



# SJAA EPHEMERIS

## SJAA Activities Calendar

Jim Van Nuland

### September

- 1 Houge Park star party. Sunset 7:36 p.m., 64% moon sets 0:25 a.m. Star party hours: 8:30 to 11:30
- 2 ATM Workshop at Houge Park. 7:30 p.m.
- 9 **General meeting at Houge Park.** Slide and Equipment night. Latest images, latest equipment. 8 p.m.
- 14 ATM Workshop at Houge Park. 7:30 p.m.
- 15 Astronomy Class at Houge Park. 7:30 p.m.
- 15 Houge Park star party. Sunset 7:15 p.m., 31% moon rise 1:04 a.m. Star party hours: 8:00 to 11:00
- 16 Dark sky weekend. Sunset 7:14 p.m., 23% moon rise 2:07 a.m.
- 21/24 CalStar star party at Lake San Antonio Park
- 23 Dark sky weekend. Sunset 7:03 p.m., 2% moon sets 7:33 p.m.
- 29 Houge Park star party. Sunset 6:54 p.m., 48% moon sets 11:14 p.m. Star party hours: 8:00 to 11:00
- 30 ATM Workshop at Houge Park. 7:30 p.m.
- 30 Coyote Lake Star Party. Sunset 6:52 p.m. 49% moon sets 0:19 a.m.

### October

- 7 **General meeting at Houge Park.** Dr. Steve Stahler of UC Berkeley will speak. 8 p.m.
- 12 ATM Workshop at Houge Park. 7:30 p.m.
- 13 Astronomy Class at Houge Park. 7:30 p.m.
- 13 Houge Park star party. Sunset 6:33 p.m., 47% moon rise 11:58 a.m. Star party hours: 7:30 to 10:30
- 14 Dark sky weekend. Sunset 6:32 p.m., 37% moon rise 1:02 a.m.
- 21 Dark sky weekend. Sunset 6:23 p.m., 0% moon rise 7:55 a.m.
- 27 Houge Park star party. Sunset 6:15 p.m., 32% moon sets 10:10 p.m. Star party hours: 7:00 to 10:00
- 28 ATM Workshop at Houge Park. 7:30 p.m.
- 29 DST ends. Retard clock. 2 am -> 1 am
- 31 Halloween. Set up at home for the little goblins

*The Board of Directors meets at 6:00 p.m. preceding each general meeting. All are welcome.*

## The Shallow Sky

### Always Kvetching about Sketching

Akkana Peck

Why am I always talking about sketching? Isn't that something that's only fun for kids and art students?

Nope! Sketching is worthwhile (and fun) for any observer, and I'll be talking about some of the benefits, tips on how to get started, and maybe even some hands-on practice, at the SJAA Beginning Astronomy class on September 15th. Show up and see what it's all about!

But I'll give you a few highlights now. You may be wondering: what's the point? Here are some of the benefits to sketching what you see through a telescope eyepiece:

- Sketching forces you to look in more detail, and ask yourself what you actually see.

*Continued on page 2*

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### Astronomy Class September 15, 2006

**7:30 p.m.  
Hogue Park**

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### CalStar 2006 Registration Open

Rob Hawley

You may now register and order meals for the SJAA CalStar star party at

[www.sjaa.net/calstar](http://www.sjaa.net/calstar)

#### **Food**

Once again Valley Catering will be selling meals on Friday and Saturday night. All Thursday night guests must bring their own food.

All Meals must be ordered in advance and prepaid at the time of registration.

As a part of the reservation process you will be given an

*Continued on page 3*

**24 hour news and information hotline: (408) 559-1221**

**<http://www.sjaa.net>**

You'll end up seeing a lot more than you would otherwise.

- You'll have a permanent record of what you saw, including lots of details you wouldn't think to put in an observing log.
- Sketches are really interesting to look back on later.
- Sketches give you a way to compare what you see in different scopes, from different sites and seeing conditions, and over time as you get more practiced.
- Sketches give you a way to show other people what you can see through your telescope.

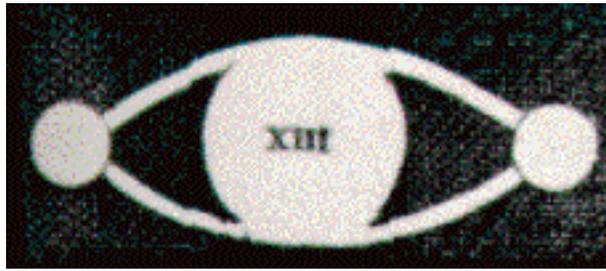
Why not just snap a photo?

Surprisingly, even with today's amazing digital camera technology, the human eye can still pick out details that a camera won't show.

Of course, you're not going to see those amazing color details in faint galaxies



The lunar crater Atlas, sketched by the author.



A drawing made by Christiaan Huygens in 1655. Courtesy of PPARC at [www.pparc.ac.uk](http://www.pparc.ac.uk).

and nebulae which are so beautiful in photographs. A camera is the only way to collect that.

But consider: have you ever seen a photograph that captured the glittering pinpoints of the Trapezium while still showing the full extent of the Orion nebula, its knots and wisps extending outward from the four stars at the center? A camera can't show both at once: you have to choose between a short exposure, which shows the stars but not the nebula, or a long exposure, which gives a beautiful and colorful nebula with a

white, blown-out central portion in which the stars can no longer be distinguished.

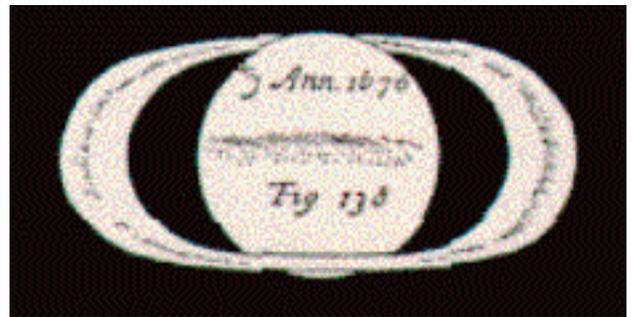
Same for globular clusters: have you ever seen a photograph that showed the glittering three-dimensional snowball you see through the eyepiece of a big scope?

Or consider the moon or Jupiter. A photograph can't capture the bright three-dimensional gleam of a Galilean moon hanging just over the limb of Jupiter, or the shining tip of a lunar mountaintop poking just barely up into the light beyond the terminator.

All these sights have a wide dynamic range: the difference

between the brightest and dimmest parts is very large. Cameras (either digital or film) can't record the dynamic range the eye can see. But you can record all those details in a single sketch. With practice, sometimes you can even make the sketch show something of the beautiful view you saw in the eyepiece.

In addition, the eye can react faster than a camera. When you're observing bright shallow sky objects, you can catch those instants of good seeing that in a photo would get averaged with the bad moments on either side. Modern CCD astrophotographers compensate



In 1676 Giovanni Cassini made this sketch showing the shapes of two rings with a dark band between them. We now know this as the Cassini gap. Courtesy of PPARC at [www.pparc.ac.uk](http://www.pparc.ac.uk).

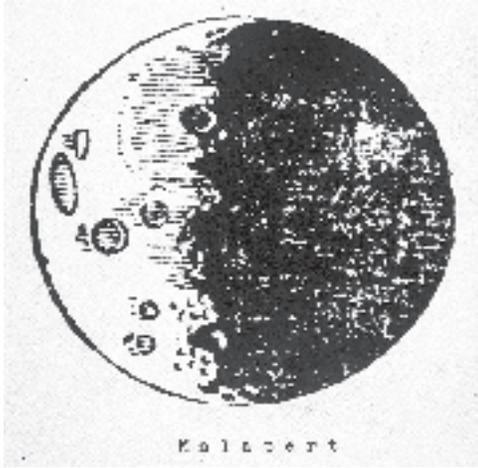
for this by taking hundreds, sometimes thousands, of photos of the same object, searching through them for the good ones, then either taking the best, or combining many images together using a technique known as "stacking". This produces great images, but it's a lot of work, and much of the time it doesn't even show as much detail as you could have seen yourself through an eyepiece.

And besides – a pencil is a lot cheaper than a CCD camera rig, a laptop and the stacking software!

I know what you're thinking. "I'm not an artist! Everything I draw looks terrible!"

Don't think in terms of making art to frame and put on the wall. If you

practice, you'll probably eventually produce attractive and cool looking sketches; but there are lots of reasons to sketch even if you never get to that point.



The moon as sketched by Malapert in 1619.

If you doubt that, look at the history of science, like the sketches of the moon, Mars or Saturn from scientists like Galileo, Lowell, Huygens, Cassini. Most of these scientists weren't artists, and their sketches often weren't pretty; but they were cutting edge science at the time, and the early astronomers traded their sketches and compared the what they saw while they tried to understand it.

"Well, okay, I guess I could try it. But I don't have any special drawing pencils or anything!"

You don't need any special equipment. The back of an envelope and any pencil will work fine. A comfy chair helps: you'll be able to concentrate a lot better on the object you're looking at. Find some sort of flashlight you can clip somewhere, so you don't have to hold it in your teeth: a head-mounted light, a little book light (sometimes you can find them at dollar stores), a flashlight with a clip, whatever you can find.

If you're sketching deep sky objects, the number one trick is to draw a negative image. Don't try to draw a black sky with white stars; let the paper

represent the black sky, and draw white where the stars are and shades of grey for the nebula or galaxy. You can look at the finished drawing as being like a photographic negative, like they used to use for scientific research; or you can scan it into a computer and invert it digitally.

If you're drawing planets, you don't have to worry about inverting the image. Just try to draw what you see. Use a regular graphite pencil at first. Colored pencils are trickier and I don't recommend them when you're starting out.

When sketching the moon, the trick is to narrow your focus. It's easy to get lost in putting in too much detail and end up not getting anything. Try showing just one crater, or just one interesting shadow, and a tiny bit of detail around it.

There are lots more tips that can help, but I'm out of space, so come to the class later this month and I'll tell you all about it!

Until then, you can try looking at planets. But there's not that much to look at this month:

Uranus is at opposition on September 5th, in Aquarius, so it and nearby Neptune (in Ophiuchus) are well placed for late night observing all month.

You can still catch Jupiter, very low in the early evening sky, before it disappears in the sunset glow. There are numerous double shadow transits this month (check the RASC Observer's Handbook or a computer program that shows Jovian moon shadows) though they will become increasingly challenging as Jupiter falls lower in the sky.

Morning observers can catch Saturn, low in the dawn sky, drawing farther from the sun as the month progresses. Venus can be caught low in the dawn sky early in the month, but moves too close to the sun to see by mid-month. Mars and Mercury are hidden in the sun's glare.

CalStar 2006

Continued from page 1

opportunity to either pay for the meals using PayPal or will get a form that you can send to SJAA along with a check. Note that a small handling fee will be charged for the PayPal transactions.

Meals are ordered when SJAA receives the money not when the reservation is made. If you are using PayPal for registration then you can reserve a meal until 10AM Wednesday Sept 20. If you decide to mail a check then it must be in the SJAA mailbox by the same time. Payments received after that time cannot be accepted. I will confirm all reservations via email.

For more information see

<http://www.sjaa.net/calstar/#food>

First Time Visitors to CalStar The website provides a Photo Tour of the CalStar site to acquaint yourself with the layout <http://www.sjaa.net/calstar/tour/CalStar-Tour.html> First Time Attending a Multi-Day Star Party? Never attended a multi-day star party before? You might find this interesting <http://www.sjaa.net/calstar/tour/Suggestions-for-First-Time-Visitors.html> Descriptions of CalStar Zones The CalStar site enables us to apply different rules to different portions of the site. You can have as casual or hard core observing experience as you like. See [http://www.sjaa.net/calstar/tour/CalStar\\_Areas.html](http://www.sjaa.net/calstar/tour/CalStar_Areas.html) for more details Questions? Please send questions to [calstar@sjaa.net](mailto:calstar@sjaa.net).



## ASTRONOMY magazine renewal time

Jim Van Nuland

It's time to renew our group subscription to Astronomy magazine. The rate for 2007 is still \$34, or \$60 for two years. Please send a check payable to Jim Van Nuland, 3509 Calico Ave., San Jose CA 95124.

Subscribers: if I have your e-mail address (from the SJAA roster), you should have gotten a note with particulars of your subscription.

If you subscribe independently, and your subscription ends during 2007, you may convert to the group rate. Send a check and the renewal card or a mailing label to Jim, and you'll be added to the group for an additional 12/24 months.

If you do not subscribe and wish to do so, send the \$34/60 and your subscription will begin with the January 2007 issue.

I will hold your checks until late September, when the renewal package must be sent in. So don't worry that your check doesn't clear promptly.

Any questions? Call Jim at 408.371.1307, from 10 am to 10 pm, or e-mail to <jvn@svpal.org>.

PLEASE NOTE: this applies to Astronomy magazine, not Sky & Telescope! The latter subscription is paid to the treasurer as part of your SJAA dues.

Good Reading!

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### FOR SALE:

Celestron C-5, excellent condition, great optics, Table plus tripod, 9-volt drive, solar filter, eyepieces, \$550 all.

Call 831-751-9704, Salinas, CA

## Electronic Ephemeris

Gary Mitchell

Did you know the Ephemeris is available on-line?

Check it out at <http://ephemeris.sjaa.net/>. There's a PDF version available for download or you can read it in HTML right there with your browser. (The PDF version requires Adobe Acrobat version 5 or higher.) Past issues are also available in case you missed one.

The PDF version is the same as what gets printed. Occasionally the HTML version has slightly longer articles or things there wasn't room for in the paper version. The PDF version includes the membership form and list of officers, but the HTML version doesn't (since that info is available elsewhere on the web site anyway).

It's nice to have paper to hold and be able to read anywhere without power or laptops, but the electronic version has certain advantages. The electronic version includes color: this is especially nice with photos! It also includes hyperlinks. It gets "delivered" instantly this will be particularly nice for those in certain zip codes that tend to get the

newsletter late. And it saves the club money and the effort it takes to prepare and mail them.

If you spill your favorite beverage on the paper Ephemeris, too bad, we don't mail you a new one. That's not a problem with the electronic version, just print out however many copies you like. And if you use a color printer you'll have a *color* Ephemeris! The only downside is: it's you who does the printing and stapling instead of the club.

If you wish to continue receiving the paper version of the Ephemeris, do nothing. However, if you'd like to switch, just check the appropriate box on the membership form or send an e-mail to [membership@sjaa.net](mailto:membership@sjaa.net) stating your wishes. (Be sure to include your name as it appears on your mailing label.)

Our editor will post a reminder to the SJAA announce e-mail list when a new issue is available. Make sure you are on that remailer if you want to see those e-mail reminders, (see the SJAA webpage: <http://www.sjaa.net/mailman/listinfo/sjaa-announce>).



### NEW SJAA MEMBERS

Scope City is offering to new members a \$25 credit towards the purchase of telescopes and binoculars. See an SJAA officer at one of the general meetings to receive the Scope City Discount Coupon.

Contact Sam Sweiss at Scope City to arrange for your discount.

Scope City  
350 Bay Street  
San Francisco, CA 94133  
(415) 421-8800

## Celebrating 40 Years of Intent Listening

Diane K. Fisher

In nature, adjacent animals on the food chain tend to evolve together. As coyotes get sneakier, rabbits get bigger ears. Hearing impaired rabbits die young. Clumsy coyotes starve. So each species pushes the other to "improve."

The technologies pushing robotic space exploration have been like that. Improvements in the supporting communications and data processing infrastructure on the ground (the "ears" of the scientists) have allowed spacecraft to go farther, be smaller and smarter, and send increasingly faint signals back to Earth—and with a fire hose instead of a squirt gun.

Since 1960, improvements in NASA's Deep Space Network (DSN) of radio wave antennas have made possible the improvements and advances in the robotic spacecraft they support.

"In 1964, when Mariner IV flew past Mars and took a few photographs, the limitation of the communication link meant that it took eight hours to return to Earth a single photograph from the Red Planet. By 1989, when Voyager observed Neptune, the DSN capability had increased so much that almost real-time video could be received from the much more distant Planet, Neptune," writes William

H. Pickering, Director of JPL from 1954 to 1976, in his Foreword to the book, *Uplink-Downlink: A History of the Deep Space Network, 1957-1997*, by Douglas J. Mudgway.

Mudgway, an engineer from Australia, was involved in the planning and construction of the first 64-m DSN antenna, which began operating in the Mojave Desert in Goldstone, California, in 1966. This antenna, dubbed "Mars," was so successful from the start,

competing with radio astronomy, radio science, radar astronomy, SETI [Search for Extra-terrestrial Intelligence], geodynamics, and VLBI [Very Long Baseline Interferometry] for time on the antenna . . . It was like a scientific gold rush."

In 1986 began an ambitious upgrade program to improve the antenna's performance even further. Engineering studies had shown that if the antenna's diameter were increased to 70 m and other improvements were made, the antenna's performance could be improved by a factor of 1.6. Thus it was that all three 64-m DSN antennas around the world became 70-m antennas. Improvements have continued throughout the years.

"This antenna has played a key role in almost every United States planetary mission since 1966 and quite a few international space missions as well. Together with its twins in Spain and Australia, it has been a key element in asserting America's pre-eminence in the scientific exploration of the solar system," remarks Mudgway.

Find out more about the DSN and the history of the Mars antenna at <http://deepspace.jpl.nasa.gov/dsn/features/40years.html>. Kids (and grownups) can learn how pictures are sent through space at [http://spaceplace.nasa.gov/en/kids/phonedrmarc/2003\\_august.shtml](http://spaceplace.nasa.gov/en/kids/phonedrmarc/2003_august.shtml).

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



*For over 40 years, the "Mars" 70-m Deep Space Network antenna at Goldstone, California, has vigilantly listened for tiny signals from spacecraft that are billions of miles away.*

that identical 64-m antennas were constructed at the other two DSN complexes in Canberra, Australia, and Madrid, Spain.

As Mudgway noted in remarks made during the recent observance of the Mars antenna's 40 years of service, "In no time at all, the flight projects were

## Solar System Stats for September 2006

Adapted from the Observer's Handbook published by The Royal Astronomical Society of Canada which in turn gets this data from the U.S. Naval Observatory's Nautical Almanac Office and Her Majesty's Nautical Almanac Office and contributions by David Lane, St. Mary's University, Halifax NS.

		Mercury	Venus	Mars	Jupiter	Saturn	Uranus	Neptune	Sun
RA	1	10 <sup>h</sup> 42 <sup>m</sup>	9 <sup>h</sup> 07 <sup>m</sup>	11 <sup>h</sup> 44 <sup>m</sup>	14 <sup>h</sup> 45 <sup>m</sup>	9 <sup>h</sup> 22 <sup>m</sup>	22 <sup>h</sup> 58 <sup>m</sup>	21 <sup>h</sup> 21 <sup>m</sup>	10 <sup>h</sup> 40 <sup>m</sup>
	11	11 <sup>h</sup> 49 <sup>m</sup>	10 <sup>h</sup> 59 <sup>m</sup>	12 <sup>h</sup> 08 <sup>m</sup>	14 <sup>h</sup> 51 <sup>m</sup>	9 <sup>h</sup> 27 <sup>m</sup>	22 <sup>h</sup> 56 <sup>m</sup>	21 <sup>h</sup> 20 <sup>m</sup>	11 <sup>h</sup> 16 <sup>m</sup>
	21	12 <sup>h</sup> 49 <sup>m</sup>	11 <sup>h</sup> 50 <sup>m</sup>	12 <sup>h</sup> 31 <sup>m</sup>	14 <sup>h</sup> 57 <sup>m</sup>	9 <sup>h</sup> 32 <sup>m</sup>	22 <sup>h</sup> 55 <sup>m</sup>	21 <sup>h</sup> 19 <sup>m</sup>	11 <sup>h</sup> 52 <sup>m</sup>
Dec	1	10°07'	14°43'	2°37'	-14°58'	16°17'	-7°30'	-15°43'	8°26'
	11	2°19'	10°35'	-0°01'	-15°28'	15°56'	-7°39'	-15°47'	4°44'
	21	-5°17'	5°58'	-2°39'	-15°59'	15°35'	-7°48'	-15°51'	0°53'
Dist	1	1.37	1.64	2.58	5.75	10.09	19.08	21.11	1.009
	11	1.38	1.67	2.60	5.88	10.02	19.08	29.18	1.007
	21	1.33	1.69	2.61	6.00	9.93	19.12	29.28	1.004
Mag	1	-1.9	-3.8	1.8	-1.9	0.4	5.7	7.8	
	11	-0.9	-3.8	1.8	-1.8	0.5	5.7	7.8	
	21	-0.4	-3.8	1.7	-1.8	0.5	5.7	7.9	
Size	1	4.9"	10.1"	3.6"	34.3"	16.5"	3.7"	2.3"	31'42"
	11	4.9"	10.0"	3.6"	33.5"	16.6"	3.7"	2.3"	31'46"
	21	5.0"	9.9"	3.6"	32.8"	16.7"	3.7"	2.3"	31'51"

## ASTRONOMY FOR POETS

### An Introduction to Stars, Galaxies, and the Universe

at Foothill College in Los Altos

(Sep. 25 - Dec. 12, 2006)

Andrew Fraknoi

Have you wondered about the recent discoveries of astronomy (such as black holes, cannibal galaxies, and the expanding universe), but worried that a formal course will be full of math and technical language?

In that case, you may want to look into Astronomy10B, Astronomy for Poets, at Foothill College this fall. Offered both during the day and in the evening, the course explores the big ideas about astronomy without math, with lots of analogies, and with the best color images from the Hubble and big telescopes around the world.

Learn the latest scoop about how the universe made life on Earth possible and might someday snuff it out. Discover

what astronomers know about the history of the universe since the Big Bang, and the life story of the stars.

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**“If you want to see the course in action before registering, you are invited to come to the first class in room 5015 at Foothill and see if you like the jokes.”**

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The course is offered Tuesday and Thursday evenings from 6 to 8:25 pm (and also during the day, Monday,

Tuesday, and Thursday, from noon to 1:25 pm.) The instructor is Andrew Fraknoi, who specializes in explaining astronomy in everyday language, both in his classes and during his appearances on Bay Area radio.

To register, go to the college web site at: <http://www.foothill.edu/reg/> Everyone needs to register for the course, but later, those students who do not need a grade can make arrangements to attend without credit.

If you want to see the course in action before registering, you are invited to come to the first class in room 5015 at Foothill and see if you like the jokes.

## Officers and Board of Directors

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**Printing** Accuprint (408) 287-7200

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Jim Van Nuland (408) 371-1307

## Telescope Loaner Program

Mike Koop (408) 446-0310

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Paul Kohlmler pkohlml@best.com

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### 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

### Submit

Submit articles for publication in the SJAA *Ephemeris*. Send articles to the editors via e-mail to [ephemeris@sjaa.net](mailto:ephemeris@sjaa.net). **Deadline, 10th of previous month.**

## SJAA loaner scope status

All scopes are available to any SJAA member; contact Mike Koop by email ([koopm@best.com](mailto:koopm@best.com)) or by phone at work (408) 473-6315 or home (408) 446-0310 (Please leave message, phone screened).

### Available scopes

These are scopes that are available for immediate loan, stored at other SJAA members homes. If you are interested in borrowing one of these scopes, please contact Mike Koop for a scope pick up at any of the listed SJAA events.

# Scope	Description	Stored by
1	4.5" Newt/ P Mount	Annette Reyes
3	4" Quantum S/C	Hsin I. Huang
6	8" Celestron S/C	Karthik Ramamurthy
7	12.5" Dobson	Tom Fredrickson
10	Star Spectroscope	Jim Albers
11	Orion XT6 Dob	Ravi Shankar Erram
12	Orion XT8 Dob	Sarah E. Jones
13	Orion XT6 Dob	Rajiv Vora
14	8" f/8.5 Dob	Colm McGinley
15	8" f/9 Dobson	Mike Koop
19	6" Newt/P Mount	Daryn Baker
23	6" Newt/P Mount	Wei Cheng
24	60mm Refractor	Al Kestler
26	11" Dobson	Vivek Kumar
27	13" Dobson	Steve Houlihan
29	C8, Astrophotography	Mark Ziebarth
32	6" f/7 Dobson	Sandy Mohan
34	Dynamax 8" S/C	Yuan-Tung Chin
35	Meade 8" Equatorial	Mike Horzewski
38	Meade 4.5" Digital Newt	Tej Kohli
39	17" Dobson	Steve Nelson
40	Super C8+	Bill Kerns
42	11x80 Binoculars	Ritesh Vishwakarma
43	Orion XT4.5 Dob	Gary Mitchell

### Scope loans

These are scopes that have been recently loaned out. If you are interested in borrowing one of these scopes, you will be placed on the waiting list until the scope becomes available after the due date.

# Scope	Description	Borrower	Due Date
8	14" Dobson	Charles Santori	10/2/06
28	13" Dobson	Craig Scull	8/1/06
33	10" Deep Space Explorer	Art Kalb	9/30/06
36	Celestron 8" f/6 Skyhopper	Kristi Whitfield	9/16/06
41	18" Sky Designs Dob	Len Bradley	9/17/06

### Extended scope loans

These are scopes that have had their loan period extended. If you are interested in borrowing one of these scopes, we will contact the current borrower and try to work out a reasonable transfer time for both parties.

# Scope	Description	Borrower	Due Date
2	6" f/9 Dob	John Paul De Silva	?
9	C-11 Compustar	Bill Maney	Indefinite
16	Solar Scope	Mike Koop	Repair
21	10" Dobson	Michael Dajewski	Repair
37	4" Fluorite Refractor	Peter Young	8/11/06
44	4.5" Skyview/ P Mount	Mantle Yu	8/03/06

**Waiting list: Empty! Reserve a scope today!**

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

## San Jose Astronomical Association Membership Form

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

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

I'll get the Ephemeris newsletter online

<http://ephemeris.sjaa.net>

Questions? Send e-mail to

[membership@sjaa.net](mailto:membership@sjaa.net)

Bring this form to any SJAA Meeting

or send to the club address (above).

Please make checks payable to "SJAA"

(not Sky Publishing).

### 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.)

You can join or renew online:

<http://www.sjaa.net/SJAAmembership.html>

**Name:** \_\_\_\_\_

**Address:** \_\_\_\_\_

**City/ST/Zip:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**E-mail address:** \_\_\_\_\_