SJAA EPHEMERIS

Serendipitous Lunar Graze

Robert A. Garfinkle, F. R. A. S.

It is not very often that you get the opportunity to observe a graze occultation of a star by the lunar south polar region from the vantage of your own front yard. I observed this graze on the night of September 6, 2000 through my 10-inch Meade Schmidt-Cassegrain from the front yard of my home in Union City, California. As part of my research for my lunar observers' handbook, I was studying and taking notes on the southern highlands crater Manginus and several of its neighbor craters as the terminator crept past first quarter. Illuminated by low-angle sunlight of the 8.6 day-old Moon, the rugged eastern rim of Clavius was within a few degrees of the terminator while the floor was in darkness.

"I timed the twinkles and flashes and the moment it blinked out entirely."

As I observed the Moon through my 12mm Nagler II eyepiece, I glanced over toward the dark western limb and noticed a triangle consisting of a 7th and two 8th magnitude stars. The asterism was fast approaching the dark southwestern limb. Some quick calculations of speed and direction indicated that there was the possibility of observing a dark limb immersion occultation or even a possible graze occultation within a matter of minutes.

The Moon was passing through the open star cluster M21 (NGC 6531) in the constellation of Sagittarius. The brightness of the Moon overpowered most of the faint cluster stars. The Moon was 64.13 percent illuminated at the start of the first graze with a phase angle of 73.58 degrees. The total libration was L=3.138 and b=-2.476. The region from the lunar south pole up to about 78 degrees south latitude was in darkness. The crater Short was bisected with its eastern wall and central peak being illuminated and the rest of the crater totally dark, giving this crater the appearance of being the southern limb.

I turned on my short wave radio and tuned in station WWV in order to time the event. Unfortunately, I did not have my cassette tape recorder handy, but got ready to count the seconds along with the radio pings as the first star, 8.68-magnitude GSC 6263:104, approached the limb. At 4:03.02 Universal Time (UT), the first star disappeared into a total occultation. I was still not sure if the brighter star, 7.21-magnitude SAO 186215 (GSC 6842:246), would graze or be a total occultation, because I could not see the southwestern limb. At 4:06.01 UT, the blue-white subgiant star began to flicker, flash, dim, and flash again as it skimmed the rugged mountains along the limb. I timed the twinkles and flashes and the moment it blinked out entirely. Two more flickers then it appeared to clear the limb at 4:06.09. I noticed that as the brightness of the star dimmed to about 9th magnitude as it flickered from blue-white to golden then back to blue-white. This change in color was repeated several times in quick succession.

Continued on following page

SJAA Activities Calendar

Jim Van Nuland

October

6 Houge Park star party. Sunset 6:43 p.m., 66% moon sets 1:27 a.m.

7 Observational Astronomy class, Kevin Medlock on CCD imaging. Houge Park 8 p.m.

14 General Meeting: Wyn Wachhorst on his book *The Dream of Spaceflight: Essays on the Near Edge of Infinity*

20 Houge Park star party. Sunset 6:23 p.m., 41% moon rises 1:04 a.m.

21 Fremont Peak star party Sunset 6:21 p.m., 30% moon rises 2:11 a.m.

28 Fremont Peak star party Sunset 6:12 p.m., 4% moon sets 7:29 p.m.

29 Darkness-Squandering Time ends. Set your clocks back 1 hour.

November

3 Houge Park star party. Sunset 5:15 p.m., 49% moon sets 11:11 p.m.

11 General Meeting — Alan Adler on enhanced mirrors for newtonian telescopes. Houge Park, 8 p.m.

17 Houge Park star party. Sunset 4:56 p.m., 56% moon rise 11:04 p.m.

18 Fremont Peak star party. Sunset 4:55 p.m., 44% moon rise 0:11 a.m.

25 Fremont Peak star party. Sunset 4:51 p.m., New moon.

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

Lunar Graze

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I was concentrating on watching the bright star and did not notice the instant the third star, 8.10-magnitude GSC 6263:525, went into occultation, but it happened during the middle of the graze. I noticed that all three stars were occulted before the first graze ended.

SAO 186215 hung close to the dark limb and I decided to continue watching until it was obviously clear of the Moon. To my good fortune, the star began a second graze at 4:09.10 UT. In between the time of the two grazes, the south polar Aitkin Basin, which is a 1500-foot deep depression, which gives the Moon's south polar region the appearance of being flat, had been passing by the star. Once again, the star began to flicker as the limb mountains intermittently blocked its light. At 4:11.06 UT, the star disappeared completely. It reappeared from the illuminated limb at 4:19.25 UT at about 75 degrees south latitude near the crater Legentil. The star did not emerge directly from the limb, but reappeared from a black band created by the intense irradiation that blocked the relatively weaker light from the 7th magnitude star. Due to the brightness of the illuminated east limb, I did not see the fainter two stars even though I knew that they were both no longer being occulted.

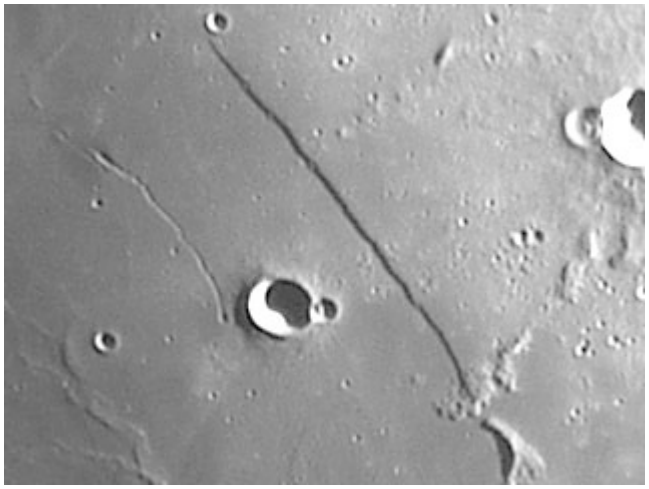
This occultation demonstrated several things including that the Aitkin Basin does in fact form a noticeable depression along the south polar limb and the zone of irradiation that surrounds the brightly illuminated portion of the Moon can block the light of a faint star. The best part of this occultation was the fact that it was totally unexpected by me until moments before it occurred. You never know what to expect when you get out to observe the night sky.

Walking on the Straight Fault

Jane Houston Jones

I always look forward to the time of month near first quarter moon. This is the time of the straight wall. These days it is more accurately called the Straight Fault. I rarely miss a look at this piece of lunar geology. On the lunar maps this feature is called Rupes Recta.

The moon was just past first quarter when I took a look recently.



Rupes Recta, better known to amateur astronomers as "The Straight Fault," is visible in small telescopes at first quarter. The cleft, Rima Birt, is visible to the left of craters Birt and Birt A. See Antonin Rukl's Atlas of the Moon*, chart 54, for more details. Photo courtesy Antonio Cidadão.*

The shadow cast on this lunar fault was deep and dark. The slope of the fault is vivid between first and full.

Looking at the Straight Fault made me think about faults on the earth. The moon's most prominent fault is only 68 miles or 110 km in length, about 580 feet (300 m) in depth and 1.5 miles (2.5 km) in width. The lower side of the fault is to the west and the westward moving terminator casts a deep shadow. In another two weeks, when the sun is on the other side of the fault, the Straight Fault will appear white. It's an amazing view through the eyepiece. Watching this feature throughout the month is a study in light, shadow and contrast. It's a study in geology too.

I was thinking about the Straight Fault while observing another planetary fault system recently — the San Andreas fault here in California. The San Andreas fault, separating the great continental slabs we call the North America and Pacific plates, is one of the most famous examples of a straight fault on earth. It is much longer than the Straight Fault on the moon. Its length is 750 miles or 1200 km. From the Mexico border to Cape Mendocino, north of San Francisco, it defines the state. This great gash in the earth spans two thirds of the length of our state of California. From the air it is unmistakable.

On the ground, this fault announces its presence as the two mighty plates collide. We feel this collision as earthquakes. You know from a visual glance that something wild is taking place on earth. To feel the earth move is frightening, yet fascinating.

This past weekend some friends gathered and walked on the earth's straight fault. On three separate days we spanned the fault. We walked on our earthly straight fault and observed the weird landscape as it slipped into the sea south of San Francisco at Mussel Rock near Skyline Drive in Daly City. This is the spot where the San Andreas fault enters the Pacific after a 500 mile journey across southern and central California. On the face of the bluff near Mussel Rock there is a massive landslide caused by rock caught and crushed in the fault zone. The face of the bluff is on the north side of the fault zone. Mussel Rock and the beach are on the south side of the fault zone. The rocks are jumbled yet different.

We walked on the straight fault a little more inland on another day.

Straight Fault

Continued from previous page

Ridges and undulations rose from the flat and slightly concave center of the San Andreas rift zone. The Los Trancos Open Space Preserve (on Page Mill Road near Highway 35, near Montebello OSP) is in the Santa Cruz mountains near Palo Alto. We walked on ridges, valleys, on both sides of the fault. We observed the sunken areas where crushed rock — crushed by the friction of the fault zone collects moisture. Permanenly wet, this sag pond is filled with marshy plants. Flat "benches" delineate the fault. Ridges parallel the benches. We were walking on the wild side of the earth!

An earthbound "Straight Fault," the San Andreas fault, seen here in the Carrizo Plain of Central California. Photo by Robert E. Wallace.

And on another day, we walked on the straight fault and saw where the rupture caused by the San Francisco earthquake of 1906 moved fences and offset creek flows. It was powerful and peaceful at the same time.

Earth and moon have straight fault geologic features. One is visible through a telescope, and one is visible under foot. Both take a trained eye and some imagination. Both are beautiful beyond words.

The Shallow Sky

Ecliptic Trick-or-Treating

Akkana Peck

It's been a long summer, with not much chance for planetary observing, but by the end of October, Venus should be up high enough in the sky around sunset to point out to trick-or-treaters. Jupiter and Saturn rise shortly thereafter, making a nice naked-eye grouping with Aldebaran and the Hyades in the eastern sky. Set up a telescope next to the candy dish this Halloween and give some youngsters (and their parents) a real treat this year!

On Jupiter, you can point out some of the moons (at least three will be visible during trick-or-treating hours) and the reddish equatorial bands and greyer polar zones. More experienced observers may see the fainter temperate bands, and transient features such as festoons (bluish swirls), white spots, and barges (dark spots). Alas, there won't be any moon or shadow transits for Halloween, and the Great Red Spot is on the other side of the planet until long after trick-or-treaters have gone to bed, but you can observe them on other nights!

Or you can wow your guests with beautiful Saturn, with its rings tilted at 24 degrees, enough to see the outer edge of the A ring all the way around (except for the area where Saturn's shadow falls upon it). Trick-or-treaters will love any view of the rings, and they'll be able to see Cassini's Division between the A and B rings, but during quiet moments of good seeing (later in the evening, when the planet is higher up in steadier air), look for the fainter C ring as a translucent grey band inside the B ring, and for the elusive darkening in the A ring, the source of so much controversy (is the "Encke Minimum" the same feature as the "Keeler Gap", and did DiVico really discover it first?) The banding on the planet itself is also lovely, much more subtle in its yellows, browns and creams than the obvious and colorful bands of Jupiter.

Venus is in gibbous phase, which probably won't be obvious to most trick-or-treaters, but at magnitude -4, it should be a lovely naked-eye sight. Be sure to point it out, if you have a clear western horizon.

Uranus and Neptune, too, continue to be well placed for observing this month, in Capricornus. With a medium-sized telescope from dark skies, you can probably see some of their moons: last month a group of SJAA observers picked up four of Uranus' moons, and Triton, Neptune's large moon, using the 30" at Fremont Peak; some of them were bright enough to be visible in 8" and 10" scopes. A planetarium program is the easiest way to locate moons of the outer planets.

Set up a telescope next to the candy dish this Halloween and give some youngsters a real treat.

Far Pluto is already fairly low in the southwest at nightfall this month. It's certainly still observable, but will become a harder target as the month wears on.

Mars rises a few hours before the sun. It probably won't show much detail in a telescope yet, but early risers can keep an eye on it and anticipate the upcoming Mars opposition next year.

From Earth To The Moon

Dave North

Looking at the Earth is, in some places, very like looking at the Moon. You've all seen some photo from somewhere and had that thought at one time or other.

Recently, though, the point was brought home in our talk on basaltic flooding by Gary Peterson from San Diego State University. And with that as an inspiration, we were off to look at moonscapes all over northern California and Oregon.

One of our targets was lava tubes. I'm fascinated by rilles, and for years have read about sinuous rilles being primarily collapsed lava tubes that run for hundreds of miles.

I've been willing to take their word for it (dubiously) but what are lava tubes? How can they run so far? Why do they collapse? It wasn't easy to see how they would form, or why they would be so long...

Once you see them, it's pretty easy.

The lava comes from a vent of some sort (there are different kinds, but that doesn't matter for our discussion) and flows in whatever direction is downhill — which is often in many directions, if the vent forms on a plain.

Once the molten rock is out of the vent, it starts to cool immediately ... on Earth, because of the air, the cool earth, maybe rain or just heavy moisture ... on the moon much more slowly because there is no atmosphere to cool the top, so "radiant heating" is about its only option.

But they both cool.

This means the upper and lower surfaces of the flow are cooling faster than the middle part. So you get a crust on top and bottom, much like an Oreo where the biscuits are rock and the creme is molten lava.

This can lead to a number of fascinating landscapes, broken and sharp, glassy ... but it's what's going on underneath that we're after.

Of course, the "creme" in the Oreo keeps flowing, in some places better than others (fluid dynamics, oh well). The faster flowing stuff will, in general, stay warmer as it is being replenished by hotter stuff from behind, and the slower areas are cooling... and when that happens, a flow is insulated top and bottom, left and right.

In other words, it has formed a tube.

This is the Ground State of Lava: its natural tendency.

So there's nothing odd about lava tubes at all: in fact, they are what we should expect.

And when we went to Lava Beds National Park in the northeast corner of California, that's what we saw.

You can just take out your flashlight and climb on down, and go for surprising distances on foot, looking at the flow lines, the strata

We can't see a lava tube below the surface of the moon, but we can sure see one that has collapsed ....

caused by different flows through the same tube, the smooth areas and rough, the colors, the sandy floors in places... this isn't travelogue (I hope) but if you ever get a chance to hike these tubes, you'll never forget it.

And when you see how often they occur, and how big they can get, and how often they collapse...

Collapse?

Well, of course that's important to us. We can't see a lava tube below the surface of the moon, but we can sure see one that has collapsed and created a trench... and that's just what they do.

When the flow is depleted (perhaps for the last time) the still molten lava will drain out the far end of the tube, until the tail end of the flow gets cool and blocks off the tube.

Time passes. Maybe a meteorite impacts nearby, or maybe there's some seismic activity, but something shakes up the place and the roof, only tenuous at best, simply starts collapsing. As time goes by (or maybe very fast) the whole thing falls like a line of dominos, and we see Schroter's Valley!

One last detail... a lava tube has to be pretty big for us to see it on the moon. Do they get that big?

Here on earth, we've walked through tubes big enough to build a four-lane freeway through with a generous shoulder and center divide. On the moon, though, there's less gravity and the lava is more "liquid" (less viscous) and can run further, and form larger (and longer) tubes.

So, yes. You bet. They could get that big, and once you've seen the blasted lunar landscapes of Lava Beds (and strolled through the underground basaltic burrows) you'll have no doubt: they could be lava tubes.

And you'll never look at a rille up there the same way again. Or, really, down here either.

Additions to Loaner Scope Program

Mike Koop

Orion Telescope held a "sidewalk sale" on the last weekend of August, and the SJAA took the opportunity to purchase two new Orion dobsonian telescopes at a deep discount. The new XT6 and XT8 telescopes are now in the loaner program.

Orion also donated various telescope caps and covers.

Special thanks to Tim Gieseler and Jack Kellythorn of Orion Telescope for their support of the SJAA loaner program!

Binary Tour of Lyra

Jamie Dillon

In July, I had fun going through the double stars in Lyra. This article may serve as a reminder of fun and easy sights for crusty veterans, or an interesting diversion for other crusty rookies.

Most famous are of course the big guy, Vega, with its tiny companion, and epsilon Lyrae. It turns out that Vega is an optical double after all, a "so-what" at this point. The double-double is famous and on everyone's hot list for good reasons — orbits within orbits.

Now for the treats that get passed up on the way to the ring. Delta Lyrae is shown on the charts as delta 1,2, but is nowhere listed as a binary, that I can find, from which I presume it's an optical double. But what a star field! In a 1 degree field, the stars around delta Lyr form a captivating pyramid.

Here's an extrememly artful shape that happens to show in a wide-field view from the angle of this planet, like the way a snowflake looks on a cold objective if you get it under the microscope in time. Beauty for its own sake. Now who has the time to set up an asterism just so, to provide a spare lovely sketch like that, just at the right time across the epochs?

Beta Lyr is a pair with close companions, with the primary a tad bluer and much brighter than the secondary, which shows white. Of course the y-pattern around beta is a comforting asterism for navigating. Eta is off to the northwest a bit from Vega, almost an even white pair in my scope.

Zeta Lyrae is the secret gem hereabouts, a lovely blue-white pair. The brighter is a bit bluer. Worth the visit.

I know this is Nortonish and quaint, but as you can see I find binaries captivating, ever since that moment last winter with ole #31 when I aimed at Mintaka. The planetary orbit experts have started to calculate possible orbits for a viable planet in a binary system. Visually the surprise factor doesn't fail to get me. Also, while the big scopes up on Mauna Kea and Paranal and in orbit, as well as photos, just smoke our instruments for deep sky, our scopes are optically optimal for visuals of most multiple systems.

From the August SJAA general meeting, Ken Miura describes his experiences volunteering as an amateur astronomer at the Onizuka Visitor Center on Mauna Kea. Ken joined SJAA member Jay

December Holiday Party

Mark Taylor

The club's December general meeting will again be held as a holiday party and social occasion. Last year we had many tasty "potluck" contributions, interesting "show and tell" items, a fun-filled "white elephant" gift exchange, and lots of great conversation.

If you would like to display a piece of unique astro equipment, an astro photo, new software, or other such item please bring it along.

Contributions of food or drink are appreciated but not necessary. No alcohol, please.

If you would like to participate in this year's "white elephant" gift drawing, please anonymously wrap (no name tag) an astronomical item of small value and/or large humor and bring it along. It can be a used item you no longer want, an inexpensive new item, and can be either useful or funny. We'll do the exchange as a "draw or steal" lottery, which is always great fun.

Please join us on December 9th at 8pm for our holiday social.

For Sale

10 month old Meade 125 ETX with tripod and Autostar computer. Excellent condition. $1300 new, asking $900. Jim Linville 408-923-4746 CafromMd@aol.com

Unassembled AstroSystems Telekit cut for 14.5" f/5 mirror. No optics included. (I ended up using the mirror in another project.) Available now for pick up in Campbell. Information about AstroSystems Telekits: http://www.ezlink.com/~astrosys/ $900 Morris Jones (408) 836-4300 mojo@whiteoaks.com

David Morrison to Talk at Foothill College

Andrew Fraknoi

On Wednesday evening, October 11, at 7 p.m., Dr. David Morrison, of NASA's Ames Research Center, will give the first talk in the 2000-2001 Silicon Valley Astronomy Lecture Series, at Foothill College. Admission is free and the public is invited.

Dr. Morrison will discuss asteroids and comets that come close to the Earth and occasionally can hit our planet — sometimes with disastrous consequences. Such an impact probably killed the dinosaurs (and close to half of all living species) 65 million years ago.

Dr. Morrison will discuss the new efforts to catalog all "near-Earth asteroids" and describe national and international discussions about what we can do if we see a large asteroid heading our way.

The lecture will be held at the Foothill College Smithwick Theater in Los Altos Hills. From Interstate 280, exit El Monte Road and travel west to the campus. Visitors much purchase a required campus parking permit for $2. For directions and information, call the series hotline at (650) 949-7888.

The non-technical program is cosponsored by NASA's Ames Research Center, the Astronomical Society of the Pacific, and the SETI Institute. Over 900 people attended several of the lectures in this series last year. Seating will be on a first-come, first-served basis. Children over 13 are most welcome.

Dr. Morrison is Chief of Space Science and Astrobiology at NASA's Ames Research Center and an internationally renowned space scientist, specializing in the small bodies of our solar system. He has served on the scientific teams of several planetary missions, such as the Galileo spacecraft orbiting Jupiter. Dr. Morrison is co-author of several astronomy textbooks, including "Voyages to the Universe," and has also written a number of popular books explaining astronomical ideas for the public. The International Astronomical Union has named Asteroid 2410 Asteroid Morrison to honor his many contributions to science.

SJAA Member Steven Nelson shows the sun in white light using his own scope and in Hydrogen Alpha using the club's solar scope at the SJAA Yosemite Star Party on Saturday Afternoon.

Celestial Calendar
October 2000

Richard Stanton

Lunar Phases:		Date	Rise	Trans	Set
FQ	03:59 PDT	05	13:37	18:35	23:35
FM	01:53 PDT	13	18:15	00:48	06:25
LQ	00:59 PDT	20	00:06	06:25	13:46
NM	00:58 PDT	27	06:42	12:23	17:57

Nearer Planets				R. A.	Dec.
Mercury, 0.79 A.U., Mag. +0.3					
07	09:21	14:28	19:34	14:25.9	-17:35
17	09:11	14:10	19:09	14:49.0	-19:39
27	07:59	13:10	18:22	14:29.1	-16:18
Venus, 1.30 A.U., Mag. -4.4					
07	09:46	14:55	20:03	14:52.4	-16:58
17	10:08	15:04	20:00	15:41.5	-20:37
27	10:29	15:17	20:04	16:32.6	-23:22
Mars, 2.37 A.U., Mag. +1.5					
07	04:32	11:00	17:28	10:58.8	+07:54
17	04:23	10:44	17:05	11:22.0	+05:29
27	04:16	10:28	16:39	11:44.9	+03:03
Jupiter, 4.28 A.U., Mag. -2.8					
07	21:23	04:41	11:55	04:38.8	+21:11
17	20:42	04:00	11:13	04:37.0	+21:07
27	20:04	03:18	10:27	04:33.8	+21:00
Saturn, 8.29 A.U., Mag. +0.5					
07	20:51	03:57	10:59	03:55.2	+18:01
17	20:10	03:16	10:18	03:53.1	+17:53
27	19:33	02:34	09:32	03:50.5	+17:44

SOL Star Type G2V Intelligent Life in System ?

Hours of Darkness						
09:34	07	07:08	12:55	18:42	12:53.5	-05:44
09:57	17	07:18	12:53	18:28	13:30.5	-09:28
10:18	27	07:28	12:52	18:16	14:08.5	-12:59

Astronomical Twilight:

		Begin	End
JD 2,451,825	07	05:42	20:08
835	17	05:51	19:54
845	27	06:00	19:42

Sidereal Time:

Transit Right Ascension at Local Midnight

07 00:00 = 05:29
17 00:00 = 06:08
27 00:00 = 06:48

Darkest Saturday Night: 28 Oct 2000

Sunset	18:14
Twilight End	19:41
Moon Rise	08:44
Dawn Begin	06:01
Hours Dark	10:20

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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
30	7" f/9 Newt/Pipe Mount	Mike Koop

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	9/5/00
6	8" Celestron S/C	Lee Barford	10/7/00
7	12.5" Dobson	Doug Hendricks	10/8/00
10	Star Spectroscope	Denny Woolaghan	10/12/00
11	Orion XT6 Dob	Peter Norvig	11/10/00
12	Orion XT8 Dob	Nick DeMonner	11/27/00
13	Orion XT6 Dob	Ilkka Kallio	11/29/00
15	8" Dobson	Daron Darr	10/20/00
16	Solar Scope	Gary Mitchell	11/20/00
19	6" Newt/P Mount	Kannan Subbiah	9/17/00
24	60mm Refractor	Al Kestler	10/7/00
26	11" Dobson	David Cameron	12/8/00
27	13" Dobson	Jeff Crilly	10/15/00
28	13" Dobson	Dennis Hong	11/27/00
29	C8, Astrophotography	Bruce Horton	9/29/00
31	8" f/8 Dobson	Robert Morgan	9/17/00
32	6" f/7 Dobson	Sandy Mohan	12/8/00

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	Tim Roberts	12/9/00
2	6" f/9 Dob	John Paul De Silva	?
8	14" Dobson	Bob Havner	12/28/00
9	C-11 Compustar	Paul Barton	Indefinite
18	8" Newt/ P Mount	Paul Barton	Storage
21	10" Dobson	Ralph Seguin	Repair
23	6" Newt/P Mount	Raghu Srinivasan	11/12/00

Waiting List

Solar Scope: Jack Kellythorne, 6" Newt/P Mount: Li-Chung Ting, 13" Dobson: Bill Maney

Submit

Members are encouraged to 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 send email to
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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)

Make checks payable to "SJAA"

Bring this form to any SJAA Meeting
or send (along with your check) to

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