SJAA EPHEMERIS

Constellations

Mark Wagner

Recently at Houge Park some of the more interested visitors looking through my telescope would ask where the object they'd just seen was located in the sky. I would guide them through some of the more familiar or easy to recognize constellations. Objects such as M3, M94 and M104, or some of the good doubles were favorites and people enjoyed "star hopping" to them. It was fun too to turn my telescope over to a few people and describe to them where to point it.

When I returned home I began looking through some old Internet bookmarks and rediscovered this one:

Out of This World - The Golden Age of the Celestial Atlas - An Exhibition of Rare Books from the Collection of the Linda Hall Library http://www.lhl.lib.mo.us/pubserv/hos/stars/welcome.htm

Perseus from Poeticon astronomicon. Venice, 1482. The woodcut reproduced here is that of Perseus, holding the newly-severed head of the Gorgon. In the Renaissance the work was usually attributed to the Roman historian C. Julius Hyginus, who lived in the first century B.C., but we now know it was probably composed by some other Hyginus at a later date. The order of the constellations follows that of the catalog in Ptolemy's Almagest, so the work may date from the second century A.D or later.

The historical depictions of our recognizable star patterns as shown on the web-page reminded me of the people at Houge Park, and made me think of how ancient this practice of personifying the stars is. I think the Internet "exhibition" is unique and provides an interesting historical overview.

Coincidentally, I found a nice book about constellations at The Santa Cruz Bookstore a week later... *The Starlore Handbook - An Essential Guide to the Night Sky* by Geoffrey Cornelius, ISBN 0-8118-1604-4. I recommend this book for those who like to attach some of the history and myth (starlore) to your experience outside at night. Contained between the covers are handy small maps for each constellation showing the major stars and describing some details about them.

From the inside front cover:

"The Starlore Handbook is the first beautiful and practical, fully illustrated guide to explore the infinite night sky. Combining astronomy, myth, and symbolism, it gives a detailed and rich understanding of the cosmos. Original maps help identify each of the constellations and the stars within them, while thorough explanations of the intriguing symbolic significance attributed to the heavens throughout the ages bring star watching vividly to life.

Continued on next page

SJAA Activities Calendar

Jim Van Nuland

June

1 Deep-Sky weekend. Sunset 8:19 p.m., 58% moon rises 1:42 a.m.
8 Deep-Sky weekend. Sunset 8:25 p.m., 4% moon rises 4:52 a.m.
14 Houge Park star party. Sunset 8:29 p.m., 20% moon rises 0:05 a.m.
15 ATM Class X — Houge Park, 7:30 p.m.
11 Deep-Sky weekend. Sunset 8:04 p.m. No visible moon tonight.
22 **General Meeting**: Robert Naeye, *The Great Pluto Debate*
28 Astronomy Class VII — Houge Park, 7:30 p.m.
28 Houge Park star party. Sunset 8:32 p.m., 82% moon rises 11:44 a.m.

July

5-6 Glacier Point Star Parties.
6 Deep-Sky weekend. Sunset 8:28 p.m., 12% moon rises 3:26 a.m.
13 Deep-Sky weekend. Sunset 8:27 p.m.,18% moon sets 11:16 p.m.
19 Houge Park star party. Sunset 8:21 p.m., 81% moon sets 2:36 a.m.
20 ATM Class XI — Houge Park, 7:30 p.m.
27 **General Meeting**: Dr. Ken Lum, *Optical Designer Bernhard V. Schmidt*

Upcoming Speakers:
August Juanita Ryan, *Antartica Meteor Trip*

24 Hour News and Information Hotline: (408) 559-1221
www.sjaa.net

Constellations

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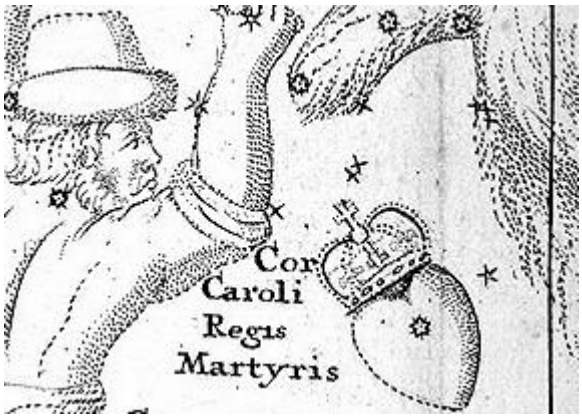
You don't need a prior knowledge of astronomy to use this striking book, which concentrates on features that can be made out both with the naked eye and binoculars of average power. Each of the 88 constellations is given separate treatment with a constellation map and star table indicating Greek letter designations, brightness, and other points of interest. The celestial symbolism and mythology of each constellation are covered in fascinating detail. Where appropriate, a "signpost chart" explains how to locate the constellation by reference to easily identifiable landmarks such as the pole star Polaris or the "saucepan" of the Big Dipper. In addition, a series of "whole sky" charts plots the movements of the stars during the course of the year, while easy-to-use tables enable you to determine the positions of the visible planets. Brief sections on the Sun, the Moon and the planets complete this celestial tapestry.



Cor Caroli by Edward Sherburne. London, 1675. This is a small detail of a larger region which shows a new constellation, Cor Caroli Regis Martyris, that was invented by Sir Charles Scarborough only two years earlier to honor Charles I. The constellation, containing only a single star, would later be incorporated into Canes Venatici, but Cor Caroli has stayed on as a name for the star.

Rich with both traditional lore and compelling science, The Starlore Handbook opens our eyes to the beauty and wonder of the heavens, and the rich interpretations of the night skies that have come down to us through history."

If you know of other interesting books or Internet sites covering this topic, please let me know.

Clear skies!

— Mark Wagner,
mgw@resource-intl.com

[The exhibition contains forty-three star atlases and maps, covering the period from 1482 to 1851. Focal points include all five of the "Grand" celestial atlases — Johann Bayer's Uranometria *(1603), Julius Schiller's* Coelum Christianum*, Johann Hevelius's* Firmamentum *(1690), John Flamsteed's* Atlas coelestis *(1729), and Johann Bode's* Uranographia *(1801) — as well as such colorful jewels as Andreas Cellarius's monumental* Harmonia macrocosmica *(1661) and Johann Rost's tiny* Atlas portatalis coelestis *(1723).]*

Centaurus and Lupus, by Christoph Semler, Coelum stellatum. Magdeburg, 1731. Semler is another one of those celestial cartographers who is unknown except through his atlas. The Semler atlas is immediately distinguishable from all its predecessors by the black background on the plates. Each plate was printed from a woodblock, cut only to outline the constellations and pinpoint the stars. Each of the 35 woodcuts has a different orientation, which can sometimes be disconcerting, although celestial north is indicated by an arrow on each plate. Some of the illustrations are quite attractive, such as the one that depicts Centaurus, standing over the Southern Cross, engaging Lupus the Wolf.

Directions to Houge Park

Houge (rhymes with "Yogi") Park is in San Jose, near Campbell and Los Gatos. From Hwy. 17, take the Camden Avenue exit. Go east 0.4 miles, and turn right at the light, onto Bascom Avenue. At the next light, turn left onto Woodard Road. At the first stop sign, turn right onto Twilight Drive. Go three blocks, cross Sunrise Drive, then turn left into the park.

From Hwy. 85, take the Bascom Avenue exit. Go north, and turn right at the first traffic light, onto White Oaks Road. At the first stop sign, turn left onto Twilight Drive. You will now be passing the park. Turn right at the first driveway, into the parking lot.

Between the parking lot and tennis courts is a strip of grass where public star parties are held. The meeting hall is directly ahead (south) of the parking lot. There are restrooms on the other side of the the hall.

For directions to observing sites commonly used by SJAA members, visit the SJAA web site: http://www.sjaa.net/directions.html.

Mooning

Bad Moon On The Rise

Dave North

This month you'll get an opportunity to see a really bad moon, first hand.

One of the worst, actually.

It will happen June 21, the last day of Spring and the first day of Summer: the Solstice. On that day, the Sun will be highest in the sky for us northerners.

On the other hand, the Moon will be just about as low in the sky as it gets, and further there won't be much darkness (shortest night of the year). That, of course, means we'll probably have completely rotten seeing.

And if that wasn't enough, it will also be only three days short of full, with the terminator just past Mare Humorum, offering a minimum of targets.

And if that isn't enough, since it's getting on to full, the Moon won't even manage to haul itself up to its modest maximum elevation until later in the evening.

So why would I even suggest you check out such a thing?

Well, for one thing it's just kind of fun to get out and look at something on the Solstice. For another, it's a mechanically visible representation of how the orbital dynamics of the Sun and Moon relate to each other.

And if that isn't enough, it's probably going to be warm and pleasant, and you can keep all your lights on while looking at the Moon.

Okay, so maybe there's another minor point: since it's not going to be very good anyway, you can just catch a glance early on and see if you're interested.

This Moon theme is also useful in pointing out that, though the weather is better and there will be more clear nights, this is not going to be a very good season for Moon observing in great detail, since the evening Moon will generally be pretty low in the sky for quite a while.

The best way to approach it is to set up each night, and take a look around sunset (when near the first quarter). We often get our best seeing just as twilight fades to dark — for some reason the air is particularly calm.

Later in the lunation (as we approach full) the Moon will be so low near sunset that it will be hard to get a good look until it's further up. So there you just set up and let stuff sit around until later, then take a glance to see how the seeing is behaving. If it looks like you've had several martinis too many, probably best to forget it for tonight.

If it looks like you've had several martinis too many, probably best to forget it for tonight.

But the paradoxical bonus is, sometimes in summer the air just goes dead still for some reason, and even at low elevations you can still get spectacular Mooning nights.

So that's the basic technique for the devoted Moon junkie: check it out every night and soak up what you can when it works well.

It's also fun to note how many times you get clouded out — some years it's fairly surprising how few clear nights we get, even in Summer. If none of that sounds like fun to you, there is another possibility that's actually pretty pleasant. Get any book or decent reference that shows you the larger features on the Moon, and sit down with a nice reading light, your telescope, and make sure you have a comfortable chair.

Look at the items visible and check their names from the chart, and if there are any descriptions, note what you think of the author's impression.

Cherrington's Moon Through Binoculars and Small Telescopes is pretty good for this game.

It will give you a feel for how things relate, how their sizes compare, and what may have been the cause of many objects you see. This is, curiously, best done at lower powers — where poor seeing is not so important. What ever you do, have fun with it. Even people who get paid to look at the Moon seem to enjoy it, so you should too!

Determine Your Longitude With Jupiter's Moons

Morris Jones

It was MIT physicist Philip Morrison on a television documentary who taught me how to use Jupiter's moons as a system for synchronizing clocks, the first step in calculating longitude with astronomical observations. With an ephemeris for Jupiter satellite transits and occultations that is accurate for the time at the Royal Greenwich Observatory, you can synchronize your clock to the observatory's by watching the scheduled event. The difference between your local time and Greenwich local time reveals your longitude.

On a clear night in late February, I decided to try this experiment. I set up my 4-inch refractor on my back deck outside my house in San Rafael, California. My favorite Jupiter ephemeris (www.projectpluto.com/jevent.htm) predicted an occultation of Europa for 0510 Greenwich Mean Time (GMT) the following day, or 9:10 p.m. Pacific Standard Time, my local "standard" clock. This event provided a splendid opportunity to synchronize my own GMT clock.

These days it's easy to set your watch to GMT. My computer stays synchronized to a variety of reference clocks available on the Internet using

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Longitude

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the network time protocol (NTP). So I already knew that my watch was correct.

At about 8:40 p.m., I had my mount aligned and tracking, and Jupiter was looking big and beautiful. I wanted to test my ability to judge the precise moment when the occultation was complete, so I stopped looking at my watch. I knew it was several minutes before the ephemeris's predicted time when I first saw Europa brushing against Jupiter's limb. It was like watching a very distant sunset as Europa sank further behind Jupiter's disk, appearing as a tiny lump on the edge. The lump shrank to a smaller dot, but it was still there. Would I be able to tell the exact moment of occultation? I looked again and couldn't see Europa — but wait, I thought, "There's still a tiny pinpoint on the edge. Or is it just my imagination?"

... My experiment was missing a crucial piece of equipment that an 19th-century surveyor would have had ...

Finally it was clear that nothing was left. No odd pinpoints appeared even when I used averted vision. It was time. I looked at my watch. It was 9:10:30: dead center in the designated minute.

Following through with the experiment, now that I had a clock synchronized to GMT, I could calculate the sidereal time at Greenwich. Sidereal time, the right ascension coordinate crossing overhead at any particular moment, is the key to calculating longitude. Longitude is simply the difference between the sidereal time at a reference location (Greenwich) and the local sidereal time, expressed as degrees instead of hours, minutes, and seconds.

But my experiment was missing a crucial piece of equipment that an 19th-century surveyor would have had: a transit scope. A transit scope points only along the meridian. The mount would be plumbed to vertical, and aligned very carefully with the north celestial pole. I could approximate a transit scope by turning off my mount's clock drive, and reorienting the mount so the telescope is constrained to rotate along a line including the zenith and the north celestial pole. Alas, most telescope mounts, mine included, won't twist into such a configuration.

But if I had such a device, I could watch for any charted star to cross my local meridian. At that moment, my local sidereal time would match the right ascension of that star. I would consult my recently synchronized GMT clock, and convert that time to the Greenwich sidereal time, using published tables. Take the difference between local sidereal time and Greenwich sidereal time, convert it to degrees, and bingo! Longitude.

— *Morris Jones*, mojo@whiteoaks.com

Messier Marathon

Paul and Mary Kohlmiller

On April 13, the SJAA Don Machholz Messier Marathon was held at Coe Park. We got there shortly after 7 and there were already more than a dozen telescopes in various stages of being set up. As we got closer to the 7:39 sunset, I wondered if the best part of the evening was going to be the sunset. The clouds were high and thin but they kept encroaching all night long.

Finally it was dark enough to see a few stars. I tried to align our Meade LX 200 10" scope but it wasn't going very well. After rechecking the coordinates and the time, we decided that our 7 amp battery didn't get charged right so we hooked the scope up to the car's battery. This time the alignment worked. Bob Havner passed out a list of all the Messier objects in the Machholz order. Besides that list we had the *Messier Marathon Observer's Guide* by Don Machholz and a book by Stephen James O'Meara, *The Messier Objects*. It was difficult to see the first few objects. In fact, we went down the list trying and failing to spot anything until we got to the eighth object on the list.

Bob came around a few times during the evening making sure we were still having fun. Of course we were, we were "cheating." Well, we were using the "goto" feature on the Meade. After all the problems with the alignment feature, when we started asking it to find Messier objects it was nearly flawless. One fellow observer asked if we used the equatorial wedge. Our experience with the wedge is that it was a lot more work with no greater accuracy. Mike Koop also came by to see how we were doing.

Our first interesting find was an open cluster, M35. The darker sky at Coe, compared to our backyard, made it a more interesting object than we remembered. A few other open clusters in the same part of the sky were also great to see. Eventually we got to some other objects. Bob recommended throwing some magnification at the global clusters. M3, M13 and M5 were much more interesting using the 13mm eyepiece. This also worked with a few edge-on galaxies like M104 and M82. (O'Meara also talks about how increased magnification helps with these and other galaxies.) It was easy to see the two cores in M51, the Whirlpool Galaxy. M57, the Ring Nebula, always looks out of focus to me.

Then there were the Messier objects that were just plain surprises. M40 is a double star. That didn't seem right. There were a couple people at the park that night that came by to see some objects who didn't know about Messier objects at all. I gave the short

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Messier Marathon

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version about how a guy named Messier was trying to find comets and decided to catalog these annoyances that might look like comets but weren't. So why a double star? According to O'Meara, an earlier astronomer, John Hevelius, saw this "nebula" in 1660. Might have been a bad viewing night and certainly the state of telescoping was not quite up to modern standards. O'Meara also reports that Hevelius' position suggests a different part of the sky than what Messier put in the catalog. M40 was later rediscovered by A. Winnecke but Hevelius was apparently looking at 74 Ursae Majoris — not a double star after all and not a nebula either. Whatever, we marked it as "observed and checked" on our Messier sheet and moved on.

Other objects were very difficult to see. If it wasn't for being able to check them off the sheet, it might not have been worth the effort. Galaxies like M98, M99 and M100 were very dim, small and uninteresting. To convince ourselves that we saw M100, we moved the scope left and right. This seems to help when the object is dim. M100 is magnitude 9.3. A few objects are even dimmer. The dimmest on the list is M91 at 10.2 where the left-and-right shifting helped. M76 (magnitude 10.1) was the only object we gave up on for magnitude reasons alone.

Eventually we got to the part of the Messier list that said, "Congratulations, you have completed the Virgo hump. It's all down hill from here!" Well, there were still about 45 objects to see but a lot of them were not visible yet. We skipped over some objects in Puppis because there was a tree in the way. When we went back to find them, the clouds had overtaken that part of the sky. When the clouds had moved in as far as Polaris, I figured our time was going to be limited. Eventually we stopped a bit before 1:30 a.m..

"Congratulations, you have completed the Virgo hump. It's all down hill from here!"

At the end we claimed 68 objects. We got most of the objects from #8 on the list, M103 down to #85 which is M62. We missed M76 because it was dim, M79 was too low, M41 and M46 were behind a tree. Part of Scorpio and all of Sagittarius wasn't up yet. For the most part we slewed to and saw it, marked it and slewed on. We stopped to take a few 3-5 minute exposure shots of M35 and M51 but I'm not optimistic about how they will turn out.

All in all, we were glad to do the Marathon in April instead of March. It was much warmer, we got all the Virgo objects by 1 a.m. And although Darkness Squandering Time meant it seemed to take forever for the sky to darken, it also meant that we didn't have to rush to the park to get there before dark.

It was critically important to have an observing sequence. I'm not sure what we would have done without the SJAA sheet and the Machholz book. A "goto" scope was very important but if you have to slew across large sections of the sky all the time, your alignment gets to be a bit off. This really hurts when looking for something faint. As for the items we missed, that's what summer is for!

— *Paul and Mary Kohlmiller,* pkohlmil@best.com

SJAA Membership, May 2002: 273

Announcing the Inaugural 2002 Shingletown Star Party

For the past eight years the San Francisco Bay Area internet observers group The Astronomy Connection (TAC) has been hosting star parties at Mount Lassen Volcanic National Park. The location's outstanding dark skies and wonderful daytime sights have made for an annual gathering that continues to increase in popularity and attendance.

This year, in conjunction with TAC, TAC-SAC (Sacramento) and Shasta County, the Shingletown Activities Council is proud to host the inaugural Shingletown Star Party for 5 days and nights at the Shingletown Airport, which is located approximately 40 miles east of Redding off of Hwy 44 in Shingletown, CA. The dates are from noon on Wednesday, July 10th through Monday at noon on July 15, 2002. The airport will be officially closed to air traffic during our stay, so we will be able to camp on site and leave our equipment set up on the paved runway.

While a few details are left to work out, this star party is happening and is open to all amateur astronomers. Come out and join the fun at a real dark sky event.

More details and a sign-up form can be found at: http://www201.pair.com/resource/resource-intl/ssp.html or contact Jim Ster by e-mail (sterjf@ecs.csus.edu) or telephone (916 278-5624 /voicemail) or Mark Wagner by e-mail (mgw@resource-intl.com) or telephone (408 356-1125).

Project Astro South Bay Partners Needed

Bob Havner

Karin Avila, the Project Astro coordinator, needs astronomer partners for the Peninsula and San Jose areas. I am a Project Astro partner astronomer and my own personal experience with the program has been great! It is a great way to share what you know with young people in our community. For information about Project Astro go to: http://www.astrosociety.org/education/astro/project_astro.html

— *Bob Havner*, bhavner@earthlink.net

SJAA Auction XXII Results

Gary Mitchell, Treasurer

We did pretty well this year at the SJAA auction. There were 42 bidders. Commission on auction totalled $952.41, and includes $1 bidder fee & donations. Commission on swap totalled $286.60. Profit on sodas was $8.40. Sodas cost $21.60 (we sold 30 cans at $1 each). The grand total net for the auction was $1,247.41.

— *Gary Mitchell*, wb6yru@aenet.net

Photos from the 2002 Auction — Top right: SJAA members examining the bootie. Top left: "Looks like it'll make a good finder scope!" Middle right: Auctioneer Kevin Medlock explains how a photo enlarger works. Bottom: Eager bidders anxiously await the next item. Photos by David North and Akkana Peck.

Celestial Calendar
June 2002

Richard Stanton

Lunar Phases:		Date	Rise	Trans	Set
LQ	22:05 PDT	02	01:44	07:06	12:39
NM	16:46 PDT	10	05:34	12:59	20:30
FQ	17:29 PDT	17	12:49	19:23	01:16
FM	14:42 PDT	24	20:46	00:38	05:30

Nearer Planets:				R. A.	Dec.
Mercury, 0.74 A.U., Mag. -1.9					
07	05:07	12:04	19:01	04:00.4	+16:34
17	04:38	11:37	18:38	04:11.6	+17:07
27	04:28	11:39	18:51	04:51.3	+19:58
Venus, 1.19 A.U., Mag. -4.5					
07	08:14	15:39	23:04	07:32.4	+23:42
17	08:33	15:49	23:05	08:22.4	+21:28
27	08:53	15:57	23:01	09:10.0	+18:18
Mars, 2.56 A.U., Mag. 1.6					
07	07:06	14:33	22:00	06:28.1	+24:18
17	06:57	14:22	21:47	06:56.6	+23:51
27	06:49	14:11	21:33	07:24.8	+23:06
Jupiter, 6.14 A.U., Mag. 1.9					
07	08:02	15:21	22:40	07:17.4	+22:30
17	07:33	14:51	22:09	07:26.4	+22:14
27	07:04	14:21	21:38	07:35.7	+21:54
Saturn, 10.0 A.U., Mag. 0.9					
07	05:57	13:13	20:29	05:08.9	+21:37
17	05:23	12:39	19:55	05:14.5	+21:45
27	04:49	12:05	19:22	05:20.0	+21:51

SOL Star Type G2V Intelligent Life in System ?

Hours of Darkness						
05:29	07	05:44	13:07	20:30	05:00.6	+22:44
05:21	17	05:44	13:09	20:34	05:42.1	+23:23
05:22	27	05:46	13:11	20:36	06:23.7	+23:20

Astronomical Twilight:		Begin	End
JD 2,452,432	07	03:51	22:22
442	17	03:49	22:28
452	27	03:52	22:30

Sidereal Time:

Transit Right Ascension at Local Midnight

07 00:00 = 15:54
17 00:00 = 16:33
27 00:00 = 17:13

Darkest Saturday Night: 08 June 2002

Sunset	20:30
Twilight	22:23
Moon Rise	04:18
Dawn Begin	03:51
Hours Dark	05:28

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SJAA Loaner Scope Status

All scopes are available to any SJAA member; contact Mike Koop by email (loaner@sjaa.net) or by phone at work (408) 473-6315 or home (408) 446-0310 (Leave Message).

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
7	12.5" Dobson	Bruce Horton
15	8" Dobson	Daron Darr
19	6" Newt/P Mount	Ilkka Kallio
24	60mm Refractor	Al Kestler
26	11" Dobson	Tajinder Singh
27	13" Dobson	Gene Schmidt
32	6" f/7 Dobson	Sandy Mohan

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
3	4" Quantum S/C	Hsin I Huang	7/8/02
6	8" Celestron S/C	Carl Ching	6/23/02
8	14" Dobson	Dana Crom	7/4/02
10	Star Spectroscope	Lew Kurtz	5/23/02
12	Orion XT8 Dob	Mike Macedo	4/23/02
13	Orion XT6 Dob	Dennis Hong	7/5/02
14	8" f/8.5 Dob	John Templeton	7/5/02
16	Solar Scope	Tobias Giles	6/30/02
29	C8, Astrophotography	Kevin Roberts	4/18/02
33	10" Deep Space Explorer	Sandy Mohan	4/18/02
34	Dynamax 8" S/C	George Wang	6/30/02

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
1	4.5" Newt/ P Mount	Annette Reyes	7/18/02
2	6" f/9 Dob	John Paul De Silva	?
9	C-11 Compustar	Paul Barton	Indefinite
11	Orion XT6 Dob	Wai Tuck-Low	4/27/02
21	10" Dobson	Ralph Seguin	Repair
23	6" Newt/P Mount	Wensheng Hua	4/27/02
28	13" Dobson	Michael Dajewski	6/31/02
31	8" f/8 Dobson	Jan Lynch	4/27/02

Waiting List: #12, Tajinder Singh; #3, Eric Anderson

Submit

Submit articles for publication in the SJAA Ephemeris. Send articles to the editors via e-mail to ephemeris@sjaa.net.

To subscribe to or unsubscribe from the SJAA Mailing List, visit http://www.sjaa.net/mailman/listinfo/sjaa-announce

San Jose Astronomical Association Membership Form

New __ Renewal __
Membership - $15
Junior (younger than 18 years old) - $6
Sky and Telescope - add $30 to membership
(Sky & Tel will not accept multiyear subscriptions)

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