SJAA EPHEMERIS

SJAA Activities Calendar

Jim Van Nuland

(late) May

30 Astronomy Class at Houge Park. 7:30 p.m. Paul Kohlmiller and Steve Nelson will present an Introduction to Astrophotography.

30 Houge Park star party. Sunset 8:22 p.m., 16% moon rises 3:09 a.m. Star party hours: 9:30 until midnight.

31 Dark Sky weekend. Sunset 8:22 p.m., 8% moon rises 3:43 a.m.

June

7 Coyote Lake County Park public star party. Sunset 8:26 p.m., 25% moon sets 12:13 a.m.

7 Dark Sky weekend. Sunset 8:26 p.m., 25% moon sets 12:13 a.m. Henry Coe Park's "Astronomy" lot has been reserved.

13 Houge Park star party. Sunset 8:29 p.m., 84% moon sets 2:46 a.m. Star party hours: 9:30 until midnight.

20 Summer Solstice at 4:59 p.m.

21 **General Meeting at Houge Park**. 8 p.m. Our speaker is Dr. Helen Quinn on the "Mystery of the Missing Antimatter."

27 Houge Park star party. Sunset 8:32 p.m., 30% moon rises 1:39 a.m. Star party hours: 9:30 until midnight.

28 Astronomy Class (beginner's workshop) at Coyote Lake County Park

28 Coyote Lake County Park public star party. Sunset 8:32 p.m., 20% moon rises 2:14 a.m.

July

2-5 **Golden State Star Party. See March Issue.**

5 Dark Sky weekend. Sunset 8:31 p.m., 13% moon sets 10:40 p.m. Henry Coe Park's "Astronomy" lot has been reserved.

11 Houge Park star party. Sunset 8:29 p.m., 69% moon sets 1:18 a.m. Star party hours: 9:30 until midnight.

19 **General Meeting at Houge Park**. 8 p.m. Our speaker is TBA

25 Houge Park star party. Sunset 8:21 p.m., 43% moon rises 12:13 a.m. Star party hours: 9:30 until midnight.

25 Astronomy Class at Houge Park. 7:30 p.m. TBA

26 Coyote Lake County Park public star party. Sunset 8:20 p.m., 33% moon rises 12:53 a.m.

The Board of Directors meets before each general meeting. Call the hotline for the exact time.

Coyote Summer Program Returns

Rob Hawley

Coyote Park and SJAA are once again offering a summer program to the public this summer. Coyote Park is one of the closest dark sky sites. It is certainly the easiest to get into. We are offering 5 Saturday nights

June 7, 28, July 26, Aug 23, Sep 20

Coyote is one of my favorite sites for private viewing. We use the boat dock which offers us some protection from road lights and has a safer surface than the field we used in the past. We will have a grill running for you to cook your own food or share as you wish.

Most of the nights this year are 3rd quarter weekends. 3rd quarter allows us to show dimmer objects.

We will hold the next beginner's workshop at Coyote on June 28 during the public star party. This will allow you to practice on a wider range of targets.

I hope you can join us. You can find directions on our website.

Please Tell Us When You Move

You may have noticed the "Address Service Requested" that appeared on the cover last summer. Postal Regulations now require that bulk mailers such as SJAA request this service. What is it?

If we send an Ephemeris to your old address, then it is returned to us with the forwarding information you provided the post office. That way we can update our mail list and the post office gets fewer pieces of dead mail.

The catch is that USPS charges SJAA 50 cents each time we use the service.

Please save the club some money by notifying membership@sjaa.net when you move. Alternatively you can send one of the Change of Address cards in your moving packet to the club PO Box.

24 hour news and information hotline:
(408) 559-1221
http://www.sjaa.net

Volume 19 Number 6 Official publication of the San Jose Astronomical Association, June 2008

DEEP SKY OBSERVING

by Mark Wagner

June 2008 third quarter to new moon observing list. The list begins in the north and moves southward. Targets are rated 1 to 3 for challenge, with 1 being easier. All objects are within one hour of right ascension, north to south, in the east at astronomical dark. More objects are in the full list which is at http://www.resource-intl.com/Deep.Sky.Jun.08.html

Rating	Object	Const.	Type	Size	Mag	R.A.	Dec.
2	Arp 185	UMi	GX	3.0'x2.4'	11.8B	16 32 38	78 11 56
	NGC 6217 - fairly bright, fairly large, elongated 2:1 NW-SE, ~2.5'x1.5', small bright core.						
2	N6340	Dra	GX	3.2'x2.9'	11.9B	17 10 24	72 18 16
	B251		DN	20'x5'	3	17h 13' 48"	-20° 09'
	Fairly bright, moderately large, slightly elongated, prominent bright core, stellar nucleus with direct vision.						
3	Arp 293	Dra	GX	1.5'x1.4'	14.1P	16 58 31	58 56 13
3	N6155	Her	GX	1.3'x0.8'	13.2P	16 26 08	48 22 01
2	NGC 6229	Her	GC	4.5'	9.4	16 46 48	47 31 40
	Bright, fairly small, very bright core, faint mottled halo.						
3	N6239	Her	GX	3.3'x1.2'	12.9B	16 50 05	42 44 22
3	N6166	Her	GX	2.2'x1.5'	12.8B	16 28 38	39 33 05
3	AGC 2199	Her	GXCL	89.6'	13.9	16 28 36	39 31 00
3	NGC 6207	Her	GX	3.3'x1.7'	12.2B	16 43 04	36 49 56
1	M13		GC	20.0'	5.8	16 41 41	36 27 37
	Several hundred stars in a 10'-12' diameter with a bright central core of 6' diameter.						
3	Abell 39	Her	PN	2.9'	13.7P	16 27 33	27 54 33
3	N6181	Her	GX	2.5'x1.1'	12.5B	16 32 21	19 49 29
1	M12		GC	16.0'	6.1	16 47 14	-01 56 52
	220x highly resolved over the entired isc. Appears smaller than M10						
3	NGC 6118	Oph	GX	4.7'x2.0'	12.4B	16 21 48	-02 17 00
1	M10		GC	20.0'	6.6	16 57 08	-04 05 58
	Beautifully resolved at 220x. The halo appears to extend to nearly 14'.						
1	M 107	Oph	GC	13.0'	7.8	16 32 31	-13 03 13
	Bright globular well resolved at 220x, halo elongated, sharply defined core is circular.						
3	B41	Oph	DN	40'	3	16h 22' 17"	-19 37
2	NGC 6235		GC	5.0'	"14.0	16 53 25	-22 10 38
	Fairly bright, small, 3' diameter, mottled. A few stars resolved at edges of the halo.						
2	NGC 6287		GC	4.8'	9.3	17 05 09	-22 42 29
	Fairly bright, irregular, 3' diameter, mottled, no resolution at 280x. Core is elongated.						
1	M80		GC	10.0'	7.3	16 17 02	-22 58 30
	Fairly bright, round, 5' diameter, well-concentrated with a bright 1.5' core and an intense 30" nucleus.						

Note: Source catalogs are Messier, Arp, Abell Planetary, Abell Galaxy Cluster (AGC), Hickson Compact Galaxy (HCG), Sharpless HII Regions, Barnard Dark Nebulae, Herschel 400-I, Herschel 400-II. Herschel 400-I are identified as NGCXXXX, Herschel 400-II as NXXXX.

How Bright is the Moon? or Neptune?

Akkana Peck

We have an unusual occultation in June: on the night of the 22nd-23rd, the moon occults Neptune. Neptune is already behind the moon when they rise at about 11:30; watch for its reappearance about midway up the moon's dark limb at 12:59 am. Unfortunately, the gibbous moon is only a few days past full, so it might not be easy to see dim Neptune with all that lunar glare.

How hard will it be? Just how bright is the moon compared to Neptune?

I had hoped to be able to give you a number; but it turns out the moon's surface brightness isn't an easy number to find. Of course, it varies over the surface of the moon – the terminator is usually not as bright as areas away from the terminator. It also varies with the moon's phase: a full moon is brighter than a first quarter moon, not only in total brightness (duh, the full moon has twice the area lit up) but also in surface brightness: the first quarter moon is only 8% as bright as the full moon, not the 50% you might expect.

Why is that? There are several effects going on. The main reason appears to be related to shadows. Put simply, when we look at a full moon, we don't see any shadows since the sunlight is coming from pretty much our direction. When we look at a first quarter moon, the light is coming in from the side and there are lots of shadows. So for any given area of the surface, we're seeing less of it illuminated than we would when the light is more direct. (It turns out that effect happens on more than one level: not only are there shadows from major features like mountains and crater walls, but also on a much smaller scale in the way the light is reflected from the top few millimeters of the lunar regolith, the deep fine powder that covers the moon.)

Some people also claim that there's an effect from millions of tiny glass beads in the lunar regolith, formed from millions of meteor impacts. These glass beads act like retro reflectors, reflecting most of the light that hits them back in the direction it came from. But the retro reflection is very directional; in fact, it may be so directional that we can't see the effect at all from Earth. There's only one time when we'd be enough in line with the sun to see the effect from the glass bead retro reflection: during a lunar eclipse, when we're blocking most of that sunlight! Anyway, I haven't been able to get good numbers on how this works, so I can't say with any confidence whether it's part of the brightness we see or not.

Anyway, this was getting interesting but not helping in figuring out whether that Neptune occultation should be visible. So let's try another approach. How does Neptune's surface brightness compare to Saturn? I've seen several lunar occultations of Saturn, and while it's always striking how dim the planet looks compared to the moon, it's easily bright enough to see, even against the moon's dark limb. But Neptune's albedo (the amount of light it reflects) is a bit less than Saturn's, plus it's three times as far from the sun as Saturn so it's getting nine times less light to reflect.

So it's pretty dim, but don't give up all hope. I'd recommend fairly high magnification, and scanning along the moon's dark limb while keeping the illuminated part out of the field as much as possible. If you stay up for it, let me know how you did!

Meanwhile, there's some other stuff going on in the shallow sky too.

Jupiter rises in the early evening and transits a couple hours after midnight, moving toward its opposition next month. Unfortunately, it's quite far south and so never gets higher than about 30° – so you probably won't see a lot of detail this month.

Mars is visible in the evening sky, setting around midnight. It moves from Cancer into Leo during June, and ends the month right next to Regulus, nearly the same brightness but a very different color. They should make a striking pair.

Meanwhile, Saturn spends the month about 5° east of Regulus, showing a slim ring tilt of 8.5°.

Mercury emerges into the dawn sky during the last third of June, but it remains close to the sun and fairly difficult to spot. Venus is even harder to spot: on June 9 it passes directly behind the sun, marking the midpoint between the Venus transit Jun 8 2004 (which wasn't visible from San Jose) and the one on June 6 2012 (which will be).

Last but not least, Pluto is at opposition this month, on June 20th. That means it's the beginning of "Pluto season", the best time to hunt for this distant planet. As veteran Plutocrats know, the trick is to get a really good star map that shows stars at least down to Pluto's magnitude (13.9 at opposition). But you also have to be able to find the field that the finder chart is showing, which can be challenging all by itself! Planetarium programs aren't always right in their Pluto predictions – its orbit is much more complicated than those of the other planets – so if you have more than one program, compare their output, or get a copy of the usually reliable RASC finder chart (it's on page 213 of this year's Observer's Handbook, and I think the SJAA might still have a few left for sale).

It's in a tricky field, though – the star-packed center of the galaxy in Sagittarius, just north of open cluster M23 and due west from open cluster

Continued on page 6

Cataloging Stars

Rob Hawley

Last month we explored the history of cataloging deep sky objects. This month we will look at how astronomers catalog the positions of stars. The cataloging system for stars is a much more overlapped system than with Deep Space Objects. The positions of bright stars are cataloged in several overlapping catalogs. A star might also be in one or specialty catalogs based on some property. On the surface this might all seem very confusing, but there is a definite method to it.

In this article I will be discussing *Positional* catalogs whose purpose is to map the locations of *all* of the stars down to some level of depth (dimness). The technically correct name is *Astrometric Survey*[1]. In a future article I will discuss *Specialty Catalogs* that list stars as belonging to a particular group (e.g. double stars, carbon stars, etc.)[2].

Historic Star Names

The International Astronomical Union (IAU)[3] recognizes the "proper" names for about 250 stars[4]. You may know this group for its work on Pluto. It is the only world body authorized to assign names to astronomical objects. The IAU is no longer assigning names to stars.

Most of the traditional star names were derived from Arabic, but some are from Latin or Greek or have been Latinized from Arabic or other cultures. Names beginning with "Al" are definitely from Arabic sources[5]. Scientists have generally moved away from names since there are many overlapping traditions of which stars have which names[6]. For example, is Almach or Almaach or Almak or Alamak the correct spelling for Gamma Andromedae? Is the correct name for Alpha Persei Mirfak or Algenib or Alcheb? These seem like minor points until a name comes up in your DSC[7] hand controller that does not match your paper chart. It has happened to me!

What about all of the services that "sell" new star names? We talked about that last month. The IAU has a wonderful piece on this practice on their site[8]. Needless to say if you want to spend $50 for a pretty piece of paper that is your own business. As PT Barnum said "This way to the Egress"!

Bayer and Flamsteed – Bringing Some Order

Johann Bayer (1572-1625) and John Flamsteed (1646-1719) introduced more formal systems of identifying or cataloging stars. Bayer's system assigns a Greek letter to each star in a constellation. He labeled the brightest[9] alpha, second beta, and so on. Altogether Bayer's system cataloged 1,564 of the brightest stars[10] in his star atlas Uranometria. Bayer's system had the advantage that each star had a unique and simple name. The obvious disadvantage was that the alphabet was limited (and you have to know Greek). He did extend beyond the Greek alphabet, but today we only retain at most 26 stars in each constellation. Bayer's system remains the most common formal designation of bright stars.

Flamsteed's system was to number the stars[11]. This avoided the problems with Bayer's approach. Flamsteed's numbers were assigned by right ascension, but today the assigned stars are not strictly by RA due to precession[12]. His system catalogs about 3,000 stars[13].

The Bayer and Flamsteed systems overlap. Generally the Bayer designation is used in preference to the Flamsteed.

Positional Catalogs

The stars that Bayer and Flamsteed cataloged were the stars that one might see visually in a perfect dark sky. As technology improved there was a need for a more complete catalog that listed the positions, spectral type, movement, etc. of dimmer stars. Successive catalogs have improved the positions of stars and provided accurate information on their movements.

HD (Henry Draper)

This catalog containing 225,000 stars was published between 1918 and 1924[14] by Harvard. It catalogs stars down to about 9 magnitude or about what an 9x50 finder would see. I occasionally see HD numbers used. For example, Stellarium uses this as its preferred catalog. Other more modern catalogs have gained more support.

SAO

The Smithsonian Astrophysical Observatory Catalog was published in 1966[15]. It contains about 260,000 stars and like the HD catalog is limited to about mag 9. This catalog is more popular. For example, this is the preferred designation in the Meade handset.

Hipparcos

This is a product of the ESA satellite of the same name[16]. The satellite, which operated for four years from November 1989 to March 1993 returned high quality scientific data. The HIP catalog contains 118,218 stars charted with high precision[17]. It maps stars down to about mag 8[18].

Tycho-2[19]

The Tycho-2 catalog contains about 2.5 million stars to about magnitude 11[20]. This catalog was also derived from the ESA Hipparcos satellite.

GSC

The Hubble Guide Star Catalog is exactly what it says it is[21]. Hubble Space Telescope can use this list of stars as guide sources (to correct for movement during an exposure). The catalog contains objects in the range of 7-16. Thus it is deeper than the Tycho without being as large as the USNO. The GSC used Hipparcos satellite data but also used their own data from Schmidt Survey plates.

USNO

The USNO catalog is the mother of all catalogs. The Naval Observatory compiled the catalog by examining a complete set of photometric plates. B1.0 contains more than 1 *billion* entries[22] of both stars and DSOs. That is over 80 GBytes of data! A2.0 is just ½ billion and contains every detectable star down to declination -30º. The next release UCAC3 will be available soon. It has about 60 million entries[23] making its size more realistic for common use. The main feature is the accuracy of the positions. UCAC3 is spec'd to chart the positions to 20 milliarcseconds[24].

As a practical matter the B1.0 catalog is so large that it is not useful except in research projects. Planetarium programs that rely on DVDs[25] can exploit the smaller USNO catalogs to give an almost photographic representation of the sky.

Summary

Every star you observe will be in one or more of these catalogs. The very brightest stars will be named and be in each. The chief difference of the catalogs is their depth and improved accuracy.

So what should you use? For the brightest stars I use either the name or Bayer letter. Using a DSC will quickly teach you star names (at least according to the conventions used by the DSC maker). When I had a Meade LX200 I used SAO most often since the Meade tools prefer that designation.

I configure my SkyMap Pro Planetarium (SMP) program to display the popular name, then Bayer letter, then Flamsteed number. If the star has none of these it reverts to the Tycho then GSC catalogs. SMP does not support the USNO. An information popup will list other catalogs entries. The combined catalogs contain all of the stars I am likely to see visually with a 15" telescope.

Uranometria lists the name, Bayer, and Flamsteed number. The rest of the stars are plotted, but not identified. Their locations are plotted using Hipparcos and Tycho data.

(Endnotes)

1 http://clavius.as.arizona.edu/vo/jd13/talks/turon_talk.pdf
2 http://ad.usno.navy.mil/star/star_cats_rec.shtml
3 http://www.iau.org/about/
4 http://www.obliquity.com/skyeye/misc/name.html
5 http://www.naic.edu/~gibson/starnames/
6 http://en.wikipedia.org/wiki/Star_designation#Proper_names
7 Digital Setting Circle
8 http://www.iau.org/public_press/themes/buying_star_names/
9 Although as measuring techniques improved it was discovered that the alpha star is not always the brightest. See: http://en.wikipedia.org/wiki/Bayer_designation#Is_Alpha_Always_the_Brightest_Star.3F
10 http://en.wikipedia.org/wiki/Bayer_designation
11 http://en.wikipedia.org/wiki/Flamsteed_designation
12 http://en.wikipedia.org/wiki/Precession
13 http://student.britannica.com/comptons/article-9323377/John-Flamsteed
14 http://en.wikipedia.org/wiki/Henry_Draper_Catalogue
15 http://en.wikipedia.org/wiki/Smithsonian_Astrophysical_Observatory_Star_Catalog
16 http://heasarc.gsfc.nasa.gov/W3Browse/all/hipparcos.html for more reading http://www.rssd.esa.int/SA/HIPPARCOS/docs/vol3_all.pdf
17 http://www.rssd.esa.int/index.php?project=HIPPARCOS
18 http://www.daviddarling.info/encyclopedia/H/Hipparcos_Catalogue.html
19 http://www.astro.ku.dk/~erik/Tycho-2/
20 http://en.wikipedia.org/wiki/Tycho-2_Catalogue
21 http://tdc-www.harvard.edu/catalogs/hstgsc.html
22 http://www.nofs.navy.mil/projects/pmm/catalogs.html
23 http://adsabs.harvard.edu/abs/2006IAUJD..16E..24Z
24 http://ad.usno.navy.mil/ucac/
25 http://www.bisque.com/Tom/stars/stars.asp

NASA Space Place

Stellar Compass for Space Explorers

Patrick L. Barry

In space, there's no up or down, north or south, east or west. So how can robotic spacecraft know which way they're facing when they fire their thrusters, or when they try to beam scientific data back to Earth?

Without the familiar compass points of Earth's magnetic poles, spacecraft use stars and gyros to know their orientation. Thanks to a recently completed test flight, future spacecraft will be able to do so using only an ultra-low-power camera and three silicon wafers as small as your pinky fingernail.

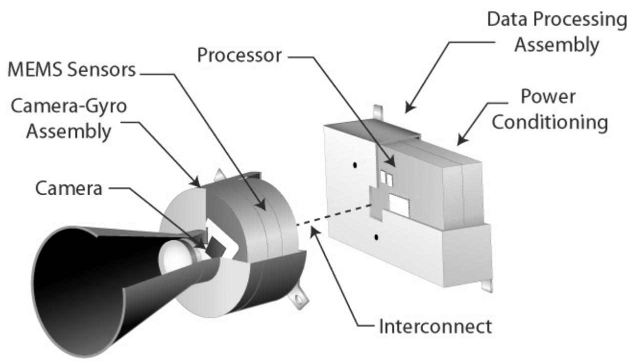
"The wafers are actually very tiny gyros," explains Artur Chmielewski, project manager at JPL for Space Technology 6 (ST6), a part of NASA's New Millennium Program.

Traditional gyros use spinning wheels to detect changes in pitch, yaw, and roll—the three axes of rotation. For ST6's Inertial Stellar Compass, the three gyros instead consist of silicon wafers that resemble microchips. Rotating the wafers distorts microscopic structures on the surfaces of these wafers in a way that generates electric signals. The compass uses these signals—along with images of star positions taken by the camera—to measure rotation.

Because the Inertial Stellar Compass (ISC) is based on this new, radically different technology, NASA needed to flight-test it before using it in important missions. That test flight reached completion in December 2007 after about a year in orbit aboard the Air Force's TacSat-2 satellite.

"It just performed beautifully," Chmielewski says. "The data checked out really well." The engineers had hoped that ISC would measure the spacecraft's rotation with an accuracy of 0.1 degrees. In the flight tests, ISC surpassed this goal, measuring rotation to within about 0.05 degrees.

That success paves the way for using ISC to reduce the cost of future science missions. When launching probes into space, weight equals money. "If you're paying a million dollars per kilogram to send your spacecraft to Mars, you care a lot about weight," Chmielewski says. At less than 3 kilograms, ISC weighs about one-fifth as much as traditional stellar compasses. It also uses about one-tenth as much power, so a spacecraft would be able to use smaller, lighter solar panels.



Compass is built as two separate assemblies, the camera-gyro assembly and the data processor assembly, connected by a wiring harness. The technology uses an active pixel sensor in a wide-field-of-view miniature star camera and micro-electromechanical system (MEMS) gyros. Together, they provide extremely accurate information for navigation and control.

Engineers at Draper Laboratory, the Cambridge, Massachusetts, company that built the ISC, are already at work on a next-generation design that will improve the compass's accuracy ten-fold, Chmielewski says. So ISC and its successors could soon help costs—and spacecraft—stay on target.

Find out more about the ISC at http://nmp.nasa.gov/st6. Kids can do a fun project and get an introduction to navigating by the stars at http://spaceplace.nasa.gov/en/kids/st6starfinder/st6starfinder.shtml.

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

The Last 30 Days in Astronomy

MAY-05-2008 ***Sign onto Kepler*** You can have your name placed on the spacecraft that might find the first extrasolar, Earth-like planet in the galaxy. To find out more, visit the Kepler website at http://kepler.nasa.gov/.

APR-16-2008 ***No change on Apophis*** The odds that the asteroid Apophis will hit the Earth in 2036 are still at 1 in 45,000 according to NASA. A student in Germany says his calculations tell a more pessimistic story. His estimate includes a scenario where Apophis strikes one or more artificial satellites when Apophis cruises past Earth in 2029. http://www.jpl.nasa.gov/news/news.cfm?release=2008-063

APR-15-2008 ***Cassini Continues*** The Cassini mission to explore Saturn and its moons will continue until at least mid-2010. The extended mission includes 26 more flybys of Titan. http://www.jpl.nasa.gov/news/news.cfm?release=2008-060

The Shallow Sky
Continued from 3

M18. Does that make it harder (too many stars to confuse with Pluto) or easier (lots of field stars to compare)? You could make an argument either way, but most people would probably say it's harder with that many field stars. On the other hand, it has its compensations: if you get frustrated in the Pluto hunt, there's lots of eye candy nearby to cheer you up, so take a break, go look at some Messiers and go back, refreshed, to the Pluto hunt.

Telescope Loaner Program

The loaner program offers members a means to try scopes of various sizes and technologies before you buy. It is one of the real jewels of being a member of the club. Scopes are available for all experience levels.

The inventory is constantly changing. As of this writing (early May) these scopes were available.

These scopes are currently available for loan.

Scope Number	Scope Description
43	4.5" f/8 Orion XT Dob
44	4.5" f/8 Orion Skyview Newt
32	5.5" f/7.6 Signature Dob
23	6" f/8 Edmund Newt on EQ Mount
11	6" f/8 Orion XT Dob
34	8" f/10 Dynamax S/C
29	8" Celestron S/C Astrophoto
36	8" f/6 Celestron Skyhopper Dob
48	C-8 Celestron Ultima
45	10" f/5 Dob, Earletron
7	12.5" f/7 Homemade Dob
47	12" Meade Lightbridge
41	18" f/4.5 Sky Designs Dob
10	Star Spectroscope

For up to date information please see the loaner program web page: http://www.sjaa.net/loaners

Officers and Board of Directors

Pres Rob Hawley (408) 997-6526
VP Rich Neuschaefer
Sec Craig Scull (408) 292-9317
Tres Gary Mitchell (408) 265-2336
Dir Lee Hoglan
Dir Gordon Reade
Dir Robert Armstrong
Dir Mark Wagner
Dir Phil Chambers

Ephemeris Staff

Editors Paul & Mary Kohlmiller (408) 848-9701
Circulation Gordon Reade
Printing Accuprint (408) 287-7200

School Star Party Chairman

Jim Van Nuland (408) 371-1307

SJAA Email Addresses

Board of Directors board@sjaa.net
Membership ?'s membership@sjaa.net
Chat List chat@sjaa.net
President president@sjaa.net
Treasurer treasurer@sjaa.net
Announce sjaa-announce@sjaa.net
Secretary secretary@sjaa.net
School Star Parties schools@sjaa.net
Ephemeris ephemeris@sjaa.net
Web Page pkohlmil@best.com
Circulation circulation@sjaa.net
Telescope Loaners loaner@sjaa.net
Members Email Lists:
http://www.sjaa.net/majordomo.html

Publication Statement

SJAA Ephemeris, newsletter of the San Jose Astronomical Association, is published monthly.

San Jose Astronomical Association,
P.O. Box 28243
San Jose, CA 95159-8243

The SJAA Ephemeris is published in three formats: hardcopy, Adobe Acrobat PDF, and HTML. The PDF and HTML versions are found at http://ephemeris.sjaa.net.

Articles for publication should be submitted by the 10th of the previous month. The PDF version is generally available by the 24th of the previous month and the HTML version by the last day of the previous month.

San Jose Astronomical Association
P.O. Box 28243
San Jose, CA 95159-8243

Nonprofit Organization
U.S. Postage Paid
San Jose, California
Permit No. 5381

ADDRESS SERVICE REQUESTED

San Jose Astronomical Association Membership Form

P.O. Box 28243 San Jose, CA 95159-8243

☐ **New** ☐ **Renewal** (Name only if no corrections)

Membership Type:

☐ Regular — $20
☐ Regular with Sky & Telescope — $53
☐ Junior (under 18) — $10
☐ Junior with Sky & Telescope — $43

Subscribing to Sky & Telescope magazine through the SJAA saves you $10 off the regular rate. (S&T will not accept multi-year subscriptions through the club program. Allow 2 months lead time.)

☐ **I'll get the Ephemeris newsletter online**
http://ephemeris.sjaa.net Questions?
Send e-mail to membership@sjaa.net

Bring this form to any SJAA Meeting or send to the club address (above).

Please make checks payable to "SJAA".

You can join or renew online:
http://www.sjaa.net/SJAAmembership.html

Name: ______________________________

Address: ______________________________

City/ST/Zip: ______________________________

Phone: ______________________________

E-mail address: ______________________________