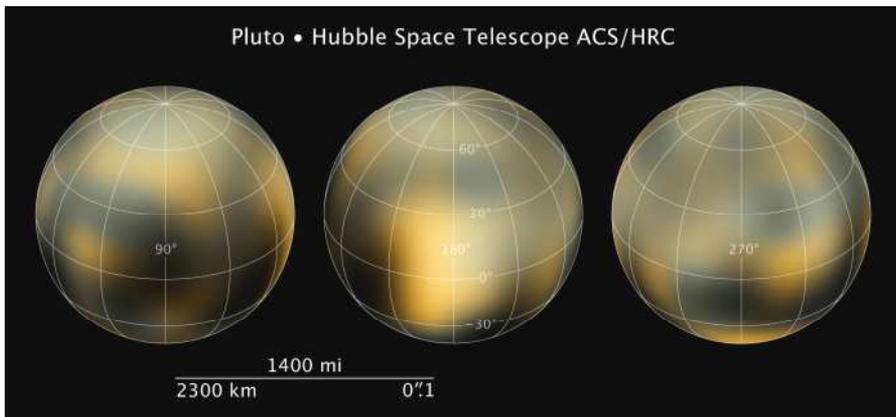
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than Pluto. They are also both probably about 30 miles across, but this is very uncertain, they could be anywhere from 10 to 50 miles across. Their orbits are close together and outside the orbit of Charon. There may even be some mutual interactions between them, as is known in some of the smaller moons of Saturn. After their discovery, studies implied that the region outside the orbits of Nix & Hydra would be an orbitally unstable region and no new satellites were expected to be found there.

The new moon of Pluto, S/2011 P 1 (or simply P4) was first spotted on 28 June 2011 when the new Wide Field Camera 3 (WFC3) on the Hubble Space Telescope (HST) was searching around Pluto for any possible rings (none found so far). Followup images from July 3 and July 18 allowed for the new moon to be confirmed on July 20. P4 is only about 0.1 as bright as Nix and has remained undiscovered until now because Pluto images were not exposed deeply enough to see it. P4 is surely the smallest of Pluto's moons, probably 8 to 20 miles across. P4 orbits between Nix & Hydra, and so was not found in the region previously determined to be orbitally unstable.

Current thinking is that all the moons of Pluto owe their existence to a collision between Pluto and another trans Neptunian object, much like the hypothesis for the origin of our own moon.

The surface of Pluto



Features were not directly imaged on the surface of Pluto until after the optics of the Hubble Space Telescope (HST) were improved in late 1993. Faint Object Camera (FOC) images were made with HST in 1994 and took two years to process before being released in

(Continued on page 8)

1996. The Advanced Camera for Surveys (ACS) imaged Pluto from the HST during June 2002 to June 2003 then combined with the 1994 FOC images. The new ACS/FOC maps of Pluto were released in February 2010. Not only can we now see amazing detail on the surface of Pluto, but we can also see that the surface has changed, indicating the evaporation or deposition of ice on the surface. The ACS images were made when Pluto was on average 30.6 astronomical units (AU) from Earth (that's about 2,881,749,832 miles).

The new ACS maps show clear changes on the surface of Pluto over time. The *B-V* average color of Pluto in the 2002-2003 ACS maps was 0.9540 +/- 0.0010, while the color measured in 1992-1993 was a considerably bluer 0.868 +/- 0.003. This change in color cannot be explained by viewing geometry, but requires real physical change on the surface. Most likely this change is the sublimation of surface ices into the atmosphere, which is consistent with observations of the atmosphere.

The surface temperature is roughly 40 Kelvins (that's -388 degrees Fahrenheit, compared to Earth's global average temperature of +57). This is somewhat colder than one would expect, most likely because sublimation of surface ices into the atmosphere cools the surface, carrying away the heat energy that would otherwise warm the surface perhaps 10 Kelvins higher.

The Atmosphere of Pluto

Until fairly recently, the only way to see the atmosphere was to take advantage of the rare opportunities when Pluto occulted or grazed a background star. But the advent of really large telescopes has made direct observation from Earth possible, but stellar occultations are still the best way to see vertical structure in the atmosphere. Since perihelion in 1988 the atmosphere of Pluto has been observed to double in mass, despite a decrease of input solar energy as Pluto moves away from perihelion.

The atmospheric surface pressure is in the range 6 – 24 microbars, where one bar is slightly less than one Earth atmosphere. The lower atmosphere is not much warmer than the 40 Kelvin surface, maybe 45-50 Kelvins. The upper atmosphere, as is the case for Earth, is somewhat warmer, about 100 Kelvins.

The atmosphere of Pluto consists mainly of nitrogen, maybe 99%.

(Continued on page 9)

The remaining 1% is mostly methane with a tiny fraction of carbon monoxide (CO). The CO abundance appears to have increased considerably over the last decade, almost certainly due to the sublimation of surface ices.

Pluto rolls along much like Uranus. In 1987, about 15 months before perihelion, the south pole of Pluto came into sunlight after 120 years in darkness. Surface ices exposed to the sun have been sublimating into the atmosphere and are the cause of the observed doubling of Pluto's atmosphere since Perihelion. It is likely that this process will continue until about 2015, when the atmosphere will reverse its expansion and begin to freeze out onto the north pole, which is destined to be dark for 120 years, just like the south pole. 2015 also happens to be the year that the New Horizons mission will fly by Pluto and its moons, just in the nick of time to see Pluto while it still has an atmosphere worth looking at.

New Horizons

The mission formerly known as Pluto Express, but now called New Horizons, launched on 19 January 2006, while Pluto was still a real planet. It picked up a gravity assist from Jupiter in February 2007. Currently in cruise mode, it will arrive at Pluto in July 2015 and whiz by, like Voyager touring the solar system, back in the "old days" of space exploration. During the period 2016 to 2020 New Horizons will tour the Kuiper Belt.

The New Horizons spacecraft carries a payload of 7 science instruments. "Ralph" will provide color and surface composition maps of Pluto and Charon. "Alice" is an ultraviolet imaging spectrometer to study the atmosphere of Pluto. "REX is the Radio Experiment, which will use the radio communication system to send back to Earth through the atmosphere of Pluto, which will provide very high resolution probes of the atmosphere, since the position and velocity of the spacecraft are very well known. "LORRI" is the Long Range Reconnaissance Imager, an 8.2 inch telescope that will image Pluto with 100 meter resolution at closest approach. "SWAP" is the Solar Wind Around Pluto experiment, which will use the solar wind to determine if there is a magnetosphere around Pluto. "PEPSSI" is the Pluto Energetic Particle Spectrometer Science Investigation will look for any neutral atoms or molecules escaping from Pluto's atmosphere and joining the solar wind. And finally, SDC is the Venetia Burney Student Dust Counter, built by students at the

(Continued on page 10)

University of Colorado at Boulder, which counts and measure the size of dust particles along the entire trajectory of New Horizons, which will sample the interplanetary dust in regions where it has never been sampled before.

When New Horizons makes its closest approach to Pluto on 14 July 2015 at 11:49:59 UTC, Pluto will be 31.9011683461252 AU from Earth and 32.908263686450 AU from the sun with an apparent visual magnitude 14.12. ✧

LAAS On Night Sky Network

LAAS has recently joined Night Sky Network which was developed by NASA and JPL. All LAAS Members are encouraged to register using the following link.:

[http://nightsky.jpl.nasa.gov/club-apply.cfm?
Club_ID=1344&ApplicantType=Member](http://nightsky.jpl.nasa.gov/club-apply.cfm?Club_ID=1344&ApplicantType=Member)

Or type in the name of our group under the map section.

Having our club on Night Sky Network not only promotes LAAS in Southern California but lists us on a national registry for astronomy groups. NSN assists groups like LAAS in providing FREE tools such as DVDs, handouts, props, posters, flyers, books, teaching manuals, CDs, and more to be used in our great Outreach program. They even have teaching videos on the web site so that we can easily learn how to use the Tool Kits. At this time, we have received two Tool Kits from NSN which you can use at your next Outreach event. Mary Brown has them in the library at Garvey Obs..

Join LAAS as we evolve into the world of technology by signing up on Night Sky Network (NSN).

Also, please check out LAAS on Facebook ! ✧

Andee Sherwood



Bob Deubler took this image at the July Family night and Camp Out at Lockwood Valley. We welcome you to join us at Lockwood for an evening of family, friends and stargazing fun. Let's bring the FUN back to Lockwood! Activities will include a guided laser night sky tour and plenty of ohhhhs and ahhhhhsss! GATES OPEN AT 3:00 PM! We ask our members to RSVP with the number in their party and bring a potluck meal, a possible side dish, drinks or desserts to bring to share. Join us early and set up your tent and sleeping bags for the kids, and settle in to make a night of it! Please respond early so we can get a tentative count and start a list of items that members are bringing to share. Call 213-673-7355 to RSVP Please note that there will be NO Family Night in September due to PATS. There will be a Family Night in October. ✧

Mary Brown

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 your 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 join the LAAS Yahoo group. To join the LAAS Yahoo group, see below.) ✧

Don DeGregori

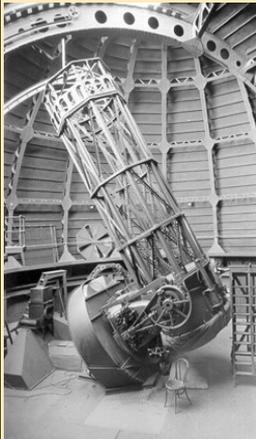
Map to Monterey Park Observatory

(The place to build your telescope)



Mt Wilson 60" Nights

LAAS has arranged for two half-nights and one full-night at the Mount Wilson 60-inch telescope this year. All are New Moon nights. Half-nights are until 1:00 am. The two remaining nights are:



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

Oct 28th, Fri (half night)

shows up, whether family member, friend, or guest, will have to pay in order to be allowed in the 60-inch telescope observatory. The cost is \$80 per person for the full night (no half night reservations on a full-night outing), and \$45 per person for the half night. We are allowed to accommodate only a limited number of participants at each session, and your reservations are being accepted on a first come, first serve, basis.

To secure your reservation, send in your request AND A CHECK payable to LAAS to our Treasurer at:

P.O. Box 56084

Sherman Oaks, CA 91413

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 Shapley and Hubble will add to your appreciation of their contributions.

The scope will belong to LAAS for the time indicated. 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.

For further information, contact our Treasurer at treasurer@laas.org or by mail at P.O. Box 56084, Sherman Oaks, CA 91413. ✧

Griffith Observatory

Public Star Party Procedure

Before 6:00pm, 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 Ave. After 6:00pm, no one is allowed to drive up East Observatory Ave, and you'll need to drive through the tunnel, up West Observatory Ave., and through the public parking lot to the traffic control person at the end of the lot. Show the person there your badge and they should let you through. Once at the U curve in front of the Observatory, temporarily park your car on the side nearest to the observatory and unload your equipment. Mary Brown will be available with a cart to facilitate moving your equipment. Unload your equipment at the spot where you wish to set up. Mary will oversee your equipment while you park along East Observatory Rd. Then set up your equipment.

Volunteers without equipment are also needed. We especially need help with crowd control with the LAAS 26-inch telescope.

Those who volunteer should remember that the main focus is to be of service to the patrons at Griffith Observatory and show them the nighttime sky. New Members are not expected to adhere to this policy.

Please check the LAAS website and Yahoo group messages for changes and updates in any LAAS event.

To be trained in moving, setting up, and preparing the 26-inch, please attend one of the Griffith public star party events. We normally start setting it up around one hour before sunset, weather permitting. We'd like as many members to be trained and comfortable handling the telescope.

Have fun and enjoy! ✧

PJ Goldfinger & David Nakamoto

EVENTS CALENDAR

Date	Event	Location and Information
Sep 3 rd (Sat)	Public Star Party	Griffith Observatory 2:00pm to 10:30pm See pg 14 for Procedures and Rules.
Sep 7 th (Wed)	Board Meeting	Garvey Ranch Park Class Room. 8:00pm to 10:00pm
Sep 12 th (Mon)	General Meeting	Griffith Observatory Event Horizon Theater 8:00pm to 9:45pm. Speaker and topic to be determined.
Sep 24 th (Sat)	Dark Sky Night	LAAS Lockwood Valley site
Oct 1 st (Sat)	Public Star Party	Griffith Observatory 2:00pm to 10:30pm See pg 14 for Procedures and Rules.
Oct 5 th (Wed)	Board Meeting	Garvey Ranch Park Class Room. 8:00pm to 10:00pm
Oct 15 th (Sat)	Family Night & Camp Out	LAAS Lockwood Valley site For details see pg 10
Oct 17 th (Mon)	General Meeting	Griffith Observatory Event Horizon Theater 8:00pm to 9:45pm. Speaker and topic to be determined.
Oct 22 th (Sat)	Dark Sky Night	LAAS Lockwood Valley site
Oct 28 th (Fri)	Mt. Wilson Night	Details on pg 13.



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

Sky and Telescope Subscriptions

Sky and Telescope subscriptions renewals should be sent directly to Sky Publishing. To start a Sky & Telescope subscription at club rates, send a check payable to "Sky & Telescope" in the amount of \$32.95 for a one year subscription to :

LAAS treasurer

P.O. Box 56084

Sherman Oaks, CA 91413

Be sure to include the exact name and mailing address for your subscription.

Then thereafter send the renewal bills directly to Sky Publishing. ✧

Astronomy Magazine Subscriptions

For a club rate subscription to Astronomy, send a check payable to Kalmbach Publishing Co. in the amount of \$34 for one year or \$60 for two years to :

LAAS treasurer

LAAS

P.O. Box 56084

Sherman Oaks CA 91413

Be sure to include the exact name and mailing address for your subscription. That magazine also requires later subscription renewals to be handled through the LAAS Treasurer. ✧

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