EPHEMERIS

January 2012

SJAA Activities Calendar

Jim Van Nuland

(late) December

24 Dark-Sky weekend. Sunset 4:55 p.m, 5% moon sets 6:30 p.m. Henry Coe Park's "Astronomy" lot has been reserved.

30 Houge Park star party. Sunset 4:59 p.m, 40% moon sets 11:30 p.m. Star party hours: 7:00 until 10:00 p.m.

January

7 General Meeting. Board meeting (*) at 6:30; General Meeting at 8:00. Our speaker is Dr. Alex Filippenko (UC Berkeley) on "The Birth and Early Evolution of the Universe".

13 Astronomy Class at Houge Park. 7:00 p.m. The topic: Winter Constellations / Highlight Objects. (outdoors)

13 Houge Park star party. Sunset 5:12 p.m, 74% moon rises 10:22 p.m. Star party hours: 7:00 until 10:00 p.m.

14 Dark-Sky weekend. Sunset 5:13 p.m, 62% moon rises 11:30 a.m.

21 Dark-Sky weekend. Sunset 5:20 p.m, No moon. Henry Coe Park's "Astronomy" lot has been reserved.

27 Houge Park star party. Sunset 5:26 p.m, 23% moon sets 10:14 p.m. Star party hours: 7:00 until 10:00 p.m.

February

4 General Meeting. Board meeting (*) at 6:30; General Meeting at 8:00. Our speaker is Dr. Lynn Rothschild, on Life at the Edge: Life in Extreme Environments on Earth and the Search for Life in the Universe.

17 Astronomy Class at Houge Park. 7:00 p.m. The topic: Types of telescopes, designs, utility, practicality.

17 Houge Park star party. Sunset 5:49 p.m, 15% moon rises 4:34 a.m. Star party hours: 7:00 until 10:00 p.m.

18 Dark-Sky weekend. Sunset 5:50 p.m, 8% moon rises 5:15 a.m.

25 Dark-Sky weekend. Sunset 5:57 p.m, 17% moon sets 9:57 p.m. Henry Coe Park's "Astronomy" lot has been reserved.

(*) The Board of Directors meets before each general meeting at 6:30 p.m. All are welcome to attend.

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

Exoplanet Scoreboard

as of mid-December 2011

Current number of exoplanet candidates from all sources: unknown but probably more than 3000.

Number of exoplanet candidates found by Kepler: 2,326

Eclipsing binary stars detected by Kepler: 2,165

Planets Detected - all sources: 708

Confirmed planets detected by Kepler: 28

Super Earths Detected: 1

Extraterrestrial Life Confirmed: 0

Intelligent Life: 0 (not counting Earth and, then again, why would we?)

The Kepler team has announced the detection of a planet about 2.4 times the diameter of Earth and located in the habitable zone of its star. Kepler-22b is the closest Earth analog found so far. It takes 3 transits to verify a planet and this planet takes 290 days to complete its "year". That means this planet was studied by Kepler for at least 580 days. Kepler has been in space for over 1000 days but it takes a while to process all of the data.

Analemma dilemma

Akkana Peck

Jupiter remains a force to be reckoned with in our early January evening skies, still high at sunset and visible until it sets, a bit after midnight.

Tuesday night, Jan 3, sees a double shadow transit a bit before midnight; then the following Tuesday night, Jan 10, sees another multiple-moon event, starting around 10 p.m. with Ganymede and Europa, then following up with the same two moons' shadows starting around 1:15 am.

Venus remains in our dusk skies. It makes a fairly close pass (a bit over a degree) with Neptune on the 13th — can you find the dim blue orb in the twilight sky so close to bright Venus? Uranus, too, is visible in early evening, though it's much higher in the sky, in Pisces.

Mercury is visible in the dawn sky through most of the month, disappearing in the last week of January. Saturn, too, is in the morning sky, showing a ring tilt of about 14 degrees, which won't change much until October.

Mars rises in late evening, so late-night observers can start getting their "Mars eyes" on for this year's opposition. True "Mars season" won't start until the opposition, on March 3, but it always takes practice to remind your eyes and brain how to see details on that small, red disk, so it doesn't hurt to start early. Right now it's only about 10 arcseconds — but it'll only reach 13" at opposition, so 10" now isn't so bad.

Last month saw the successful launch of the new, much larger, Mars rover, "Curiosity", more formally called the Mars Science Laboratory.

Curiosity is a lot bigger than the two rovers that are on Mars now, at about the size of a Mini Cooper (the new upsized version, not the classic sixties classic) and only weighs a bit less than the car.

It's not as fast as a Mini Cooper, though, with a top speed of around 90 m (300 feet) per hour. On the other hand, Minis don't have radioisotope power sources that last for 14 years without a visit to a gas station, and they can't drive themselves around another planet taking chemical analyses of rocks and soil.

Last month also saw news from one of the older rovers.

Opportunity, still rolling along just fine, detected some gypsum — considered a definite sign of water. I know, water on Mars, yawn.

We're used to new water-on-Mars news every month or so now. But really, when you look at it, that's one of the amazing successes of the rover program, isn't it?

I'm writing this on a dark, cold December evening. We're still a few weeks away from the winter solstice, the shortest day of the year.

But there's hope — last week, December 6th, was the earliest sunset, and from now on the sun will set later, even as we move into winter.

That's always a hard thing for me to wrap my head around — why is the date of the latest sunset happen more than two weeks before the shortest day?

It has to do with the famous "Equation of Time". And that's tied up with the analemma, that odd figure eight that makers of world globes like to draw in the middle of the Pacific Ocean. Usually it's just there, without any explanation for what it means or why. And it's too bad, because it's pretty interesting for astronomers.

If you take an accurate clock, and every day you go out exactly when the clock says noon, take a compass and measure the sun's position, you'd expect it to be due south, right? But you'll find that it hardly ever is. No, you didn't mess up and forget about daylight savings time: the problem is that the sun appears to move at different rates across our sky, sometimes faster than the clock, sometimes slower.

That's also why sundials seldom show the right time.

The rate changes for two reasons. First is the eccentricity of our orbit. Because earth's orbit is elliptical and not circular, earth changes speed as it orbits the sun. So depending on whether we're in a fast- or slow-moving part of earth's orbit, the sun will appear to race ahead or lag behind the meridian even when our clocks say it should be noon.

Second, because our axis is tilted, the changing angle of the ecliptic at different times of year adds a second complication.

The "Equation of Time" combines these two effects to compute how many minutes ahead the sun's position ("apparent solar time") will be compared to our smoothly-running clock ("mean solar time"). Each effect is a simple sine wave, so adding them gives us the equation you'd need to keep your sundial adjusted.

Of course, in real life there are other influences too, including the gravitational effects of other planets like Jupiter. Calculating all those effects is a lot harder, but those effects are small and normally you can ignore them, unless you're trying to guide a spaceship or analyze Large Hadron Collider results.

So what about that figure eight in the Pacific Ocean?

The analemma has two components. Its horizontal component is the equation

of time. Take that, then add a vertical component representing the sun's declination — how far north or south is it? — and you get that familiar figure eight.

The neatest thing about the analemma is that it describes the path the sun really takes in the sky. You can photograph it! Set up a fixed camera with a wide-angle lens in your backyard, pointing south, and take a photo every day (or once a week) at exactly the same time. (Subtract an hour during daylight savings.) Combine all those frames (or make it a multiple exposure), and you'll end up with a beautiful figure-eight analemma.

So why do they put the analemma on globes? And why in the Pacific Ocean?

Well, ship navigators who tracked their location by sighting with a sextant (in the days before GPS) needed that information, so they could compare their sightings to what their clocks said.

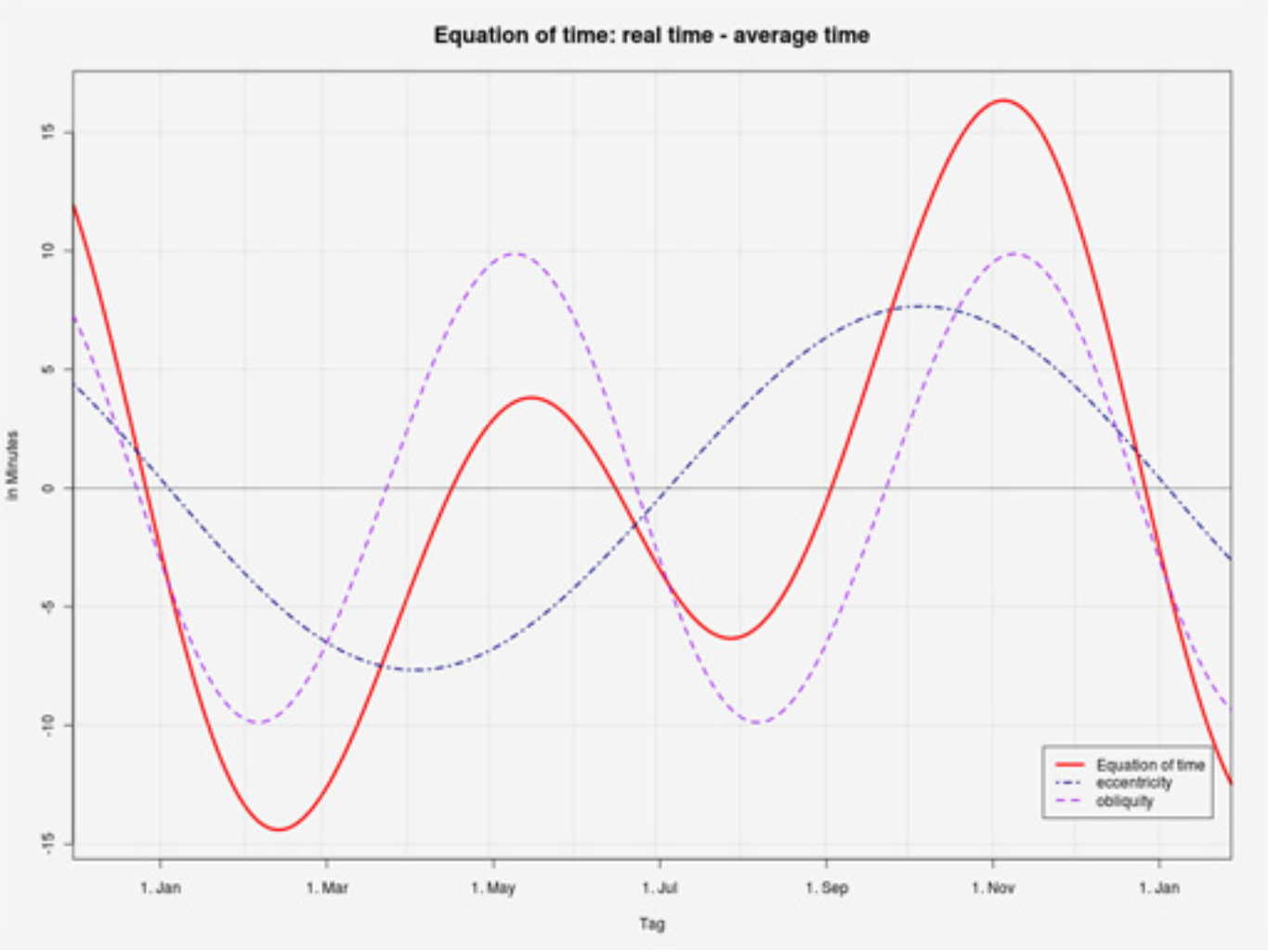
But it would seem easier to use a table listing values for the equation of time, and I doubt many ships were navigating using small consumer globes. In truth, I can't figure out why they put it on globes, except for the nice old tradition linking maps and celestial navigation.

The second question is easier to answer: if you're going to stick an analemma on your globe, put it in the Pacific because that's the biggest place where there's no land to get in the way.

I guess an analemma is more useful than a warning like "Here there be dragons".

One last thing about analemmas: because they're due to the shape of a planet's orbit and how much its axis is tilted, not all planets have similar analemmas. Quite a few planets have figure-eight shaped analemmas like ours, but Mars' analemma is teardrop shaped, not a figure-eight — it never crosses itself. And Saturn's is a figure eight with a tiny top loop, so it doesn't look like an eight at all.

So watch the sun, pay attention to those sunrise and sunset times, and think about analemmas over the next few months as you're waiting for the warm spring weather!



The equation of time, showing the contributions of earth's orbital eccentricity and the obliquity, or tilt, of its axis. Plotted using code posted on Wikimedia Commons by Thomas Steiner.

Dawn Takes a Closer Look

Dr. Marc Rayman

Dawn is the first space mission with an itinerary that includes orbiting two separate solar system destinations. It is also the only spacecraft ever to orbit an object in the main asteroid belt between Mars and Jupiter. The spacecraft accomplishes this feat using ion propulsion, a technology first proven in space on the highly successful Deep Space 1 mission, part of NASA's New Millennium program.

Launched in September 2007, Dawn arrived at protoplanet Vesta in July 2011. It will orbit and study Vesta until July 2012, when it will leave orbit for dwarf planet Ceres, also in the asteroid belt.

Dawn can maneuver to the orbit best suited for conducting each of its scientific observations. After months mapping this alien world from higher altitudes, Dawn spiraled closer to Vesta to attain a low altitude orbit, the better to study Vesta's composition and map its complicated gravity field.

Changing and refining Dawn's orbit of this massive, irregular, heterogeneous body is one of the most complicated parts of the mission. In addition, to meet all the scientific objectives, the orientation of this orbit needs to change.

These differing orientations are a crucial element of the strategy for gathering the most scientifically valuable data on Vesta. It generally requires a great deal of maneuvering to change the plane of a spacecraft's orbit. The ion propulsion system allows the probe to fly from one orbit to another without the penalty of carrying a massive supply of propellant.

Indeed, one of the reasons that traveling from Earth to Vesta (and later Ceres) requires ion propulsion is the challenge of tilting the orbit around the sun.

Although the ion propulsion system accomplishes the majority of the orbit change, Dawn's navigators are enlisting Vesta itself. Some of the ion

This full view of the giant asteroid Vesta was taken by NASA's Dawn spacecraft, as part of a rotation characterization sequence on July 24, 2011, at a distance of 5,200 kilometers (3,200 miles). Credit: NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

thrusting was designed in part to put the spacecraft in certain locations from which Vesta would twist its orbit toward the target angle for the low-altitude orbit. As Dawn rotates and the world underneath it revolves, the spacecraft feels a changing pull. There is always a tug downward, but because of Vesta's heterogeneous interior structure, sometimes there is also a slight force to one side or another. With their knowledge of the gravity field, the mission team plotted a course that took advantage of these variations to get a free ride.

The flight plan is a complex affair of carefully timed thrusting and coasting. Very far from home, the spacecraft is making excellent progress in its expedition at a fascinating world that, until a few months ago, had never seen a probe from Earth.

Keep up with Dawn's progress by following the Chief Engineer's (yours truly's) journal at http://dawn.jpl.nasa.gov/mission/journal.asp. And check out the illustrated story in verse of "Professor Starr's Dream Trip: Or, how a little technology goes a long way," at http://spaceplace.nasa.gov/story-prof-starr.

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

On December 10th our speaker was Dr. Bruce Magnon who showed us impressive pictures from Hubble and the stories behind some of them. Our next speaker is Dr. Alex Filippenko from Berkeley on January 7th. His topic is "The Birth and Early Evolution of the Universe". Photo by the editor.

Astronomical Spacecraft

Below is a list of spacecraft related to astronomical studies. All of these spacecraft are still operational (or they were recently, some like WISE will not be listed in future lists). This list was compiled from a number of web sources including Wikipedia, nasa.gov, and http://spider.seds.org/oaos/oaos.html. If you know of an active astronomical spacecraft that is still in operation please let us know.

Name	Location	Year Launched
MESSENGER	Mercury orbit	2004
Cassini	Saturn orbit	1997
Voyager 1	Heliopause	1977
Voyager 2	Heliopause	1977
Hubble	Earth orbit	1990
Rosetta	Enroute to 67P/Churyumov-Gerasiminko	2004
Dawn	Vesta	2007
New Horizons	Beyond Uranus enroute to Pluto	2006
Herschel	L2 Lagrangian point	2009
Kepler	Earth-trailing heliocentric	2009
Fermi	Earth orbit	2008
Planck	L2 Lagrangian point	2009
WISE	Earth orbit	2009
Spektr R	Earth orbit	2011
Agile	Earth orbit	2007
CoRoT	Earth orbit	2006
AKARI	Earth orbit	2006
Suzaku	Earth orbit	2005
Swift	Earth orbit	2004
Spitzer	Earth-trailing heliocentric	2003
MOST	Earth orbit	2003
GALEX	Earth orbit	2003
CHIPSat	Earth orbit	2003
Integral	Earth orbit	2002
MAP	L2 Lagrangian point	2001
XMM Neutron	Earth orbit	1999
Chandra	Earth orbit	1999
Opportunity	Mars	2003
Curiosity	Enroute to Mars	2011

The Last Month In Astronomy

DEC-10-2011 ***Lunar Eclipse*** A lunar eclipse was seen by most of the United States on December 10. On the west coast the eclipse left totality about the same time the moon set. Follow this link to find a large variety of pictures of the lunar eclipse. http://asterisk.apod.com/viewtopic.php?f=29&t=26135

DEC-09-2011 ***Largest Telescope*** If you were to guess the size of the largest telescope what would you say? 8 meters, 10 meters, 30 meters. Would you believe 360,000 kilometers? You can guess that this means a radio astronomy telescope. Multiple radio astronomy telescopes can create a long baseline for interferometry. When dishes in Germany, Ukraine and Russia are used with the Spektr-R spacecraft a baseline equal to 30 Earth diameters is created. This gives a resolution as fine as 1/100,000 arcsecond. http://www.mpifr-bonn.mpg.de/public/pr/pr-radioastron2011-en.html

DEC-07-2011 ***Opportunity checks vein*** The Mars Rover Opportunity has found a mineral vein of calcium sulfate. This can exist in many forms depending on how much water is bound into the crystalline structure. In this case the substance appears to by gypsum, the same substance that is used for making drywall. Previous orbital observations had detected gypsums in dunes that look similar to the white sands in New Mexico. It is unknown where this vein of material came from. Steve Squyres, the Rover's PI, says "This gypsum vein is the single most powerful piece of evidence for liquid water at Mars that has been discovered by the Opportunity Rover." http://www.jpl.nasa.gov/news/news.cfm?release=2011-377

DEC-05-2011 ***Fastest spinning star*** Probably all stars rotate. One star has been detected spinning at the rate of 1 million miles per hour. This is 300 times the speed of our sun's rotation. That star, VFTS 102, is located in the Large Magellanic Cloud. It might be the near the speed at which a star can rotate without being torn apart by the centrifugal forces. It might itself be the result of a stellar explosion by its binary counterpart. http://www.universetoday.com/91579/incredible-spinning-star-rotates-at-a-million-miles-per-hour/

DEC-02-2011 ***18 new exoplanets*** 18 new exoplanets have been discovered using the wobble method by Caltech astronomers using the Keck Telescopes. It is the biggest single announcement of new planets other than from Kepler. These planets are around A type stars that are more than 1.5 times the size of the sun. In addition, these stars are just about to leave the main sequence. http://keckobservatory.org/news/keck_telescopes_confirm_18_new_exoplanets/

DEC-01-2011 ***More Gamma-Ray Sources*** NASA's Fermi Gamma-Ray Space Telescope has found many sources of gamma rays. Some are the expected: supernova remnants, active galactic nuclei. But some are emitted by objects that have not been detected at any other wavelength. Of the 1873 sources identified by Fermi, about one third are unknown. One example is near the galactic plane suggesting it is a source within the galaxy instead of far away. The breakdown of all sources goes like this: Blazers 57%; Unknown 31%; Pulsars 6%; Supernova remnants 4%; Miscellaneous 2%. http://www.space.com/13784-fermi-telescope-gamma-ray-map-universe.html

NOV-29-2011 ***Phobos-Grunt*** No, that isn't the name of a rude sound, it's the name of a Russian Mars probe that made it into Earth orbit but that's all. It is expected to fall to Earth in January. A Dutch astronomer used his 10" scope to capture an image of the stricken spacecraft. http://www.space.com/13774-skywatcher-photos-russian-phobos-grunt-probe.html On December 13, a spokesman for the company that built the spacecraft called it a failure and "Mission Impossible". The spacecraft is expected to break up during reentry in mid-January and no parts should reach the Earth including the 7.5 tons of dangerous rocket fuel (Hydrazine).

NOV-26-2011 ***Curiosity to Mars*** The most ambitious robotic spacecraft ever launched is on its way to Mars. The Mars Science Laboratory was launched aboard an Atlas V rocket. A midcourse maneuver planned for early December has been postponed because the launch-time accuracy was so good. http://www.jpl.nasa.gov/news/news.cfm?release=2011-362

NOV-16-2011 ***Europa and liquid water*** The Galileo spacecraft was launched from the Space Shuttle back in 1989 and it has been years since it was deliberately dropped into Jupiter. But data from that mission is still paying dividends. One example of that is the evidence for liquid water on Europa. Analysis suggests the chaotic features may be formed as a result of an exchange between that moon's icy shell and liquid water that lies beneath. "The data open up some compelling possibilities" according Mary Voytek, director of NASA's Astrobiology Program. Britney Schmidt, lead author of this new study, said "One opinion in the scientific community has been if the ice shell is thick, that's bad for biology ... [but] now we see evidence that it's a thick ice shell that can mix vigorously ... that could make Europa and its ocean more habitable." http://www.jpl.nasa.gov/news/news.cfm?release=2011-355

It Must Be Astronomical ...

Upcoming Election

During the February General Meeting the SJAA membership will be asked to elect board members for the 4 positions that are up for election. The incumbents will be running for reelection. They are: Greg Claytor, Rob Jaworski, Robert Armstrong, and Kevin Roberts. After the new board is elected in February the board selects officers at the March board meeting.

Nominations for the board can be made at the February General meeting but those wishing to be nominated are advised to make themselves known to the club president, Mark Wagner.

RASC Handbooks and Calendars

RASC Handbooks ($20) and Calendars ($15) are available while supplies last. Contact Robert Armstrong to reserve a copy. Copies may still be available at the January General Meeting.

Loaners

The loaner program offers members a means to try scopes of various sizes and technologies before you buy. For more information please see the loaner program web page: http://www.sjaa.net/loaners.shtml

School Star Parties

Completed Events					
	Total Sched.	Good Sky	Partial Success	Cloudy Fail	Cancel at noon
Jul	0				
Aug	1	1			
Sep	1	1			
Oct	6	3			3
Nov	13	9		1	3
Dec	3	3			
Total	*24*	*17*		*1*	*6*
Scheduled					
Dec	2				
Jan	4				
Feb	11				
Mar	6				
Apr	1				
Total	*24*				

As of December 6, 2011

School Star Party Link

For information on school star parties including how to schedule one see http://www.sjaa.net/school.shtml. For more detailed information on upcoming star parties go to http://www.sjaa.net/current.shtml

Officers and Board of Directors

Pres Mark Wagner
VP Greg Claytor
Sec Rob Jaworski
Tres Robert Armstrong
Dir Lee Hoglan
Dir Rich Neuschaefer
Dir Rod Norden
Dir Kevin Roberts
Dir Michael Packer

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School Star Party Chairman

Jim Van Nuland (408) 371-1307

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Other e-mail contacts are available at http://www.sjaa.net/contacts.html

Members Email Lists:
http://www.sjaa.net/majordomo.html

http://sanjoseastronomy.blogspot.com/
twitter: sj_astronomy
http://www.meetup.com/A-A-N-C/

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.

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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 $5 off the regular rate. (S&T will not accept multi-year subscriptions through the club program. Allow 2 months lead time.)

☐ **I prefer to get the Ephemeris newsletter in print form (Add $10 to the dues listed on the left). The newsletter is always available online at** 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/membership.shtml

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