

SJAA EPHemeris

VOLUME 5 NUMBER 1 OFFICIAL PUBLICATION OF THE SAN JOSE ASTRONOMICAL ASSOCIATION January 1994



The Eyepiece
by Bob Madden

This month we have Pat Donnelly's Multiple Stars and we'll also devote a section to Ernie Piini and Joe Shrock, who write about their trip to Canberra, Australia to view and record the Mercury transit. This month they will speak on this subject and show their beautiful photographs. Please be sure to attend.

This month is important for getting in your nomination for Board of Director candidate. If you have a friend who is interested in being a member, get her/his consent and tell Jack Zeiders or Jim Van Nuland - or nominate them from the floor. It is important to obtain their consent first. February is the month to vote. Four are to be elected. Bob Madden (me), Jack Petersen (current treasurer), Bob Brauer and Gene Cisneros have agreed to run again, but nominations are still welcome. Bill O'Shaughnessy was elected to the Board to fill Paul Mancuso remaining term.

Remember this month is the start of Observational Astronomy.

I have been talking to Ed Erbeck, of C.E. Optical. Ed has taken up supplying amateur astronomers with 'STUFF' for their hobby. "Crazy" Ed, as he is so well known, has been

Jan 1: No activity. Holiday
Jan 9: Star Party at Fremont Peak. Sset 5:07p, 9% moon, Mnise 5:19p. Also Public star party at Grant Ranch County Park.
Jan 14: Star Party at Hough Park. Sset 5:13p, 11% moon, Mset 8:26p
Jan 15: Observational Astronomy Class at Hough Park 8:00p.
Jan 22: General meeting at the Milpitas Library. Board of Directors meeting at 6:15. Speaker(s) will be Ernie Piini and Joe Shrock talking about the Mercury transit.
Jan 29: No activity. Mn 2d after full.
Feb 5: Star party at H. Coe SP. Sset 5:36, 21% moon rises 3:59 am.
Feb 12: Star party at Fremont Peak. Sset 5:44, 7% moon sets 8:08 pm. ALSO: Public star party at Grant Ranch County Park.
Feb 18: Star Party at Hough Park. Sset 5:52 pm, 54% moon set 1:43 am.
Feb 19: Second session of Observational Astronomy class at Hough Park.
Feb 26: General meeting at the Milpitas Library. Board of Directors meeting at 6:15. Speaker needed.

a member for about four years and is frequently seen at our Hough Park public star parties. Ed is also a builder of dobsonian telescopes, which he sells for profit - he hopes. Ed sells bearing material, bearing kits, tube trim, LED flash lights, illuminated magnifier, Rigel Systems Quickfinder™ and Rigel Systems Align™ for Newtonian alignment. The neatest for last is a Key-ring LED Squeeze on light (battery inc.). This last item sells for \$4.50 to association members. "Crazy" Ed will also give members a 10% discount. Call him at: (408) 364-0944.

Finding Planet Mercury

From Down Under

by Ernie Piini and Joe Shrock

On 6 November 1993, the inferior planet Mercury transited the Sun for the twelfth time this century. It was visible, in its entirety, from India, Southeast Asia, China, Japan, Indonesia, Australia and New Zealand. Mercury's tiny disc measured 10 arc-seconds in diameter, only 1/194th the apparent diameter of the Sun. Mercury's transit was almost a graze, taking about 101 minutes to cross inside a small segment of the Sun's Southwest limb.

In December 1992, we met to discuss the feasibility of observing and photographing this challenging event. We had three major questions to resolve:

1. What equipment do we need to capture the 10 arc-second disc of the planet Mercury?
2. Who will design and build what equipment?
3. Where will we go for the transit?

To answer question no. 1, we researched 1986 and 1987 editions of various astronomy magazines and Fred Espenak's article, "*Transit of Mercury - 6 November 1993*", found in the Observer's Hand Book 1993. Photographs found in Sky and Telescope used telescopes with an Objective of 5-inches or larger. Mr. Espanek recommended magnifications of 50X to 100X to watch this event.

A telescope-eyepiece projection system sounded like the most promising at this time. Ernie had just finished developing a 5-inch (125mm) double folded refractor telescope with

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Mercury

(Continued from page 1)

a 72-inch (1800mm) focal length. Also in Ernie's design plans for another project involving a spectrohelioscope was a simple heliostat not yet under construction. This instrument, which uses a motorized flat mirror to steadily reflect the sunbeam into a telescope, would eliminate the need for a hefty telescope mount and reduce weight.

Joe would work on the projection portion of the system and components required to shield out stray light for increasing image contrast and accommodate both video recording and still photography. Rear projection would simplify access for photographing the screen and would allow more room for multiple cameras.

By using state-of-the-art camcorders we could make timings to within a second of the four contacts during the planet's ingress and egress and also capture the location of the small disc along with any sun spot activity that day.

As a back-up, we could try using our Celestron C-90 telescopes (1000mm focal length) with Ernie using 12mm eyepiece projection (80X) and Joe photographing at prime focus using the new Kodak Luminare-100 super fine grain film.

We studied the prospects of going to Hawaii for an ingress only observation since the sun sets before the transit ends. We gave up this idea since a small 10 arc-second spot on the sun's disc would most likely be swallowed up by the usual atmospheric diffraction phenomenon and turbulence around sunset. Why not travel to Australia where the transit could be seen in its entirety and during their springtime? Also we could once more marvel and photograph those impressive Southern skies. We've both been to Sydney several times before so we decided to visit the capitol city of Canberra and its surroundings.

Construction of the Heliostat was completed in March 1993 and our first integrated test was conducted in April. Ernie also built a motorized eyepiece focuser with remote control

to conveniently sharpen the sun's image since the eyepiece was located well inside the projection box. No solar filter was used with this system and we used an 18mm Kellner eyepiece for magnifying the Sun's image to 18-inches. One pair of the eyepiece's glass elements are glued together, and after many hours of testing we experienced only very slight burn marks on the periphery with no degradation of our results.

Joe made preliminary tests using a projected image of the sun and a model spot (0.10-inch) of proper Sun/Mercury size relationship for determining dimensions and other details of the projection design. He also used a fluorescent plastic ball (with an appropriate sized spot) under UV light to simulate a self-luminous surface to determine working distances and resolution limits of the 8mm camcorder.

A 0.10-inch spot required a sun image diameter of 19.4-inches and placed the screen about 20-inches beyond the eyepiece Ernie had chosen for his optical design. Now, placing the model spot inside the sun's limb gave us a feel for the 194:1 Sun/Mercury ratio we must contend with.

Rear projection techniques produce an undesirable bright area in the center of the screen. A copper disc of around 3/8-inch diameter was suspended into the optical path about 4-inches in front of the eyepiece to help diffuse a good part of this brightness and provide a smother contrast range across the screen. The disc also reduced some of the heat being absorbed by the eyepiece.

Packing all this equipment for our trip to Australia was simplified by using space in both the wooden telescope box and it's shipping crate. The five telescope baffles and two internal mirrors were disassembled along with the heliostat hardware and electronics. All components were well protected with bubble packing material and fitted inside the two boxes. Joe conveniently broke down the projection box and screen and packed them into his suitcase.

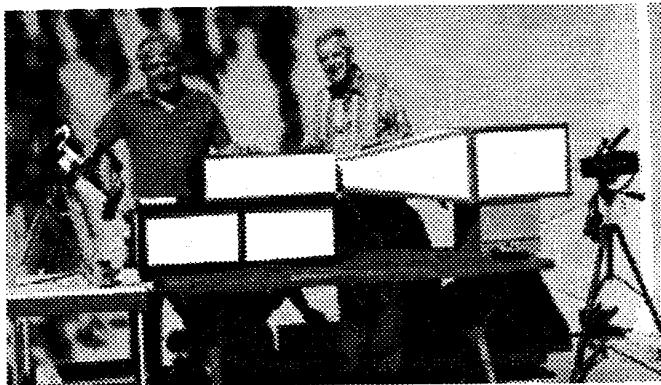
We departed for the land down-under on Halloween night, 31 October 1993. Arriving in Sydney after a tiring 14-hour flight and 31 hours without sleep, we rented a station wagon for our drive south to the capitol city of Canberra. Of course, we had to face the agony of learning how to drive on the wrong [left] side of the road. It wasn't easy and within 20-minutes we managed to get into a two-car accident. Luckily no one was hurt, but the side doors on both cars were creamed shut. It took another four hours to get our police reports filed and go back to the airport for another car exchange.

In Canberra, the selected city, we stayed at the luxurious Lakeside Hotel for two nights. We visited Australia's impressive War Memorial, something akin to our Arlington Cemetery. Driving up the wide Anzac Parade street towards the memorial we saw the huge bronze monuments, appropriately spaced on each side, depicting Australia's contribution to past wars. Inside the memorial we saw the large reflection pool with an eternal flame burning. On both sides are tall walls with engraved names of over 100,000 war dead. Inside are many rooms with all sorts of war memorabilia: each room dedicated to a particular war.

That afternoon we drove to Mt. Stromlo, about a 20-minute drive from Canberra center, and visited the observatory the famous Dr. Bok once supervised. We both knew Dr. Bok; Ernie, from his trip to the Siberian Solar Eclipse in 1981, and Joe met him during the 1983 Java Eclipse. At the observatory we met Bill Roberts, a Research Assistant, who showed us the 50-inch telescope currently involved with the MACHO project. We also took time to see their small visitor's center and the large 74-inch reflector telescope behind glass.

Mr. Roberts also gave us hints as to where best to set up for the transit and optimum night sky observing sites. We needed a place where we could bring some tables together and have them oriented in a

(Continued on page 3)



The telescope with eyepiece projection system developed by Ernie Piini (left) and Joe Shrock (right) as setup in October 1993 before departure for Australia. The system consists of: Ernie's simple Heliostat (far left), Ernie's 5-inch double-folded refractor telescope (72-inch focal length) set on top of the shipping crate, Joe's projection unit with screen, and the tripod with two camcorders (far right).

Mercury

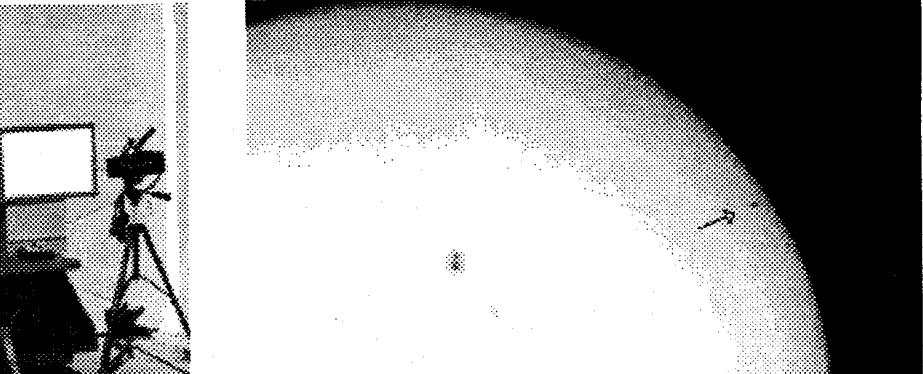
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North-South direction. We needed about eight feet of table length to accommodate the heliostat, telescope and projection system. The tripod with two camcorders would be located just aft of the projection unit with a straight-in shot of the solar image on the screen.

One of the possible sites was at the Cotter Reserve Hotel. This was formerly a resort but is now a restaurant and bar with no bedroom accommodations. The management, and especially Pam Fealy, were more than happy to accommodate us with tables and a spacious outside area with lawn and a space clear of trees.

In the meantime, we found cabin accommodations at the nearby Greenhills Conference Center, a youth center of the Uniting Church. We had very good sleeping, cooking and bathroom facilities. The outdoors were filled with wildlife including kangaroos, kurawangs, colorful rosellias, nosy cokatoos, and lots of cottontail rabbits.

We found an excellent night sky observing site just a few hundred feet from our cabin. We had two clear nights for astro-photography. Interesting was to see the False Cross, Scorpio, the "Teapot", and parts of the



The planet Mercury nears the midpoint of its 6 November 1993 transit near the south west limb of the sun. (time is approximately 3:45 UT). Photo taken with a Celestron C-90, 12mm Orthoscopic eyepiece projection (80X), through a thousand Oaks ND-4 Photographic Solar Filter, using Kodacolor-200 film with 1/250 second exposure. Site: The Greenhills Conference Center approximately 20 kilometers west of Canberra's city center.

Southern Cross on their backs. Well placed in the sky were the two Magellanic Clouds and the second brightest star in the sky, Canopus. Canopus was later joined by Sirius, the brightest. The real treat came around 11 p.m. when Orion began to rise majestically, but feet first, above the faint glow of Canberra's lights.

On 5 November, the day before the transit, we set up our equipment at the hotel. Getting the tables to our liking was a little tight. The clouds played havoc on us all afternoon allowing only a few seconds now and then to attempt to adjust our electronics for proper tracking in both RA and declination. A simple heliostat requires some tracking in declination and Ernie designed a stepper motor circuit with a special control box to correct this problem. As we were leaving the hotel, we realized that the clouds surrounded the nearby mountains but was totally clear just a few kilometers away. We couldn't chance something like this. In checking further with people East of this location we learned that they had clear skies for most of the afternoon. This prompted us to look for a site away from this mountain cloud trap.

On transit day, 6 November, we decided to set up on the grounds near the cabin. Joe found a volleyball

court that we could set two bar-be-cue tables for our equipment. There was plenty of clearing from trees and a clear shot at the sun all afternoon. The sky was unbelievably clear and the wind was calm - that is until about one-half hour before the start of Mercury's transit. The winds picked up to a point where it violently shook the heliostat mirror rendering the camcorder recordings almost useless. Joe had installed a light shield over the projection unit and camcorder placements but the wind was flopping it dangerously against the top of the projection box and our heads. We did spot ingress and transiting during short periods of wind quieting. Both of us occasionally ran to our C-90s, which were tracking the sun on our Takahashi Sky Patrol mounts, to make exposures. We both obtained excellent results from our back-up telescopes.

In our spare time we drove out to Tidbinbilla twice to visit the Canberra Deep Space Tracking Station. It, along with the tracking stations at Goldstone, California and near Madrid, Spain were used during the Voyager and other space programs to communicate with distant probes. A mammoth 70-meter tracking dish along with several other smaller radio telescopes

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Mercury

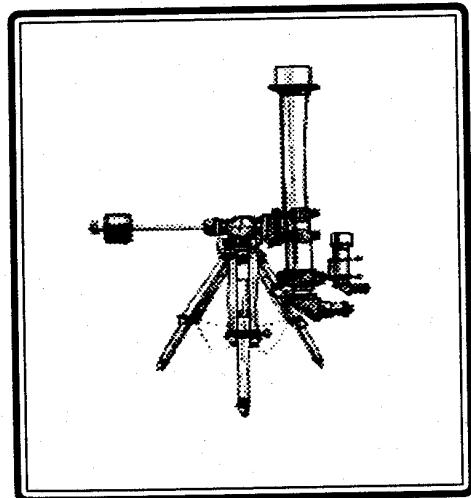
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are worthwhile seeing in this picturesque valley with sheep herds, interesting rock formations and poplar trees. A well equipped museum with loads of NASA space photos, Apollo lunar excursion paraphernalia and two theaters can take up a good part of an afternoon if one has the time to study each display.

We also visited the Royal Australian Mint in Canberra learning how to make money from metal blanks. We struck our own one-dollar coin costing us two dollars each for the simple push of a button (this is not the way to make money).

A Panoramic view of Canberra is possible from the 195-meter tall Telecom Tower. We got to see points of interest from the many segmented viewing windows aided by well labeled poster size photos located just above each window.

On November 9, we woke early to make our drive through Canberra, and North towards Sydney. We stopped briefly in historic Berrima and photographed an old catholic church, graveyard, and some of the old buildings that make up this town.

We dreaded our final drive into Sydney and to the airport. It was almost as bad as when we tried to drive out just a week before. Driving on the "wrong side" of the road is for the birds and mad Englishmen.
[All photo by the authors - the Editor appologizes for the quality of printing]



Double, Triple, and Multiple stars

by Patrick M. Donnelly

One of the constellations often overlooked for double and multiple stars is Andromeda. I find this strange because one of the premier multiple star systems, Gamma Andromedae (another member of the Gamma Gang), is located in this constellation. Also, with the Andromedae Galaxy near by, it would seem to be natural to hunt for other objects in the constellation. I have observed in this constellation, and here are some double stars for your telescope.

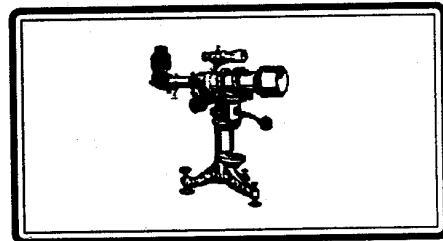
Probably the most interesting object is Gamma Andromedae. Gamma is a visible triple system about 269 light years away from the earth. If you examine Gamma under low power it appears as a nice yellow-purple pair separated by about 10". This view alone makes Gamma one of the best doubles on the sky. However, under very good sky conditions and high power the secondary can be split into a green and blue components separated by about 0.5". I have seen this star split only once by the 30-inch Challenger telescope at Fremont Peak. The blue green pair has a period of approximately 61 years. I would suggest trying to resolve this star soon as the separation will decrease to under 0.4" in the next ten (10) years and become all but invisible. The magnitudes of the secondary are 5.5 and 6.3. In addition to this, the brighter of the secondary components is a spectroscopic double. Hence, the entire system is a quadruple star system. I believe the secondary can be resolved using a 12-inch or larger telescope and 300 power or higher. Also, you need exceptionally steady skies, but the wait is worth it with a yellow primary and the blue secondaries. It is a most enjoyable sight.

Besides Gamma there are other multiple stars in Andromeda. One of my favorite is Pi-Andromedae. Pi is also a triple star, but one of the companions is only an optical member. Pi consists of a 4.43 magnitude

primary and a magnitude 9 companion at 36.1" from the primary. There is also an 11.5 magnitude companion at 55.5". I personally believe this companion is dimmer than 11.5, because it is very difficult to find in my 8-inch telescope even under dark skies. The colors all appear white to me. Next to Pi Andromedae is μ -Andromedae. Mu is also a visual triple star with very dim companions at 34.2" and 42.2". Their magnitudes are 11 and 13, and they are both optical companions. Surprisingly, I find these companions easier to find in the 8-inch telescope than for Pi. Also, near Pi is Delta-Andromedae. Delta is a true binary system about 160 light years away. It has a magnitude 12 companion about 29" away from the primary. I found the companion fairly easy to find; so I question the magnitude estimate for this system, but the stars have a common proper motion, and the spectroscopic parallaxes are about the same.

Finally near Gamma Andromedae are three (3) other interesting objects. The first is NGC 752. NGC 752 is an open star cluster and has several close but dim doubles and triples within its boundary. Its distance is about 1300 light years and can best be seen in binoculars. Also in the same field of the binoculars is 56-Andromedae. The components are magnitudes 6.0 and 6.7 and easily seen. The primary also has a true companion of magnitude 11.5 about 18.4" away. This makes the star a triple and a fine sight at high power. Nearby is 50-Andromedae, which consists of magnitude 6.5 and 7.0 components separated by an easy 17". The stars form a nice yellow-blue pair if you like color.

Andromedae should be overhead about this time of the year and in good position to observe.



Creeping wimpism, and frustration

Jack Zeiders, Pres.

Hello again, from the virus factory. Last week I had a meeting with a new client, he was in the throws of a nose bug attack, coughing and sneezing, but the meeting went on. I got the contract.

To calibrate I went over to Orion just to look around and see what's new. Norm Wild, a long time SJAA member was there along with another fellow who's name escapes me at the moment. I will no doubt remember it after this has been printed. Norm was talking about how much he likes his new 12" Dobson.

I remember when his 10" f/5.6 was a big scope in the SJAA. I also remember he called it his "cluster buster" due to its ability to blow apart globulars. As I was looking about, the conversation drifted here and there and I ended up buying a 35mm Panoptic eyepiece. I'm gonna have to stay away from that place.

Any way I have not had a chance to try it out yet what with the clouds and cold weather. Grumble, complain, harrumph! Now it looks like we have a clear weekend I've got a nose bug and can't go out, oh well. While I was at Orion the fellow that purchased Paul Bartons 18" was talking about winter cold weather observing. I guess that is where creeping wimpism is rearing its ugly head. I don't feel the siren call of the freeze party at the peak as I once did. I have memories of observing from Pine Ridge at 5 degrees, a Messier Marathon at Loma Prieta when we had to defrost Bob Fingerhuts C-8 with my propane heater about every two hours. Then there was the time when I went down to Death Valley between Christmas and New Years day to do some astrophotography, we got blown out of there by a sandstrom in the middle of the night.

Yes, I'll take the 60 degree summer evenings with the glorious Milkey way splitting the sky.

Whatz going on in the club? I know that Paul Barton has completed

the rebuiled of the club's 14" telescope and it is much more usable. He is thinking of putting the 12.5" Dobson on a serious weight reduction plan so someone other than a linebacker can move it. Bob Madden and Jim Van Nuland have been on a major campaign to relocate the general meetings to the South Bay. If you have any thoughts of where you want the meetings held, contact any board member and share your opinions.

SCOPE Version 3.5 IBM Astronomical Application

Received a call from Steve Waldee the other day about some software he was donating to the Association and wished the proceeds to go into the Telescope Loaner fund. Steve gave us about 15 copies of his Scope program which runs on an IBM compatible computer running under DOS 2.0 or later. The application does not require a graphics card or math coprocessor. There are over 30 pages of help files - instructions - definitions!

This application will take all the guesswork out of finding powers of magnification, exit pupil, estimated relative fields, limiting magnitude of faintest stars, and the correct conditions for viewing your favorite celestial objects! The easy automated functions provide almost INSTANT calculations for getting the power desired, viewing double stars, and finding the proper use of contrast-enhancing LUMICON filters. There is a complete BUILT-IN database of 115 standard types of eyepieces where you can find an eyepiece, or define your own!

Plan observing sessions with SCOPE's valuable suggestions for viewing based on magnification ranges for types of objects. Prints charts of your eyepiece performance.

We wish to thank Steve for his generous offer.

Internet article re: Eyepiece Magnification

In article

<1993Nov30.130910.85070@ucl.ac.uk>, zcapk43@ucl.ac.uk (Peter Newman) wrote:

> The question is: is the intensity of
> radiation falling on your eye more or
> less? This depends not just on the
> diameter of the objectives, but also
> the magnification. E.g. a 50mm lens
> is about 7 times the size of your
> eye's pupil, so you get more light.
> But, a 7 times magnification spreads
> this out again, so you end up even.

Correct, this far.

> Hence a 7 x 70mm will give you
> brighter-than-naked-eye,

Wrong. A 7x70 will give you an exit pupil of 10 mm, but your eye can only use a 7 mm circle of this exit pupil, so you will lose exactly the amount of light that your objective gains over a 50 mm (a factor of two, in this case).

> while a 10 x 40mm will give you
> dimmer.

This is correct again. What we learn from this is, that we cannot, by no means, get a higher surface brightness than is perceived with the naked eye.

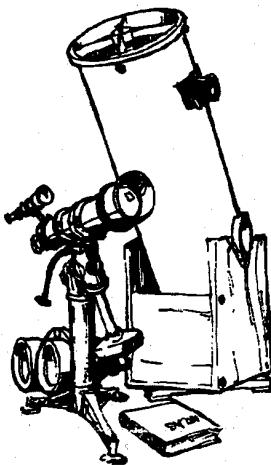
(What about pointlike sources, like stars? They become brighter, if we increase the telescope aperture, while keeping the exit pupil smaller than the eye pupil, which is the case if the magnification is at least 1/7 of the aperture in mm; their brightness remains constant, if we increase magnification, unless the diffraction limit of the scope is reached; the reason for this is that all the light of the star falls onto one cell in our eye, so that the term 'surface brightness' is meaningless).

Dieter Kreuer
dieter@informatik.rwth-aachen.de

1994 SJAA Calendar

General Meeting	Houge Park Star Party	Observational Astronomy Class
Jan 22	14	15
Feb 26	18	19
Mar 26	18	19
Apr 23	15	16
May May be the 14?	17	21
June 25	17	18
July 23	15	16

Please read your *Ephemeris* each month for changes



Telescope Loaner Status

by Paul Barton

	Name	User	Due Date
4-1/2"	Newt/P mount		available
6"	Dobson	Ken St. George	2/5/94
4"	Quantum	Chung-Lin Lee	1/6/94
60mm	Cometron Ref.	Jim Marquis, Jr.	1/26/94
C-8	Celestron	John Schoenenberger	1/19/94
12-1/2"	Dobson		available
14"	Dobson	Lee Courtney	1/5/94
C-11	Celestron	Paul Barton	*****
6"	Newt/P mount	Craig Mohrman	11/28/93
8"	Dobson	Jim Marquis	1/26/94
8"	Newt/P Mount	John DaSilva	12/9/93
6"	Newt/P Mount	Jim Ricks	12/26/93
4-1/2"	Dobson	Tom Rice	Special Loan

Solar telescope. Available only to experienced members for special occasions such as day time public star parties, etc. Call.

(on waiting list)

Get on the the waiting list - please call . Thanks - Paul

If you want to borrow a telescope call Paul Barton (number is on the credit Marquee) and get your name on a general list (any telescope) or on a specific telescope list.

ASTRO ADS

ASTRO ADS are free to all noncommercial advertisers wishing to sell astronomically related products or services. Please send your ad directly to the Editor: Bob Madden

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San Jose, Ca. 95118-2825

NO LATER THAN THE 12th OF EACH MONTH! Your Astro Ad will run approximately 3-months.

Celestron C-11 many accessories \$1750. Mike Ryan (408) 241-4508

11/93

6" Rich-field telescope - Coulter optics, rack and pinnion focusing w/eyepiece - \$80. **Edmund Sci** med to heavy duty GEM - short wooden legs for reflector - \$75. **Edmund Sci** light duty GEM - long legs for refractor - \$50. **Edmond Sci** w/ aluminum setting circles - \$75. **Pantax ME Super** 35 mm SLR camera - 50mm f/2.0 lense - through the lense metering - perfect astro-camera. MINT! \$150. Call Ben Blake (408) 3795276 Leave message if answering machine. 11/93

C-6 Tube Assy - \$200, **German Equatorial pier Mount** - heavy duty - \$500. **14-inch Mirror** - Cassegrain, hole in center, chip on edge - best offer. Call Ted Blanchard (408) 2655683 12/93

Roll-off Roof Observatory - 6-1/2 X 6-1/2 X 6-1/2 feet semi-moveable, new condition, worth \$2000 - sell for \$700 or make offer. **Deep Sky Nebula Filter** - 1-1/4-inch size, brand new - \$40. **Olympus OM-1** w/Tokina Zoom 28-85mm lense - good condition, \$160 or make offer.

Wanted 4-inch(100mm) Binoculars. Call Edward Hyeler (209) 931-0486 6:30 to 9:30pm or leave message. 1/94

Sky and Telescope 1954 to 1982 (missing 14 issues) and **Aug 1984 to Dec 1992**. \$300 takes all. Quality eyepieces may be considered in trade. Call John Brookman (408) 374-0594 (before 7pm) 1/94

Celestron Ultima 8 w/hand control. Mint condition. Great Gift. \$1750. call Patrice (408) 736-2153.

CELESTIAL CALENDAR

January 1994

LunarPhases	Date	Rise	Trans	Set
LQ 16:01hr	04-1	-----	0536	1122
NM 15:11hr	11-1	0655	1207	1722
FQ 12:27hr	19-1	1112	1808	0014
FM 13:24hr	27-1	1806	0004	0702

Nearer Planets

Mercury	07-1	0740	1226	1711
1.33 AU	17-1	0800	1257	1756
Mag -1.8	27-1	0807	1324	1842

Venus	07-1	0717	1205	1653
1.71 AU	17-1	0725	1219	1714
Mag -3.9	27-1	0729	1232	1736

Mars	07-1	0715	1201	1648
2.39 AU	17-1	0705	1155	1645
Mag +1.1	27-1	0654	1149	1644

Jupiter	07-1	0215	0734	1254
5.60 AU	17-1	0142	0700	1218
Mag -2.0	27-1	0108	0625	1142

Saturn	07-1	0940	1500	2021
10.6 AU	17-1	0903	1425	1947
Mag +1.2	27-1	0827	1350	1913

SOL	Star Type G2	V Mag -	26.72
RA	DEC		
19:12	-22:23	07-1	0721 1214 1707
19:58	-20:39	17-1	0719 1213 1717
20:40	-18:21	27-1	0714 1220 1728

Astronomical Twilight	Dawn	Dusk
JD 2,449,359.5	07-1	0550 - 1839
,369.5	17-1	0549 - 1847
,379.5	27-1	0545 - 1857

Sidereal Time

Transit Right	07-1	0000 PDT=0659
Ascention at	17-1	0000 PDT=0738
Local Midnight	27-1	0000 PDT=0818

Darkest Saturday Night Jan 8

Sunset	1708
Twilight End	1840
Moon Set	1419
Moon rise next morning	0512

TIMES AND DATES ARE PACIFIC DAYLIGHT

Times are Local Civil

Planet distance and Magnitude calculated for the 17th of the month
Derivation of these values are from *Astronomy with Your Personal Computer*

by Peter Duffet-Smith
MacEphem
by Elwood Charles Downey

by Elwood Charles Downey

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COMET COMMENTS

by Don Machholtz

Four comets remain visible in our skies, while one was recovered.

comet Mueller (1993s): Jean Mueller discovered this comet on Nov. 20 during the course of the Second Palomar Survey. An early orbit indicates it may brighten to magnitude 14 in more than a year. It has a distant (2.3 AU) perihelion distance.

EPHEMERIDES

DATE (00UT)	R.A. (2000)	DEC.	ELONG	SKY	MAG
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COMET MUELLER (1993a)

12-24	21h12.8m	+27°04'	67°	E	9.0
12-29	21h19.5m	+24°13'	63°	E	9.1
01-03	21h25.9m	+21°40'	58°	E	9.2
01-08	21h32.0m	+19°23'	53°	E	9.2
01-13	21h37.9m	+17°19'	49°	E	9.3
01-18	21h43.7m	+15°29'	44°	E	9.4
01-23	21h49.2m	+13°49'	40°	E	9.4
01-28	21h54.6m	+12°19'	36°	E	9.5
02-02	21h59.8m	+10°57'	31°	E	9.6
02-07	22h04.9m	+09°42'	27°	E	9.7

COMET MUELLER (1993p)

12-24	22h52.8m	-02°50'	71°	E	10.4
12-29	22h54.7m	-05°00'	66°	E	10.2
01-03	22h57.1m	-07°02'	60°	E	10.1
01-08	23h00.1m	-08°55'	55°	E	10.0
01-13	23h03.5m	-10°42'	50°	E	9.9
01-18	23h07.4m	-12°24'	46°	E	9.7
01-23	23h11.7m	-14°01'	41°	E	9.6
01-28	23h16.3m	-15°36'	37°	E	9.4
02-02	23h21.4m	-17°09'	33°	E	9.2
02-07	23h26.8m	-18°42'	30°	E	9.0

PERIODIC COMET ENCKE

12-24	22h29.6m	+04°08'	69°	E	9.9
12-29	22h29.5m	+03°40'	64°	E	9.6
01-03	22h29.4m	+03°12'	59°	E	9.3
01-08	22h29.0m	+02°38'	53°	E	8.9
01-13	22h27.5m	+01°54'	48°	E	8.4
01-18	22h24.1m	+00°46'	41°	E	7.8
01-23	22h16.8m	-01°04'	34°	E	7.2
01-28	22h02.9m	-04°08'	25°	E	6.4

PERIODIC COMET SCHWASSMANN-WACHMANN 2

12-24	08h43.0m	+16°35'	144°	M	11.2
12-29	08h42.4m	+16°48'	149°	M	11.1
01-03	08h41.1m	+17°05'	154°	M	11.1
01-08	08h39.1m	+17°26'	160°	M	11.0
01-13	08h36.5m	+17°49'	166°	M	11.0
01-18	08h33.5m	+18°15'	172°	M	11.0
01-23	08h30.2m	+18°42'	178°	M	10.9
01-28	08h26.8m	+19°09'	177°	E	10.9
02-02	08h23.5m	+19°35'	171°	E	11.0
02-07	08h20.5m	+20°00'	165°	E	11.0

EPHEMERIS is published monthly by the San Jose Astronomical Association - 3509 Calico Ave., San Jose California 95124. Members are encouraged to submit articles for publication. These should be typed and submitted no later than the 12th of the previous month. All submissions should be sent to the editor, Bob Madden, 1616 Inglis Lane, San Jose, California 95118. A text file on a 3-1/2" IBM or MAC diskette is preferred, but written is accepted.

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