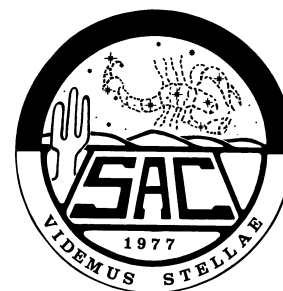


Saguaro Astronomy Club

Metro Phoenix, Arizona

SACNEWS



October 1994 — Issue #213

v9.21

“Choosing Eyepieces” Revisited

by Rick Blakley

Paul Dickson has asked me to look at Mr. Dyer's article and offer comment so as to better advise the committed amateur. While part of this review will cover myths and misconceptions, I am not intending to make a criticism of Mr. Dyer's text, and I must say in his defense that he has not claimed expert on the subject. His knowledge comes from his active participation as an amateur with amateurs, and I thank Mr. Dyer for his efforts.

I have asked Paul to number the paragraphs of Mr. Dyer's article so that direct reference can be made. Presuming that the reader has scanned “Choosing Eyepieces”, let us begin.

Ref. Par. (2). Actually, both the objective, the “main” lens or mirror, and the eyepiece magnifies. Magnification for any optical focusing element is a function of the distance of the object from the element and the element's focal length. The objective of a telescope, the eyepiece, and the eye, all are optical focusing elements. Of course, only the eye has a detector array, the retina, which presents the brain with the image information that the brain requires to build a model of the space observed. The size of the image produced by the telescope objective is larger than that made by the eye's lens. But the eye can accommodate only relatively narrow object angles (thus, the average person of thirty years +/- can read comfortably at a minimum distance of about ten inches), and one sees only a blur when looking directly at the magnified image provided by the telescope objective. (Some of the early, incredibly long, simple refractors of the time of Christian Huygens produced magnified images that could be clearly viewed without eyepieces!) The most critical effect the eyepiece accomplishes for the observer is to alter the highly angular cone of rays produced by the objective to become a series of nearly parallel rays that the eye can comfortably receive. This *cannot* be done without modifying the image, but the best eyepieces do the least harm.

Ref. Par. (3). “Many observers who have had long

Quick Calendar

SAC Star Party

Buckeye Hills Recreation Area
Saturday, October 1

All-Arizona Star Party

New Arizona City Site
Friday & Saturday, October 7 & 8

Public Star Party — Thunderbird Park

59th Avenue, 1 Mile North of Beardsley
Saturday, October 8

SAC Meeting

Speaker: Dr. Jeff Hester
7:30, Friday, October 21

SAC Star Party

Buckeye Hills Recreation Area
Saturday, October 29

Officer Nominations Open

experience of planetary work... have been of the opinion that, with amateur instruments generally, from x200 to x400 is the best planetary magnification range, more or less irrespective of aperture”, J.B. Sidgwick, page 102 of his *Observational Astronomy for Amateurs*. Also, on page 100, “...for regular planetary work in this country [Britain] less than 5 inches provides insufficient resolving power.” I concur with this statement which fairly describes my own experience.

Ref. Par. (7). For planets, 30 to 40 power per inch of aperture is appropriate. These figures result from con-

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sidering 1/30" as the minimum exit pupil diameter, the diameter at which interference effects just begin to become significant. Closely spaced multiple stars may take as much as 60 power per inch, since interference effects take less of a toll on bright, high contrast objects.

Ref. Par. (8). All of the eyepieces named perform well when used with telescopes having the appropriate speeds. The Huygens (pronounced "Hoygins", with a hard "g") and the Huygens-Mittenzwey are the *only* old types that will *not* show "fringes of color" (read "lateral color") when properly executed. In fact, their correction in this regard is better than that of the Nagler! The Huygens works well on systems as fast as F/12. Ramsdens work well to about F/9. These designs can be used effectively on fast telescopes with good Barlows. They possess apparent fields of about 35 to 45 degrees. Many professional observatories still make use of their old, classic Huygens eyepieces, and I am hoping to construct a good Mittenzwey eyepiece some day (this design can produce a well-corrected apparent field of up to 50 degrees in angular extent). Unfortunately, most cheap telescope manufacturers simply assemble eyepieces out of any convenient lens set on hand and name them with no regard as to design. This is the primary reason these eyepiece types have bad names.

Ref. Par. (11). "Orthoscopic" refers to the fact that the distortion aberration in the field is well corrected. The lines of brick walls in the field are rendered straight and square, rather than scalloped like the sides of a pin cushion or bowed like the walls of a barrel. The term means nothing in regards to general, overall correction. The Abbe "Orthoscopic" *is* an excellent eyepiece when well executed. But, like the Huygens, Mittenzweys, and Ramsdens, some poorly manufactured examples exist. Sophistication in "design" is *no* guarantee that the eyepiece

fabrication is well executed.

Ref. Par.s (13) & (14). One may consider the "modified Plössls" as pseudo Erfles that have accepted slightly less apparent field coverage for better overall performance. The middle "fifth" lens acts as a collecting lens for the eyelens which allows the field lens to transmit rays of greater angular extent that otherwise would have been lost. This is precisely Erfle's contribution in the design of the eyepiece that carries his name. The "Barlow" that is added to the front of the Vixen eyepiece mentioned, and to the Nagler and Pretoria as well, is actually called a "Smyth" lens. Barlows are not designed to participate in the correction of the aberrations of the eyepieces they are intended for use with. Smyth lenses, by definition and practice, are.

Ref. Par. (17). An eyepiece with an apparent field of 80 degrees will show you more of the sky, but you have to look around to see it. The healthy eye can accept a field of about 48 degrees in extent, and this figure was, until the advent of the Nagler and the unguided Dobsonian, considered about the ideal for the observer. Every extra degree of apparent field above about 40 degrees that one tries to design into an eyepiece requires extra measures, generally, to gain the excellent performance expected. Thus, lenses, stops, coatings, and other extras are added to make the gain.

However, modern amateurs forget that moderate field eyepieces of considerably less expense can be used very effectively on unguided telescopes, and simple eyepieces with small fields can show one something at high power if the telescope is guided. The very best view of Jupiter I have ever had was with an "antique" Tolles solid eyepiece, probably made in the late nineteenth century, with an apparent field of about 12°, used on a 6" Clark refractor. No Nagler can come close to providing the detail that was

SAC and SAC Meetings

Saguaro Astronomy Club (SAC) was formed in 1977 to promote fellowship and the exchange of scientific information among its members — amateur astronomers. SAC meets monthly for both general meetings and star parties, and regularly conducts and supports public programs on astronomy.

SAC meetings are usually held on the Friday nearest the full moon. This means that over the course of the year, meetings are not held on same week of the month. The same is true of the club's star parties. Star parties at Buckeye Hills are mostly held on the Saturday of the third quarter moon.

1994 SAC Meetings

Jul. 22
 Aug. 19
 Sep. 16
 Oct. 21
 Nov. 18
 Dec. 17 Party
 — 1995 —
 Jan. 13
 Feb. 10
 Mar. 17
 Apr. 14
 May 12
 Jun. 9

1994 SAC Star Parties

Date	Sunset	Moonrise
Jul. 2	7:42pm	1:27am
Aug. 6	7:24pm	6:09am
Sep. 3	6:51pm	4:56am
Oct. 1	6:14pm	3:40am
Oct. 29	5:40pm	2:24am
Nov. 26	5:22pm	1:12am
— 1995 —		
Jan. 28	5:56pm	5:15am
Feb. 25	6:22pm	4:00am
Mar. 25	6:41pm	2:50am
Apr. 22	7:05pm	1:30am
May 20	7:26pm	12:10am
Jun. 24	7:42pm	3:00am

seen that evening.

Ref. Par. (19). I have heard a very bad report on the manufacturing quality of the Orion MegaVista. My experience some years ago with Orion's brand name Kellner has convinced me not to purchase other eyepieces from them that carry their name. Again, quality of manufacture was the issue.

Ref. Par. (21). All eyepieces, including the Naglers, show degradation in the quality of their images away from field center when working with instruments as fast as F/4. Most amateurs feel that as long as they don't "see" the smears of unwanted aberrations they need not be concerned with them. However, even undetected aberrations rob light from the image so that faint stars are progressively dimmed and finally "eliminated" as one peers fur-

ther out toward the field edge. Practicality of transport usually drives the F/no. of the instrument an amateur will have, but as the F/no. diminishes one should understand that he will have increasing difficulty with eyepieces. F/no.s falling in the F/4 to F/6 range will place the greatest demands on eyepieces, forcing most observers to either rely heavily on Barlows or paying large sums for the very expensive designs that better manage these F/no.s.

Ref. Par. (24). Indeed, with all of the elements some modern eyepiece have, multicoatings is desirable. Sometimes, though, one can still notice a "light deficit" when comparing a design with a lot of elements that is multicoated with a simple design that has few elements. I have a beautiful Hastings triplet that has three cemented lenses with magnesium fluoride coatings on the

Comet Comments

by Don Machholz

(916) 346-8963 CC194.TXT September 7, 1994

One new comet has been discovered and a returning comet recovered. Meanwhile, Comet Nakamura-Nishimura-Machholz (1994m) fades in the evening southern sky.

I am presently looking for a computer bulletin board to carry this column each month. It should be easily accessible to anyone wanting to download it for use in their newsletters, or for their personal use. The board that I had been using is no longer available.

Periodic Comet Machholz 2 (1994o): I discovered this comet on the morning of Aug. 13, using my 10-inch reflector at 36x. At that time the comet was in the morning northern sky, a few degrees north of the open cluster NGC 1502. It was moving quickly, 2.5 degrees per day, and the appearance seemed to be changing as I was watching it. This find occurred 46 search hours and 21 sessions after my previous comet discovery five weeks before.

The orbit is rather unusual, the period is 5.44 years and the perihelion is at 0.75 AU on Sept. 13. About ten

days after discovery the comet outburst, and the brightness changed from magnitude 10 to magnitude 7. Finally, over the past week four companions—faint comets—have been found traveling with the main comet. They are magnitudes 11–15 and located in the north-east quadrant in respect to the comet. All parts are within 0.8 degree of the comet.

My article concerning Periodic Comet de Vico is still available. To receive it, send me \$2.00 in postage stamps and/or money for the complete 15-page report. Reach me at P.O. Box 1716, Colfax, CA. 95713.

Periodic Comet Machholz 2 (1994o)					
Date	RA-2000-Dec	Elong	Sky	Mag	
09-20	08h52.1m	+24°37'	49°	M	7.5
09-25	09h06.4m	+20°55'	49°	M	7.7
09-30	09h20.0m	+17°32'	50°	M	8.0
10-05	09h32.9m	+14°26'	51°	M	8.3
10-10	09h45.1m	+11°34'	52°	M	8.6
10-15	09h56.6m	+08°55'	53°	M	8.9
10-20	10h07.4m	+06°28'	55°	M	9.3
10-25	10h17.5m	+04°11'	57°	M	9.6
10-30	10h26.9m	+02°03'	59°	M	9.9
11-04	10h35.5m	+00°03'	61°	M	10.2
11-09	10h43.3m	+01°49'	64°	M	10.4
11-14	10h50.4m	+03°34'	67°	M	10.7

Periodic Comet Borrelly (1994l)					
Date	RA-2000-Dec	Elong	Sky	Mag	
09-20	05h51.2m	-02°13'	89°	M	9.0
09-25	06h04.1m	-00°51'	91°	M	8.9
09-30	06h16.9m	+00°39'	92°	M	8.7
10-05	06h29.8m	+02°18'	93°	M	8.5
10-10	06h42.7m	+04°07'	95°	M	8.4
10-15	06h55.7m	+06°08'	97°	M	8.2
10-20	07h08.7m	+08°22'	99°	M	8.1
10-25	07h21.7m	+10°50'	101°	M	8.0
10-30	07h34.8m	+13°33'	103°	M	7.9
11-04	07h47.9m	+16°32'	106°	M	7.8
11-09	08h00.9m	+19°47'	108°	M	7.7
11-14	08h13.9m	+23°17'	111°	M	7.7

Nakamura-Nishimura-Machholz (1994m)					
Date	RA-2000-Dec	Elong	Sky	Mag	
09-20	21h10.6m	-30°23'	133°	E	9.2
09-25	21h03.0m	-35°16'	124°	E	9.7
09-30	20h58.1m	-38°41'	117°	E	10.1
10-05	20h55.2m	-41°09'	111°	E	10.6
10-10	20h54.2m	-42°57'	106°	E	11.0
10-15	20h54.5m	-44°17'	101°	E	11.3
08-21	20h56.1m	-45°17'	96°	E	11.7
08-26	20h58.5m	-46°01'	92°	E	12.0
08-31	21h01.8m	-46°36'	88°	E	12.3
09-05	21h05.8m	-47°01'	84°	E	12.6
09-10	21h10.4m	-47°19'	80°	E	12.8
09-15	21h15.5m	-47°32'	77°	E	13.1

air-exposed surfaces that offers brighter images than any Nagler of the same focal length. As to “reading” the color of coatings, allow me to relate an unfortunate story. Some years ago, a manufacturer of binoculars found that their sales volume for one of their products increased after they had mistakenly undercoated the lenses for that model’s run. Apparently the public thought the new coating color they were seeing indicated a new coating technology of greater optical efficiency! If you wish to check the effectiveness of the coatings on an eyepiece you desire, observe the moon or Venus through one you have borrowed. Forget the old coating color rules! Something else to remember; it’s not always necessary to coat *every* element in an eyepiece assembly to keep the reflections down.

Ref. Par.s (30) thru (33). Generally, amateurs do not realize that the barrel sizes of eyepieces limit the size of the maximum apparent fields that they contain. Thus, the 40mm and 25mm focal length eyepieces in 0.965” barrels are limited to about 28° and 45° respectively, and the 40mm, 35mm, and 28mm focal length eyepieces in the 1.25” barrel sizes are limited at around 36°, 42°, and 52° respectively. Barrels having expanded diameters like the Nagler can manage larger apparent fields although they can slip into 1.25” adapters.

Ref. Par. (34). Restriction of the exit pupil alone does not explain why the secondary mirror’s shadow appears within the eye’s view. The true reason is more subtle. The secondary is imaged by an eyepiece at a point different from that of its exit pupil, which is itself the location of the imaging of the primary mirror. Eyepieces with long focal lengths image the secondary nearer their exit pupils than do those with short focal lengths. If the power used is so low that the diameter of the exit pupil is restricted closely around the image of the secondary, the

secondary shadow is seen.

Ref. Par. (36). I will always advocate the choice of a good Barlow with a moderate focal length eyepiece over the short focal length eyepiece for achieving high power. The eye relief is lengthened (something that is especially important for eyeglass wearers), and one obtains more power, and a range of more powers if one has more eyepieces, with less cost. Also, a good Barlow will actually improve the performance of a telescope at power.

Generally, one should avoid variable power Barlows *and* variable focal length eyepieces, for that matter.

Ref. Par. (38). I have said all one needs to about the virtues of “simpler” eyepieces. For planetary use, I say these eyepieces are better suited for transferring visual detail than are the super sophisticated, multi-element Cadillacs that one can purchase. Planets are objects of small angular diameter, and most observation will take place at or near the field center. An excellent achromatic doublet will provide great imagery here, and is certainly more transparent than any design with more elements. Unfortunately, its field is so small (around 15°) that one will have difficulty using it on any telescope not accurately driven on the pole.

You may choose to spend on a fancy multi-element eyepiece for planetary viewing, but I bet I’ll see as much or more than you with one of my “cheapies”!

Newsletter Deadline

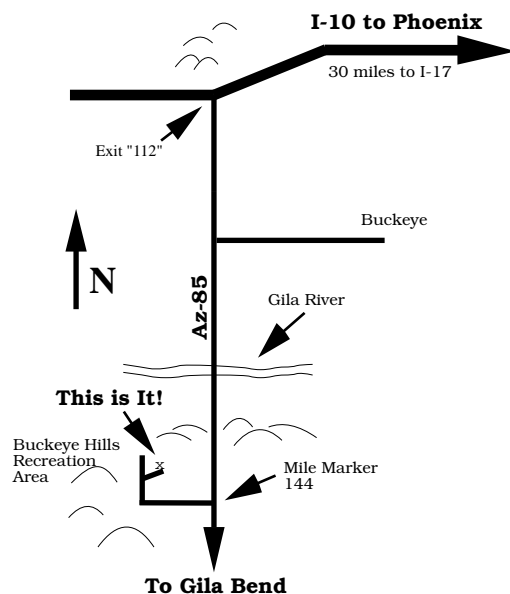
Mail items at least two weeks before the end of the month. Items arriving too late for an issue will be included in the next newsletter.

Directions to SAC Events

SAC General Meetings 7:30 PM at Grand Canyon University, Fleming Building, Room 105 — 1 mile west of Interstate 17 on Camelback Rd., north on 33rd Ave., second building on the right.

SAC Star Parties at Buckeye Hills Recreation Area Interstate 10 west to Exit 112 (30 miles west of Interstate 17), then south for 10.5 miles, right at entrance to recreation area, one-half mile, on the right. No water and only pit toilets. Please arrive before sunset; allow one hour from central Phoenix.

SAC Deep Sky Subgroup Meeting at John & Tom McGrath’s, 11239 N. 75th St., Scottsdale, 998-4661 — Scottsdale Rd. north, Cholla St. east to 75th St., southeast corner.



What's Up by Steve Coe

October 1994

Pegasus

I have already had one person voice an opinion concerning this column. In a most pleasant manner, I was informed that the positions of each object would make a fine addition to the information which has been included so far. Easily done.

Pegasus is a large constellation in the Autumn sky and being far away from the plane of the Milky Way, it contains lots of galaxies. Many are faint and small, but several are easy in any scope in the club. So, let's see what shows up in the Flying Horse.

NGC 7331 is at 22hr 37min RA and +34 25 Dec (all my positions will be given for the year 2000). It is bright, large, very elongated, much brighter in the middle with a stellar nucleus at 135X. It is an elongated shape even in the 11 X 80 finder and is surrounded by companion galaxies.

NGC 7479 is at 23 05 hr and +12 19 Dec. This galaxy is pretty bright, large and elongated 4 X 1. It has a much brighter core about 20'' across at 165X. This object is a very nice barred spiral and that structure can be seen on good evenings. The bar is about 5' in length and each end has a curved glow attached. It looks like a two-armed garden sprinkler in action. Averted vision makes the galaxy grow in size. The better the evening,

the better this object seems to get; I have always seen lots of detail in NGC 7479 on a sharp night at Dugas Rd. and I can rarely see much detail from Buckeye Hills.

NGC 7619 is at 23 20 hr and +8 12 Dec. In the 13'' it is pretty faint, pretty small, round and not brighter in the middle. This object is the center of the Pegasus I cluster and there are 5 other galaxies in a 30' field at 100X. All of the other galaxies are dimmer than NGC 7619 and are also round dots. There are another 6 galaxies within one degree of the central portion of the galaxy cluster. Several of them can only be seen with averted vision.

NGC 7741 is located at 23 44 and +26 05. It is pretty faint, very elongated, round, somewhat brighter in the middle, there is a double star on the NW side at 135X. This is the type of object that shows itself best on a clear, sharp evening. On a fuzzy night it is just a dim grainy object. On a night I rated 8/10 the central bar structure was immediately seen and averted vision showed some faint outer arm structure at 165X.

NGC 7814 is at 00 03 and +16 09. This lovely galaxy is bright, large, elongated and brighter in the middle. The arms are very mottled at 135X.

57 PEG is a double star at 23 09 and +8 41. This wide pair is 33 arc seconds apart and so it easily split in any telescope above 50X. I see the colors of this pair as yellow and blue at 100X. What is most fascinating about 57 Peg is the "pendulum effect." This means that if you move your head or tap the tube of the scope, the secondary star seems to revolve about the primary, a fun illusion, give it a try.

Bits and Pieces

Coming Events

Star Parties

All-Arizona Oct. 7 & 8
Solstice Party Dec. 17

Public Star Parties

Thunderbird Park Oct. 8

October SAC Meeting

For October, Dr. Jeff Hester from ASU will be the main speaker for the meeting. His topic is on the Hubble Space Telescope's recent improvements and discoveries.

Deep Sky Meeting

The Deep Sky Group is made up of people that like to observe celestial bodies out past the far reaches of our Solar System. These bodies include stars, nebula and galaxies. If you are interested in sharing your observations, or knowing what they look like in telescopes — then by all means come join us at the next meeting. The meeting

will be held at John McGrath's house; directions are here in the newsletter.

Continuing our discussion of the 110 Best NGC objects, the next 15 will cover the summer constellations Cepheus, Cygnus, Aquila, Lacerta and Pegasus. The following objects will be discussed in the indicated constellation: Cep 40, 6939, 6946, 7129; Cyg 6819, 6826, 6960, 6992, 7000, 7027; Aqr, 7009, 7293; Lac, 7209, 7243; and Peg, 7331.

You don't need to RSVP, we don't extend special invitations to anyone — ourselves included. If you are interested show up, we'd love to have you.

The Deep Sky meeting will take place on Thursday, September 22 at 7:30pm.

Address Change

For those of you who participated in the mirror making class and still wish to maintain contact with Leon Knott, here is his new address and phone number:

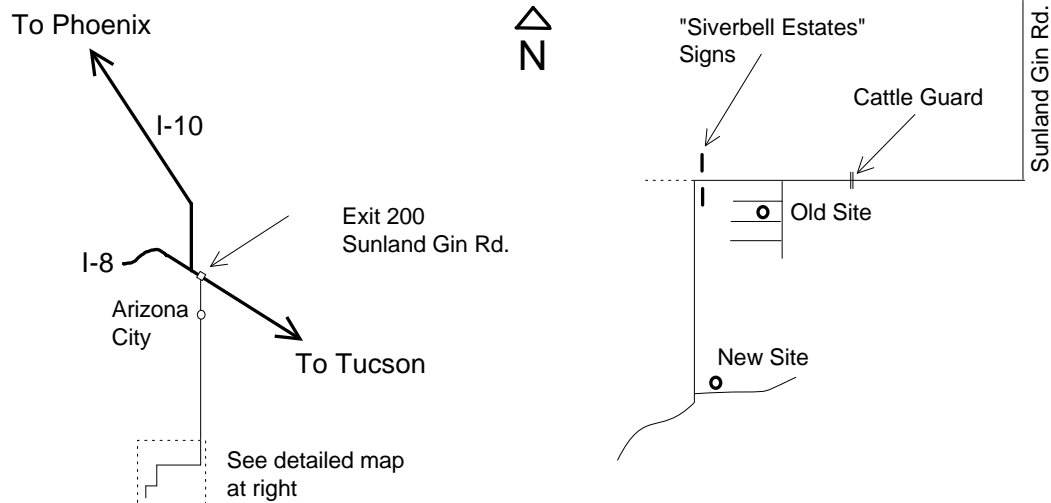
500 S 9th Street
Murray, KY 42071
(502) 753-2797

The 13th Annual All-Arizona Star Party

The All-Arizona Star Party will be hosted again this year by the East Valley Astronomy Club (EVAC). This star party is a two night affair, Friday and Saturday nights, October 7 & 8 at the new Arizona City site (the same site as the 1994 Messier Marathon). There is plenty of room for camping and scope set-up.

Friday night's observing session will begin at sunset. On Saturday afternoon there will be a Swap Meet. The second observing session will begin Saturday night.

Restroom facilities will be available. Otherwise the site is primitive (no water). Food and supplies can be obtained in Arizona City which is approximately 18 miles north of the site.



Take I-10 to exit 200 (Sunland Gin Road.) Turn right (south) after exiting the freeway. After about 15 miles, the pavement ends and about one mile further, the road turns sharply to the west. One mile past the road to the old site, the main road will turn south just after the "Silverbell Estates" signs. Continue for another 2.5 miles. The road will veer off to the west. Immediately to the east is the road to the site. About 100 yards down this road are several large, open areas to the left.

Minutes of the August Meeting

During the meeting, Paul Dickson talked about the TAAA's 40th Anniversary Banquet. There was more info supplied on the table as well as hand-outs available.

Discussion about the Buckeye Hill Recreation Area started. The facts are: the park is closed; the park will not be locked; the road into the park will be paved! Maricopa Parks has decided to not maintain the park due to the lack of money, but the State decided to pave the road through the park as part of another program.

There was no Show and Tell.

After the break Paul Dickson introduced our speaker,

Steve Mutz, from ASU.

—Paul Dickson, from notes taken from memory.

E-Mail Changes

A new roster of E-Mail addresses will be published soon, possibly in the November issue of *SAC-News*. If your address was not previously listed, or you have a new address contact Paul Dickson at p.dickson@az05.bull.com.

Public Star Party: Thunderbird Park, Oct. 8

Due to scheduling mis-communications, this public star party got scheduled the same weekend as the All-Arizona Star Party. Would those of you who aren't going to attend the All-Arizona Star Party, please bring your scope to this public star party. Thanks.

Thunderbird Park is one mile north of Beardsley on 59th Avenue. Please arrive between 5:30 and 6 PM.

October 1994

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
<div style="border: 1px solid black; padding: 5px; display: inline-block;">All Times are Mountain Standard Time</div>						SAC Star Party Buckeye Hills (members&guests) 1	
2	3	New Moon 8:55 P.M.	4	5	6	<div style="border: 1px solid black; padding: 5px; display: inline-block;">All-Arizona Star Party October 7-8</div>	
9	10	First Quarter Moon 12:17 P.M.	11	<div style="border: 1px solid black; padding: 5px;"> Arizona's High Power Rocket Launch: Flagstaff, Oct. 15-16 No Impulse Limit — Waiver to 28,000 ft All Day Launchsite is located 22 miles north of Flagstaff on Highway 89. Exit 1 mile north of Wupatki National Monument's north entrance, at Hank's Trading Post. Stay left, approximately 2.9 miles to launch site. More info: Mike Dolan, (602) 829-9117 10AM to 7PM </div>			15
16	17	18	Full Moon 5:18 A.M. EVAC Meeting (SCC: Rm. PS172)	19	20	SAC Meeting Grand Canyon University, Fleming Rm. 105	22
23/30	24/31	25	26	27	Last Quarter Moon 9:44 A.M.	SAC Star Party Buckeye Hills (members&guests)	29

Lunar Grazing Occultation

Saturday, Nov. 26 at 4:29 AM

On the morning of Saturday, November 26, 1994 at 4:29 AM, the moon will pass by a 6.7 magnitude star. A southern limit graze will occur right through the Metro Phoenix area. The graze time will be earlier for those viewing west of Mesa.

The star is a variable, RX Sextantis. It is a Delta Scuti type with an amplitude of less than a tenth of a magnitude.

All circumstances for this graze are favorable. It is a Saturday morning on Thanksgiving weekend. The star is fairly bright. The Moon's limb will be dark with a 6.7° cusp angle. The moon's altitude will be 49 degrees and it is close to home.

The profile looks good from the predicted limit south to about two miles. Gerry Rattley and Gene Lucas will be setting up a graze expedition some place locally, in either north-west Phoenix or Mesa-Apache Junction areas.

Anyone from the club is welcome to participate or come out to look. More will be said about this in the next newsletter and at the October meeting. For more info, Gerry Rattley's phone number is 892-5698.

Saguaro Astronomy Club Member Services Form

Membership

Memberships are for the calendar year and are pro-rated as follows: Jan - Mar 100%, Apr - Jun 75%, Jul - Sep 50%, Oct - Dec 25%.

- \$20.....Individual Membership
- \$30.....Family Membership (one newsletter)
- \$100.....Business Membership (includes advertising)
- \$4.....Nametag for members
- \$10.....Newsletter Only

Subscriptions

The following magazines are available to members. Subscribe or renew by paying the club treasurer. You will receive the discounted club rate only by allowing the treasurer to renew your subscription.

Sky & Telescope.....\$20.00 for one year

Astronomy.....\$18.00 for one year

Write your name, address, and phone number in the space below.

Make checks payable to SAC.

Mail the completed form to:

Adam Sunshine
SAC Treasurer
20401 N 30th Drive,
Phoenix AZ 85027



SACNEWS

c/o Paul Dickson
7714 N 36th Avenue
Phoenix AZ 85051

Stamp

First Class Mail