East Valley Astronomy Club

November *Newsletter* *1994*

EVAC HIGHLIGHTS

Gerry Rattley of Saguaro Astronomy Club started the October 19th meeting with a complete description of the grazing occultation coming up on November 26th (see the article in this newsletter). If you wish to participate in the observation (or just watch), plan to be at the meeting place (Cotton Lane and Bell Road) no later than 3:30am on the 26th. Contact Gerry for more information at 892-5698.

The main speaker for the meeting was Dr. John Winters, a professor at Glendale Community College. One of Dr. Winter's areas of interest is astrometry, the accurate measurement of astronomical positions. The derivation of accurate positions is complicated by the fact that the stars themselves move (proper motion) and that the coordinate system is also moving (precession). Although these motions are very slow, these factors must be taken into account because of the highly precise nature of the measurements.

Astrometric data is essential for computing orbits, stellar motions and accurate positioning of novae and other events. The data is generally derived from photographic plates (preferred over film because of its stability). After careful measurement of the object's position using a measuring engine, the data is fed into a computer for processing.

Even without the expensive equipment used by the professional, anyone can obtain good results with a computer, astrometric reduction program and a good ruler. Dr. Winters described a project he undertook using a program published in the July 1990 issue of Sky and Telescope. Using a *photocopied* picture and the data reduction program, he was able to obtain results accurate to a few arc-seconds.

The meeting ended with nominations for next year's officers. The nominees are:

President	Don Wrigley
Vice President	Robert Kerwin
Treasurer	Sheri Cahn
Secretary	Sam Herchak
Properties	(no nominations)
Newsletter	Sam Herchak
Board	Tom Polakis
	Ted Heckens
	Kirk Keating
	John Durham
	Don Farley
	Frank Kraljic
	Paul Dickson

The elections will take place at this month's meeting, so be sure to attend!

The local star party on October 29th saw about a dozen attendees. The early part of the evening was clear, but later on clouds moved in and most people left by 11:00pm.

The deep-sky star party at Vekol Road on November 5th had a good turnout with about a dozen people attending. High clouds to the north moved off to the east and dissipated in the early evening. Although the night was clear, some observers noticed that the contrast was not quite as good as usual. At any rate, several people stayed up until the wee hours of the morning, taking full advantage of the clear skies.

NOVEMBER'S SPEAKER

The speaker for the November meeting will be Paul Scowen, a researcher at ASU. His talk is entitled "HST Imagery of Crab synchrotron Nebula." Dr.

UPCOMING EVENTS

EVAC Business Meeting
November 16, SCC Room PS172, 7:30pm

Local Star Party
November 26, Florence Junction Site and Carefree Site

Deep Sky Star Party
December 3, Vekol Road Site

Scowen's research is mentioned in an article in the December issue of Astronomy entitled "Inside the Crab Nebula."

PUBLIC STAR PARTY

EVAC will be sponsoring a public star party at Black Mountain Elementary School in Cave Creek in late November or early December. The date will probably be either November 29th or 30th or December 1st. The exact date and more details will be given at the meeting. We will need at least a half-dozen scopes since we expect about 50 kids for the event. Unlike other public star parties, the kids are interested in deep-sky objects, so come prepared to show some of your favorite clusters, nebulae and galaxies.

COMING CELESTIAL ATTRACTIONS

Saturn is still well-placed in the evening sky, but is well past opposition, so the observing opportunities are drawing to a close. The rings also begin to close slightly.

Although Saturn is sinking toward the west, Mars is approaching its opposition (February 11, 1995). Always a challenging planet to observe, now is the time to begin observing the Red Planet. It rises in late evening and is currently in Leo. Unfortunately, this opposition is the most unfavorable in its cycle of oppositions. Nonetheless, with practice and patience, Mars can reward the observer with tantalizing glimpses of detail. For a complete guide to the coming opposition, see the December issue of Sky and Telescope.

For those observers who like to track comets, Comet P/Borrelly is at its best in November and December. It should stay at about magnitude 8 as it drifts across Cancer, Lynx and Ursa Major. P/Borrelly has a period of approximately seven years and was discovered in 1904. Perihelion occurred on November 1st; closest approach to Earth occurs on December 4th.

On the evening of December 3rd, look for the very thin crescent Moon in the west-southwest about 30 minutes after sunset. The crescent will be about 24 hours old for Arizona observers. You will probably need to use binoculars to find it.

The Geminid meteor shower peaks on December 13-14. Unfortunately, the waxing gibbous Moon will interfere, however, you will have a two-hour window of opportunity in the early morning after moonset and before twilight begins. Under dark skies, you would normally see about 80 meteors per hour. Since the shower is active several nights before and after the maximum, you can also try observing the two nights before the shower. In terms of moonlight, this would be more favorable, since the moon sets earlier in the morning, giving you some extra observing time.

ASTRONOMICAL CALENDAR

As in prior years, EVAC will be offering the *Astronomical Calendar* at a special discount rate. The calendar is a large-format book containing monthly information on celestial events along with a monthly star chart. In addition, you will find extensive information and charts explaining celestial events such as eclipses. The calendar is $12 and payment must be received in advance. Contact Bob Kelley for more information.

EVAC T-SHIRTS

At the September meeting Anne Beeby brought up the idea of astronomical T-shirts with the EVAC logo printed on them. She has contacted Main Sequence of Scottsdale which already markets shirts with beautiful renditions of such objects as the Horsehead and Trifid Nebulae. They have agreed to print our logo on the sleeve with a choice of celestial prints on the front for only $11.00 per T-shirt and $15.00 per sweatshirt. You can use the order blank in this newsletter. All orders must be received by November 23rd and the shirts should be ready by Christmas.

EVAC OFFICERS

President	Bob Kelley	451-6497
Vice-President	Don Wrigley	982-2428
Treasurer	Bill Smith	831-1520
Secretary	Frank Kraljic	991-5105
Newsletter	Don Wrigley	982-2428
	Robert Kerwin	837-3971
Properties	Carl Lorson	834-6864

LUNAR GRAZING OCCULTATION

By Gerry Rattley

On Saturday, November 26 at 4:28am, the star RX Sextantis will undergo a grazing occultation by the Moon. I have chosen to set up observing stations for this graze on the far west side of town. We will use Cotton Lane centered on Bell Road. This is just west of Sun City and east of McMicken Dam. We did a graze on this part of Reams Road back in 1983 and this area probably hasn't changed much.

The Moon's elevation is 48 degrees (still well up for our needs). The star is a magnitude 6.7 Delta Scuti variable with a very small amplitude. The Moon's limb at the graze will be dark. The only bad thing about this graze is the ungodly hour of the morning; it may also be a bit chilly in late November.

An occultation occurs when the Moon passes in front of a star. A *grazing occultation* (or *graze*, for short) occurs when the north or south edge (limb) of the Moon's disk passes in front of the star.

As the Moon passes by during the graze, the star will blink off and on as it goes behind lunar mountains and peeks out through lunar valleys. Timing these off and on blinks precisely provides us with extremely useful scientific data. The Moon's location in turn is the basis of our time system. There are many other uses for this information too numerous and involved to explore here.

Because the star's position and the Moon's orbit are pretty much known, the graze path is traced out over the Earth's surface in much the same way as a solar eclipse path. Since the graze path is only a couple of miles wide, you will most likely need to travel to position yourself in the path. If you are too far away you will either see the star miss the Moon or you will time a very long total occultation (still useful data, but not as exciting as a graze).

Professional astronomers do not have the portable equipment or the funding for this kind of field activity, so it is up to the amateur to provide this data. IOTA, the International Occultation Timing Association, provides the graze path predictions and the basic limb profile charts to persons interested in leading teams to observe, time and report these events. These persons, called graze leaders, take care of the fine details of setting up the graze expedition. The graze leader informs the team members of when and where to be for the graze and answers questions about how to make the timings.

To make useful timings of a graze, the team member should have three items of equipment (other than a pair of eyeballs):

1. He must have a telescope. A four-inch refractor would probably work fine, but a least a six-inch reflector is recommended. You'll need a fairly large image, but a comfortably large field as well—60x to 100x is best—you'll want as little eyestrain as possible. A working clock drive is almost a necessity.

2. A means of obtaining a time signal, i.e., a WWV time cube or a short wave receiver.

3. A means of recording the events and time signals at the same time. A portable cassette tape recorder would work nicely.

There are many methods of recording data on grazes, the most common is described later. One method, commonly used in the past, is to record the graze with portable video gear. I will not attempt to describe this one here, since I am not an expert at it anyway. However, I can put you in touch with someone who can help you if you need it. Call me if you need to discuss other equipment, methods or ideas.

On the day of the graze, each team member is responsible for showing up at the graze site at least an hour before the predicted central graze time. You will need at least an hour to get your station assignment on the graze line, locate that station and set up your equipment. The graze leader and his assistants will have arrived at the site many hours in advance and pre-selected these graze stations according to the graze predictions received from IOTA. Being on the station selected is important if your data is to be of any use. We must know exactly where you are, longitude and latitude to within a few feet.

The graze stations are aligned as perpendicularly as possible to the predicted limit, usually in a north-south direction a few hundred feet apart to cover the limb profile from mountain peaks to valley bottoms. Each team member's data will supply a different line, or chord, along the limb and all the chords plotted together will show a "shadow" of exactly what the Moon's limb looks like at that location.

The graze itself is the essence of the entire expedition. As you sit at the eyepiece of your telescope, you watch the edge of the Moon slowly close in on the star at a tangent. The star gets closer and closer (is it going to miss?), then, just when you are convinced it IS going to miss, OOPS! Wow! It went out! Oh, it's back again, out, in, out, it flashed, in, etc. The usual is about four to six events (two or three pairs) with a wink or a flash thrown in perhaps. Sometimes the star is double, making for a real panic scene.

The most common method for gathering data on a graze is to use a tape recorder and to leave it running until you are sure the graze is over—if the star has been on for over five minutes after the central graze time, it's a sure bet that nothing more is going to happen. Once the recorder is going, you need to get your time signal going and place it so that the recorder records the time signal as a background on your tape continuously throughout the graze. With the recorder and WWV going, stand at your eyepiece and call out your D's and R's, winks and flashes or whatever else strikes your fancy. The graze itself will generally last for only a few (1-5) minutes.

Sometime after the graze is over, you will have to listen through this tape and record the events on a reporting form (supplied by your graze leader). The graze leader then collects all of these forms, correlates them, adds the geodetic information (you station location) and reports the graze data back to IOTA and to ILOC, the International Lunar Occultation Centre in Tokyo, Japan. Results of successful grazes will be published in the SAC newsletter.

This current graze is a good one, as grazes go and if weather permits, I encourage everyone to come out and see it. If you are interested in participating as a member of the graze team, please call me. It is very helpful for me to know about how many stations I will need to prepare for. If you just want to watch, I will put you where I expect the best action to take place (enjoy). My home phone number is (602) 892-5698. I have an answering machine (leave your name and phone number and at least say the word "graze"). I will answer immediately or will call you back ASAP. Gene Lucas will be assisting me with this graze.

A Heartfelt THANKS!

The editors of the EVAC newsletter would like to thank all the people that contributed to the newsletter during the last year and helped make our job easier. Your input and contributions to the newsletter were instrumental in making it successful.

Ann Beeby

Paul Dickson

Don Farley

Réka Fromm

Ted Heckens

Sam Herchak

Frank Honer

Michael Janes

Bob Kelley

Leon Knott

Frank Kraljic

Tom Polakis

Gerry Rattley

Bill Smith

Of course, there may be others that contributed to the newsletter that we failed to mention. We sincerely apologize if this is the case. Your contributions to the newsletter (and the club) are indeed appreciated and have not gone unnoticed.

The Observer
by Tom Polakis

Dark Time

Riku Henriksson is an avid deep sky observer who has made many observations from a site near his home in Tampere, Finland. Yes, that's Finland, the same country whose most *southerly* latitudes are around 60°N. While the first uncomfortable thought that comes to many of our minds is the arctic chill, we should also appreciate Riku's use of an abbreviated amount of potential viewing time. With his night sky in summer months completely lost to twilight, his logbook of observing notes is all the more impressive. Let's take a look at how much usable dark time there really is throughout the year in different parts of the world.

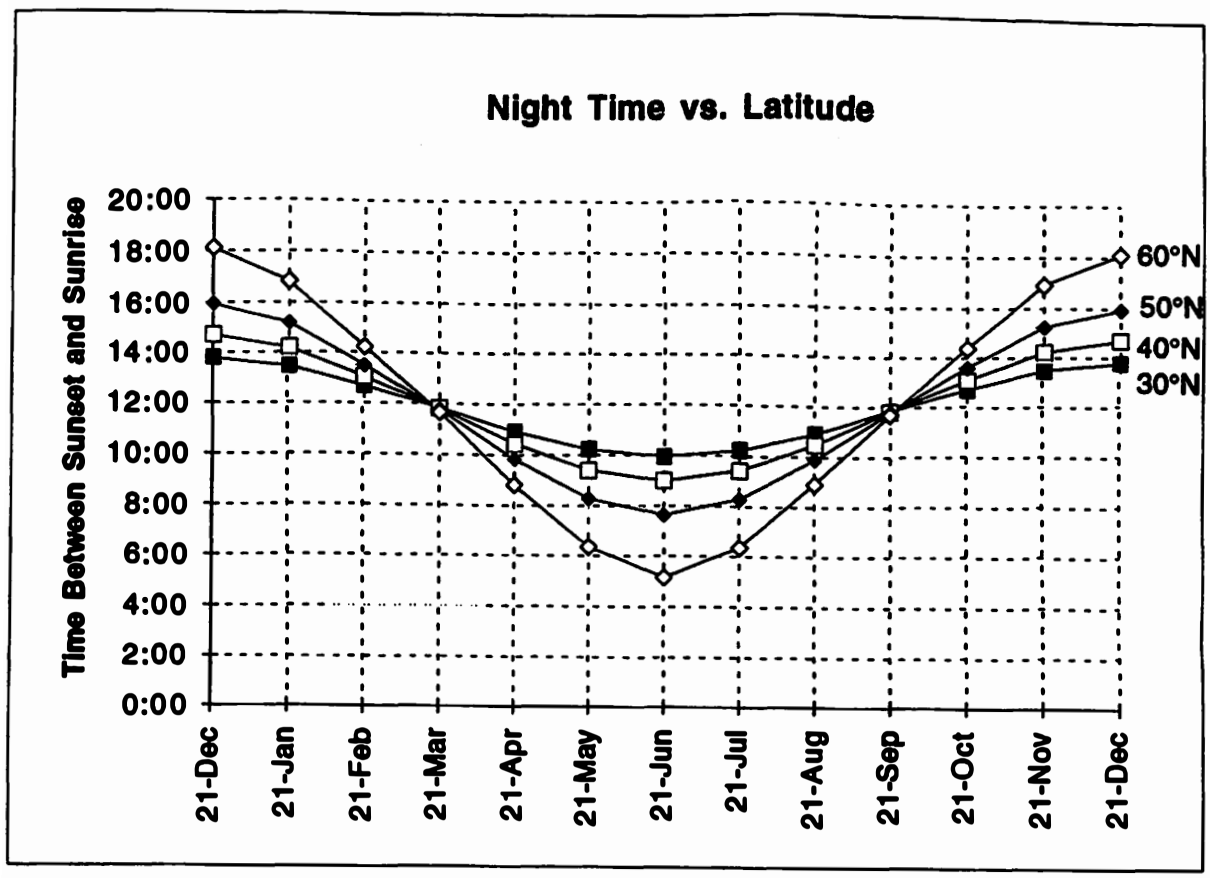
I used *Voyager*, the Macintosh desktop planetarium, to summarize dark time throughout the year. The first family of curves shows length of night, sunset to sunrise, plotted versus the time of year at various latitudes. As a validity check, look at the equinox dates in March and September. The curves cross there, where the night is slightly less than 12 hours in length. It is not exactly a half day as the small effect of refraction lengthens the period of daylight to slightly more than 12 hours when the sun is on the celestial equator. The length of night falls off as we approach the summer solstice, and the effect becomes more pronounced as we move northward. Note that the night is still 10 hours long on June 21 from the southern United States (30°N), but it has shrunk to 5 hours in southern Finland. This is only the beginning of their problems.

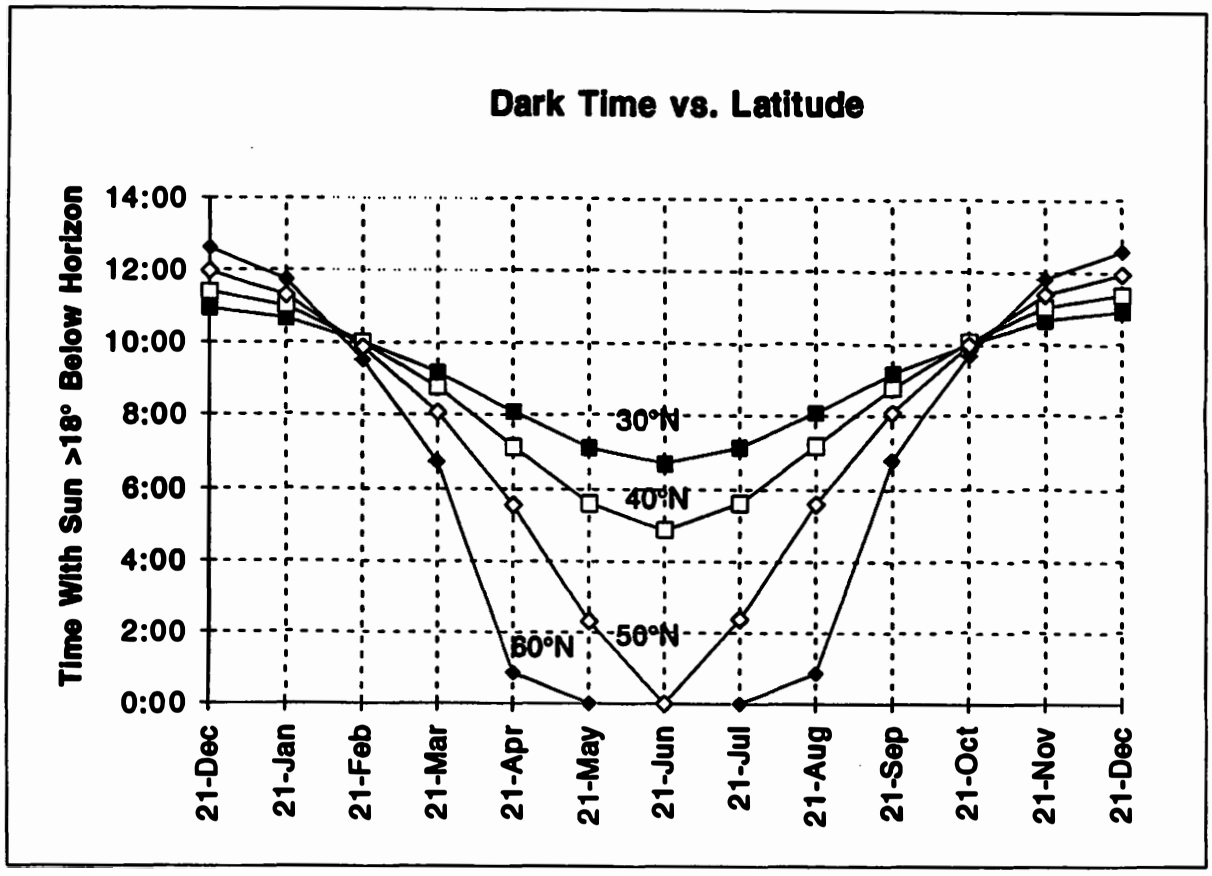
The second family of curves presents in a similar fashion the variation of actual 'dark time' throughout the year. Represented in these curves is the period of time with the sun more than 18° below the horizon. 18° is chosen as it defines *astronomical twilight*, when no glow can be seen in the direction of the sunset or sunrise point.

It is interesting to look at these curves for the winter solstice. At 30°N latitude, the length of dark time peaks out at about eleven hours on this date. Moving to 60°N, though, the dark time improves by only an hour and a half, even though the 'night time' improvement was four full hours. This is due to the shallow angle that the setting sun makes with the horizon at polar latitudes. Astronomical twilight lingers for nearly three hours at 60°N, while it lasts only half that long at 30°N.

In summer, the long-twilight effect near the north pole becomes much more pronounced. Indeed, Riku points out that Finnish observers pack away the gear between early May and late August. He mentions, optimistically, that "Summer is our time for rest, to think things over and make plans for next season." Note that the dark time at 30°N bottoms out at around seven hours on the date of the summer solstice. At this time at 60°N, however, the dark time is zero hours - the full five hours in which the sun is below the horizon are spent in twilight. Even at 50°N, or just north of the United States/Canada border, there are only a couple hours of genuinely dark time for a couple months around the summer solstice. Remember that summer is typically the good season when it comes to cloud patterns!

Curious about when it becomes 'officially dark', I made some naked eye observations of the limiting magnitude at the zenith at ten-minute intervals after sunset. The brightest stars, such as zero-magnitude Arcturus, could just be discerned when the sun was 4° below the horizon. Third magnitude stars came into view when the sun was down 7° degrees. With the sun a full 10° below the horizon, I could make out 4th magnitude theta Coronae Borealis. The sky took on the appearance of a typical light-polluted urban backyard when the sun reached -11° altitude, with 5th magnitude stars faintly visible. At this time, the summer Milky Way is apparent, with its dark rift visible with some difficulty. The zenith was as dark as it would be at midnight when the sun reached -15° altitude. A star designated as HR 5613 and catalogued at magnitude 6.6 was my naked eye limit. Note that although there was still a prominent glow in the northwest up to an altitude of 30°, the zenith had reached full darkness by this time. The last glow of twilight faded into the Zodiacal light an hour and forty minutes past sunset. The sun's altitude at this time was -18°, confirming the definition of astronomical twilight.


Night Time vs. Latitude
Time Between Sunset and Sunrise
20:00
18:00
16:00
14:00
12:00
10:00
8:00
6:00
4:00
2:00
0:00
21-Dec
21-Jan
21-Feb
21-Mar
21-Apr
21-May
21-Jun
21-Jul
21-Aug
21-Sep
21-Oct
21-Nov
21-Dec
60°N
50°N
40°N
30°N


Dark Time vs. Latitude
Time With Sun >18° Below Horizon
14:00
12:00
10:00
8:00
6:00
4:00
2:00
0:00
21-Dec
21-Jan
21-Feb
21-Mar
21-Apr
21-May
21-Jun
21-Jul
21-Aug
21-Sep
21-Oct
21-Nov
21-Dec
30°N
40°N
50°N
60°N

CLUB T-SHIRTS AND SWEATSHIRTS

Here are the options and the order blank for T-shirts and sweatshirts from The Main Sequence which have the club logo on the sleeve and a choice of prints on the front. Order these in person at the Nov business meeting,or mail orders must be received by Nov 23rd. They will be available at our Dec meeting for pickup.

PRICES

T-shirt: 11.00
Sweatshirt: 15.00
* add 1.00 for XXL

SIZES

M >38-40
L >42-44
XL >46-48
XXL >50-52*

ON BLACK

Trifid Nebula-1B
Rosette Nebula-4B
Magellanic Clouds-5B
Lunar Commemorative-6B
Horsehead Nebula-7B

ON WHITE

Galileo-3W
Earth-9W
Herschel-12W
Brahe/Kepler-11W
Copernicus-10W
18th Cen. Telescope-8W
19th Cen. Telescope-13W

ON ASH

M81-2A
Earth-9A
18th Cen. Telescope-8A
19th Cen. Telescope-13A

ON NATURAL

Galileo-3N
Herschel-12N
Brahe/Kepler-11N
Copernicus-10N

How Many?	Design Number?	T-Shirt (T) or Sweat(S)?	Size? M,L,XL,XXL	Price Each?	Total Price?
NAME:			Phone:	GRAND TOTAL:	

Make checks payable to: **ANNE BEEBY**
145 S. Norfolk Cir.
Mesa, AZ 85206

EVAC/Robert Kerwin
14206 N. Sussex Place
Fountain Hills, AZ 85268

Vekol Road Site