THE Prairie Astronomer

Volume 28 #12
December 1987

HAPPY HOLIDAY!

Please note:
Special December Meeting Time
Monday, December 28th
7:30pm

Please make a note of this special meeting date. This month's program will be presented by Larry Stepp who will relate some of his stories about what goes on behind the scenes at Kitt Peak and Mona Kea National Observatories. You won't want to miss this one. But remember... IT ALL HAPPENS A DAY EARLIER!

Inside:

PRESIDENT'S MESSAGE

by Del Motycka

It is with pleasure and relief that I can announce that the pedestrian access to the missile silo is now closed. The pleasure part is that the work is completed, and the relief part is that the firm which acquired the interests of the bankrupt firm that started the demolition work agreed to complete the work without additional cost. We can now look forward to other planned work at "OUR" dark sky site.

I urge every club member to come and enjoy the stargazing. Twelve members have leased keys so they can gain access whenever the sky is clear and at their convenience. All club members have access at every star party. Come on out and enjoy!

In closing, I express my thanks to the members for giving me an opportunity to serve you as president. I have received much from the club over the years and welcome the chance to contribute what I can to the organization. With such fine fellow officers, I look forward to a very enjoyable year.

The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc., and is free to all club members. Membership status and expiration date is listed on the mailing label. Membership dues are: Junior Members and Newsletter Only Subscribers... $8/yr; Regular Members... $22/yr; Family Membership... $25/yr. Address all membership renewals or questions to THE PRAIRIE ASTRONOMY CLUB, INC., P.O. BOX 80553, LINCOLN, NE 68501. For other club information contact one of the following officers: Del Motycka (Pres) 489-2520, Ron Veys (V.Pres) 464-1449, Ellen Owen (Sec) 423-7440, Dan Neville(Tres) 476-7772, Ron Debus (2nd V.Pres) 435-5688 All newsletter comments and articles should be sent to Newsletter Editor JOHN LORTZ, 9255 CADY AVE #14, OMAHA, NE 68134 no later than 6 days before monthly club meetings. Club meetings are held the last tuesday of each month.

Observing Chairmans Report

by David Knisely

THE NEXT SCHEDULED STAR PARTY IS ON JANUARY 15TH. When we think of winter observing, we generally consider things like the Orion Nebula or the Pleiades. But there are a number of challenging targets in the cold clear skies of January that make it worth the effort it takes to find them. One such challenge is NGC 188, a faint open cluster near the north celestial pole. Located about a degree south of 2 Ursa Minoris, this cluster consists of many faint stars arranged in a fairly large group. A six inch should show some of the stars, but an eight or ten inch should make the cluster a fine sight.

In Cepheus is an interesting combination of reflection and absorption nebulae, NGC 7023. It is best seen in eight or ten inch apertures as a puff of haze surrounding a sixth magnitude star about two and a half degrees south and two and a half west of Beta Cephi. The area around the nebula is almost devoid of stars, due to the surrounding dark nebulosity. With a ten inch and the Lumicon Deep-Sky filter, faint wings of light can be glimsed on the east and west sides of the bright nebula.

Another challenging nebula is the California nebula, NGC 1499, located less than a degree north of Xi Persei. It is very large and faint but responds very well to the Lumicon H-Beta filter. Without the filter, the nebula can only be seen as a brightening in the sky background in the field of an eight inch aperture, but with the filter, the nebula is faintly visible to the naked eye. I got a very nice view of the entire nebula in a four inch Astroscan equipped with the filter, and a ten inch with the H-Beta showed faint filaments running through the field.

If you want something a bit easier on your aperture, take a look at M35, a fine open cluster for binoculars and small telescopes. It can be found about two degrees north and one and one-half degrees west of Eta Geminorum. The cluster holds up fairly well with a moon in the sky due to the brightness of its stars. Those of you with four inch or larger telescopes can try the small faint companion to M35, NGC 2158. It can be found near the southwest edge of M35 and appears as a small fuzzy patch when viewed in a four inch. A six inch will show hints of resolution, while an eight inch shows at least 20 to 30 stars in this rich cluster.

A few of you have asked about the visibility of the Horsehead nebula in Orion. Some of you have confused the dark inclusion in the Orion nebula with the Horsehead. This dark inclusion is known as the "Fish's mouth", and is about then times easier to see than is the Horsehead, although now with the advent of Lumicon's H-Beta filter and large Dobsonians, this is no longer exactly true. The nebula itself is embedded in IC 434, a long faint band of nebulosity running South from Zeta Orionis. The Horsehead is located about half way down the band notch on the eastern edge of IC 434. A six inch rich field can also sometimes pick up the nebula, but more times than not, the observer mistakes the much brighter nebula, NGC 2024, running east from Zeta, for the Horsehead. I have found that the Lumicon H-Beta filter makes the dark horse-head shaped shaped nebula come out very well in a ten inch. The UHC or DeepSky filters will help some, but not nearly as much as the H-Beta does. The Horsehead itself is fairly small, so you probably will want to use about 50 power and keep Zeta out of the field.

Please come to the star parties, even if you don't have a telescope. There is almost always someone there who has an instrument or some filters, so you don't have to miss out on the glorious sights in the winter skies.

Sky & Tel News:

FROM COMPUSERVE'S ASTRONOMY FORUM

DECEMBER 11, 1987

COMET SNIPPITS

For those of you who compute comet ephemerides, here is the current set of epoch 1950.0 elements for COMET BRADFIELD (1987s), from Minor Planet Circular 12440:

T = 1987 Nov. 7.2739 ET
e = 0.994811
q = 0.868989 a.u.
W = 73.9085 degrees)
O = 267.3835 ") 1950.0
i = 34.0897 ")

For COMET FURUYAMA 1987f1, here is a continuation of the ephemeris presented here last week (December 4th):

Date	R.A. (2000)	Dec.	Mag.
Dec. 16	3h 28.1m	+4d 14'	9.6
17	3 23.8	3 19	9.6
18	3 19.6	2 24	9.6
19	3 15.6	1 31	9.6
20	3 11.6	+0 39	9.6
21	3 07.7	-0 12	9.6
22	3 03.9	1 02	9.6
23	3 00.2	1 50	9.6
24	2 56.6	2 37	9.7
25	2 53.2	3 23	9.7
26	2 49.8	4 07	9.7
27	2 46.6	4 50	9.7
28	2 43.4	5 31	9.7
29	2 40.4	6 11	9.7
30	2 37.5	6 50	9.7
31	2 34.6	-7 27	9.7

Here are epoch 2000.0 positions for COMET ICHIMURA (1987d1):

Date	R.A. (2000)	Dec.	Mag.
Dec. 11	22h 39.7m	-60d 58'	6.7
16	20 56.3	58 02	6.5
21	19 54.2	52 57	6.2
26	19 15.5	47 36	5.6
31	18 49.3	42 01	4.7
Jan. 5	18 33.6	35 26	3.4
10	18 37.8	26 39	2.5
15	19 07.2	17 48	4.3

DECEMBER 4, 1987

COMETS, COMETS, COMETS

Comet Furuyama, discovered November 23rd, is drifitng slowly to the southwest through Taurus and right now is just skirting the northwest edge of the Hyades. On IAU Circular 4506, Brian Marsden gives the following parabolic orbital elements:

T = 1988 March 2.415 ET
e = 1
q = 1.69121 a.u.
W = 232.953 degrees)
O = 250.063 ") 1950.0
i = 117.851 ")

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Here are epoch 2000.0 positions for 0 hours Universal time:

Date	R.A. (2000)	Dec.	Mag.
Dec. 4	4h 24.9m	+15d 50'	9.8
5	4 20.0	14 53	9.7
6	4 15.0	13 55	9.7
7	4 10.1	12 57	9.7
8	4 05.2	11 58	9.7
9	4 00.3	10 59	9.7
10	3 55.5	10 01	9.7
11	3 50.8	9 02	9.6
12	3 46.1	8 03	9.6
13	3 41.5	7 05	9.6
14	3 36.9	6 07	9.6
15	3 32.5	6 10	9.6

Comet Ichimura has headed south for the winter. Parabolic orbital elements by Brian Marsden (IAU Circular 4504) are:

T = 1988 Jan. 10.100 ET
e = 1
q = 0.19951 a.u.
W = 329.317 degrees)
O = 225.800 ") 1950.0
i = 41.564 ")

Comet Bradfield is well placed for evening viewing at about magnitude 5-1/2.

NOVEMBER 25, 1987

COMET ICHIMURA (1987d1)

On November 22nd Yoshimi Ichimura in Japan discovered a 9th-magnitude comet using 5-inch binoculars. The comet is moving rapidly in a prograde parabolic orbit and will reach perihelion on January 9th a mere 19 million miles from the Sun. By then it should have brightened to 3rd magnitude but will be only 12 degrees from the Sun and hence invisible. In fact, the comet is moving south at 3 degrees a day, so catch it right away in the evening sky before moonlight interferes. Here are epoch 1950 coordinates for 0 hours Universal time, as predicted on IAU Circular 4497:

	R. A. (1950)	Dec.
Nov. 26	3h 33m	-28.5d
27	3 24	31.6

COMET FURUYAMA (1987f1)

Sigeru Furuyama of Japan discovered the year's 32nd comet photographically on November 22nd. According to David Levy of Tucson, it was magnitude 10.2 on the evening of November 24th. At that time it was near the Hyades, at right ascension 5h 05m, declination +23.4d, and moving south-westerly.

M31 SUPERNOVA FIZZLES

On November 24th it was reported that Soviet astronomers had found a possible supernova in the geat Andromeda galaxy M31. Then purported supernova was desscribed as shining at 11th magnitude at the following 1950 coordinates: right ascension

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0h 41.8m, declination +41d 35'. But that evening observerd around the world found no trace of a new star down to 15th magnitude, either visually or photographically.

T-SCANNER by DayStar

by Rick Johnson

This article will describe the T-Scanner filter and what it does as well as how it can be modified to work with Newtonian telescopes even though DayStar indicates otherwise. All members are welcome to drop by for a very unique look at the sun. Due to trees and houses, 11 a.m. to 2 p.m. is best. Now that you know it works on with the show.

Ever since I first saw the sun through an observatory quality H-Alpha filter at the University of Hawaii's Haleakala Solar Observatory I have wanted such a filter. Even mounted in a 4" refractor the view was no less than magnificent. It's bandpass was less than .1 angstrom. The narrower the bandwidth, the higher contrast the view. You could cut your eye the image was so sharp. Unfortunately that filter's cost was several hundreds of thousands of dollars!

What does such a filter do a standard solar filter doesn't? The surface of the sun we see is called the photosphere as its where the light we see originates. It is the home of the sunspots, granulation and faculae seen when you look at a projected image of the sun or through solar filters. Above this lies the nearly transparent chromosphere. It is a layer of rarefied hydrogen gas some 3,000 miles thick. It's a red color due to most of its light being emitted in the H-Alpha Balmer emission line of hydrogen. This is the line that makes the Orion Nebula red in photographs. While the photosphere emits light in the H-Alpha line this line is mostly absorbed by the chromosphere. In turn the chromosphere emits its own H-Alpha light.

The chromosphere can normally only be seen during a total eclipse when the moon's rim blocks the photosphere allowing the chromosphere to be glimpsed for an instant before it too goes behind the moon's limb. By looking in the H-Alpha absorption line a subangstrom H-Alpha filter passes mostly light emitted by the chromosphere. The narrower the bandpass of the filter the less photosphere light that's seen, resulting in a higher contrast image of the chromosphere. This is why the .1 Angstrom filter I looked through was so spectacular. While the photosphere doesn't change much except over long periods of time, the chromosphere, being made up of very low density hydrogen reacting to the sun's magnetic field, changes right before your eyes.

Several years ago DayStar came on the scene offering subangstrom H-Alpha solar filters. I got a chance to look through one at the last Astronomical League convention held here in Lincoln. The view was poor, possibly due to hazy conditions. Again I lost interest. Later I found that that filter's band-

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pass had been a wide .9 angstroms which is the bare minimum for seeing any detail on the solar disk. DayStar offers filters with bandwidths down to .4 angstroms, maybe these would suffice? So I wrote DayStar for more information. Yes they said contrast goes up exponentially with a decrease in bandwidth! But the cost of such a .4 angstrom filter was nearly $10,000 so again I lost interest. Besides it could only be mounted on refractor, Questar or Sch midt-Cassegrain type telescopes and were totally unsuited to Newtonians. Why this was so the literature didn't say. Even the .7 angstrom filter would run $3000 and again it didn't work on reflectors. Once more interest waned along with the sunspot cycl e.

With the increase in sunspot activity last year came that old desire to see the sun as I did on Haleakala. Then DayStar announced their T-Scanner as an affordable "subangstrom" H-Alpha solar filter. The ads said nothing about price or how "subangstro m" they were. So another letter to DayStar. Again my hopes were dashed. The "subangstrom" filter was only .99 to .9 angstrom and again it didn't work on Newtonians. Price was only $999 but you also had to buy a prefilter than was about $300 on a 10" t elescope.

By this spring I was seeing a lot of sunspots on the sun. H-Alpha fever was still rising, also my curiosity. Why wouldn't DayStar filters work on a Newtonian? So another letter was sent. I learned several things. First off they will work on a reflector with reservations. Secondly DayStar could make the T-Scanner with a .7 Angstrom bandwidth at an extra cost of about $200.

Now for the reservations. Due to the requirements of the filter, it could be made as an insert and use device for unskilled telescope users only on non-reflecting telescopes. Why? Well it seems that the filter needs an f/ratio of f/30 or greater to work properly. Newtonians just don't achieve these long focal ratios. Also the filter needs a prefilter. DayStar makes these machined to slip on the front of the Questar and various Schmidt-Cassegrain telescopes but since the front end of most reflecti ng telescopes have a protruding rod from the secondary holder as well as end rings of many various designs they couldn't make a prefilter that would work. another big problem is that the filter takes up about 2" of back focus. Meaning that unless your f ocuser will crank in at least 2" from where it currently focuses with your 30mm eyepiece you will never be able to focus it! Most properly set up Newtonians don't have this much back focus available.

Now those restrictions didn't seem very difficult to overcome! In fact it took me only a few minutes to come up with the solution. A Barlow lens, properly located, would give the required f/ratio and negate the back focus problem. That protruding ro d was a perfect place to attach the prefilter! Also the cost of the prefilter was greatly reduced as I didn't have to pay for that highly machined holder for the prefilter. My holder was "machined" out of particle board with a $3.95 keyhole saw which sa ved nearly most of the higher cost of the .7 angstrom version of the filter. DayStar

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offered a full refund if not completely satisfied so I ordered one.

Since the .7 angstrom version is a special order I waited nearly 2 months. A phone call from Del Woods (Mr. DayStar) announced the filter was on its way by overnight UPS. Sure enough the next day it arrived. I know a fellow in Minnesota with a small metal lathe. He turned a small lens cell I mounted on the particle board to hold the 3.5" clear aperture prefilter. I found that my old retired Cave barlow lens fit snugly into the front 1.25" tube and was located in such a position that with the 3.5" aperture a f/ratio of f/31 resulted and the focus was about the same as with just an eyepiece so the back focus problem evaporated! Later experiments have raised this to f/45 for improved performance. This did add the need for 1" of back focus but since my telescope is setup for photography that was already built in.

By noon the day after the filter arrived it was ready for first light. The sky was even clear! Would it work? I with a pounding heart I looked in the eyepiece. Well, there was a very red sun but it still looked like a standard solar filter only red . But the T-Scanner comes with a knob. You turn the knob to move the H-Alpha passband across the sun's disk. So I proceeded to turn the knob. Nothing seemed to be happening when suddenly a large bright prominence popped into view where nothing had bee n seen before! It was working! By moving the knob I could isolate on the part of the prominence moving towards me or on the part moving away or on all of it at once. It was moving so rapidly I was seeing dopler shift!

I continued to turn the knob and the prominence vanished as the passband moved onto the disk itself. A very dark filament came into view. A filament is a prominence seen against the surface of the sun. The filter scanned across a small sunspot. It vanished! I was now seeing the chromosphere above the spot itself. Bright and dark markings appeared around where the spot had been and looked much like iron filings in a magnetic field. They are bright hydrogen spicules rising through dark falling chr omospheric gas. They seem to react to the sun's magnetic field so the analogy isn't very far off.

I have since learned that surface detail varies greatly with seeing conditions. Spicules are smaller than the granulation seen in the photosphere and therefore require even better seeing conditions. When the seeing is good you can see nearly the same amount of detail I saw on Haleakala but with reduced contrast. The constantly changing magnetic fields you see under good seeing can be spectacular. They move like some huge magnet is being moved under a paper covered with powdered iron. You can see t he motion it is so rapid at times, especially when a flare erupts. I have seen one large flare and one small something that could have been one.

When seeing is good you can see very fine detail in the prominences. While prominences are seen against a dark sky they have high contrast and are easy to see, seeing surface detail takes a bit of training of the eye

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due to the contrast. After an hour or so you will be amazed by the great increase in detail you see as they eye becomes tuned to the contrast. Even now when I first look in the eyepiece I don't see nearly the detail on the surface I see a few seconds later as the eye and brain process t he image.

One of the most interesting surface features I have seen several times is what I call a smokestack. A small dark spot will suddenly appear. After a few minutes finely textured smoke will drift out of the spot and appear to blow away in the wind. Tuning the filter so it is slightly blue shifted from the H-Alpha line you see the spot turn from dark to bright. Tune it slightly red shifted and it gets very very dark. Apparently it is some type of eruptive prominence being born. It looks just like an overhead view of a smokestack!

One day I found a huge arch prominence much like the one shown on one of the postcards displayed on the wall in Hyde Observatory. It was very active as you could see material falling rapidly toward the sun in it. By looking a few minutes later it had changed considerably but still was in the same place. After an hour or so of this, it lifted up and away over a 45 minute period. It could be seen until it got about .5 solar radii from the edge and it vanished except for a long thin twisting prominenc e that looked like a rope type tornado. The spectacular show was over.

While I can't promise you'll see such a show, all members are welcome to stop by and take a peek. Since I work at home I am here more often than not. Just give a call to be sure I am here. Once you have really seen the sun you will want a filter for yourself. Dave Knisely has and is already going through the same torture I did after seeing the sun atop Haleakala for the first time!

Telescope Making and YOU!

Here's the December insallment of Steve Dodson's articles on the art of telescope making. It was downloaded with the author's permission from Compuserve. [Ed.]

WHY MAKE A TELESCOPE?

Don't the big manufacturers with the big machines have everything going for them? Aren't there enough telescopes on the market ready made? How can I measure up to the professionals?

I'll get into some answers to these questions in a moment, but first I want to explain some terms. (Experienced telescope makers please be patient with me!)

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PARABOLOID:
Telescope mirrors (except possibly very long-focus ones) will not focus light accurately enough if the concave curve is circular in cross-section (spherical). Instead the cross-section must be in the shape of a different curve -- the parabola. The parabolic satellite dishes are a more exaggerated embodiment of the same idea. The "OID" in paraboloid refers to the rotation of a parabola about its central axis to create the parabolic cross-section across every diameter. A paraboloid is said to be the "surface of revolution" of a parabola.

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CORRECTION:
A paraboloid is usually made by generating a spherical curve first (a "circloid") and then polishing out the centre to a greater depth to create the paraboloid. But the change is not really black and white. If the deepening is 97% to 103% (rather arbitrary figures I admit) of the amount required to go from spherical to perfect text-book paraboloid the mirror will probably be called fully corrected. At 90% it would be called UNDERcorrected, and at 110% it would be OVERcorrected.

PITCH-LAP:
A funny sort of "layer cake" consisting (usually) of a glass disc with reddish brown "icing" of pine pitch mixed with bee's wax. A more serious treatment will be coming up in another article. I've never eaten one of these cakes but I have cooked some up on a camp stove!

FIGURING:
The process of adjusting the shape of a telescope mirror after it is polished with rouge or cerium oxide on a pitch-lap. This process looks like more polishing but the path of the mirror (the strokes) on the pitch-lap and the shape of the lap itself are varied by experience to achieve the desired result.

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Now, back to the reasons for telescope-making. Central to this discussion is the amazing precision that the ordinary human hand can achieve when set to work in coordination with the eye, simple materials, and straightforward time honoured procedures. In fact the highest quality optics today are still at least finished by hand if not hand-worked all the way. On the mechanical side a well-thought out carefully hand-built (with simple tools) mounting for a set of telescope optics will frequently result in a steadier more serviceable instrument than a commercially built one, and at a fraction of the cost. But the bottom line is that there is no greater view than discovering fascinating details in celestial vistas with a telescope you have built yourself!

The thrill of making your own mirror or lens comes long before you zoom in on the sky wonders with it. Studying your optical surfaces with simple testing equipment (for example a lamp, a pin-hole, and a razor blade) will reveal deviations on the order of a millionth of an inch that you can correct while figuring. The search for a more and more accurate result is something like a chess game in which you get to know the tendencies of your glass better and better. Before long you can achieve equal or better precision than commercial laboratories.

With mirrors the pay-off is in skills gained rather than financial savings. Finished mirrors, except in large sizes, are not much more expensive than the materials you use to make one. If you are anxious to look through your telescope there is nothing wrong with buying a mirror. Lenses (refractor objectives) are a different story. Here the savings can be big.
By making a telescope (or even just parts of a telescope system) you can expect, with careful planning and coordination of your needs, to end up with a finished product which is much more "user-friendly" to your own circumstances. Not everybody's needs can be reduced to brand names! Besides, a number of innovations which are doing very well commercially first appeared on amateur-made telescopes.

PLANETARY TELESCOPES - TERENCE DICKINSON AT STARFEST

StarFest, the brainstorm of Andreas and Bonnie Gada of the North York Astronomical Association, is Ontario's summer get-together for astronomical idea-sharing and dark-sky observing. The fifth StarFest was held in mid-August 1986 at a campground 150 miles north-west of Toronto. It topped previous years in terms of attendance and telescopes, and variety of talks and activities. Participants came from as far as Ohio and New York state. The focus of interest on "observing hill" was a

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cluster of three Roland Christen (Astrophysics) apochromatic refractors. A first for the astronomical world was an on-line conference linking StarFest to the Space Forum here on CompuServe (pre-Astronomy Forum days) and to the Astronomical League convention in Baltimore. Astronomers from all over North America were thus able to share in the Starfest experience.

The twilight-talk on Saturday evening was given by noted astronomical author and dedicated observer Terence Dickinson. Terry put recent trends in telescope design and their impact on observing trends into focus from a new and fascinating perspective. I will attempt to provide you with the gist of his important address in a condensed form, occasionally using Terry's own words in quotation marks.

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REVOLUTION, EVOLUTION AND MYTHOLOGY IN VISUAL ASTRONOMY

"The title of my talk includes the word mythology." I'm wondering if some well-known statements about observing are not in fact myths. For example, "I'm wondering if the 7mm exit pupil isn't verging on mythology. Do we see the most star-light and the faintest objects?" I've been experimenting and "with 10X50 binoculars (giving a 5mm exit pupil) I invariably see more than with 7X50's. The 7mm exit pupil functions only under EXCEEDINGLY DARK skies. Make the comparison yourself and you will probably find that "the 5mm exit pupil shows more in every circumstance".

"One thing that has grasped me for a long time in the same way as observing a cluster or watching the arch of the milky way across the sky is observing the changing surface features of the planets. [Here Terry showed a slide of a drawing of Jupiter with details in the belts and the shadow of Ganymede on the disc made 20 years before with a 3" Unitron refractor.] It is possible with a small refractor to see a great deal of detail on the planets.

Another bit of mythology ready for the scrap heap is the opinion that the planets are not worth watching because the spacecraft have been there taking all sorts of photos. It is a totally dumb and fallacious statement, and is just an excuse used by people who just look at the planets but don't really observe them. But there is a reason for this that has to do with trends in telescopes.

A typical repertoire of telescopes at a mid-sixties star party included a couple of 3" refractors, an 8-inch home-made cassegrain, and a lot of newtonians, with the single 10-inch considered a monster.

All that changed in 1970 when Tom Johnson brought the first orange-tubed scope to Stellafane "and everyone looked at it and said no way, you can't have it on a fork etc. You should have heard it!" Now, excluding cheap department-store scopes, sales of Schmidt-Cassegrain telescopes (SCT's) equal the sales of all other commercial scopes combined! This is a uniquely appropriate design for an all-purpose telescope, "but one thing it is no good for is looking at planets, and this is proven by the fact that planetary observation in terms of the type of drawing that I showed before has just DISAPPEARED in North America. This type of telescope is virtually never used for that pursuit. And neither is this: this is the second revolution of the past 30 years or so, the Dobsonian revolution of the 1970's, another tremendous advance which allows large apertures on convenient mounts" to be transported to dark sites. But, especially at shorter focal ratios such as f/4.5, this telescope also is no good for planets, because of what it does to the Airy disc. In a perfect, unobstructed system 83% of the light from a star goes into the airy disc, or central part of the star's image. The other 17% of the light goes into the diffraction rings around the disc. "Any obstruction pushes down the disc intensity by putting more light into the rings."

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PLANETARY TELESCOPES PART II - *Terence Dickinson at StarFest*

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The surface of a planet to be imaged by a telescope can be thought of as a large number of points or pixels, each one being imaged as a disc plus rings. The discs to some extent, and the rings especially, overlap in the image, limiting the fineness of the resolved detail and washing-out the contrast. Keeping the greatest possible portion of the light concentrated in the airy discs is the basic strategy here, but the large central obstruction of fast Newtonians and Schmidt-Cassegrain Telescopes (SCT's) "push" light out from the airy discs causing it to mix with light from other areas and creating a general smear or haze.

The popularity of these telescopes, great as they are for general observing, "is the reason, I think, why planetary observing has come to an end other than just a peek-a-boo here and there".
Another myth is the over-use of surface accuracy figures such as 1/10th wave optics or 1/20th wave etc., instead of the more realistic OPTICAL PATH DIFFERENCE (OPD) figure of a total system. This figure-of-merit specifies the amount of distortion in the wavefront of light from a star after it has passed through the entire scope and out the eyepiece. This final wavefront should be flat since the rays leaving a well-focussed scope from a single star should be parallel, but it is found to be rumpled-up to a certain degree. Manufacturers rarely state this overall performance, and even when stating the surface accuracy of the objective they rarely give the Peak-to-Valley measure, which is the important one.

The system OPD is the SUM OF THE SURFACE FIGURES OF ALL COMPONENTS. A Questar Maksutov or an excellent refractor may achieve a 1/16th wave OPD, but that means the individual surfaces have to be 1/30th to 1/60th wave. At this level of accuracy, the system operates at what we can call "100% contrast efficiency", which "I define as the maximum ability to discriminate tones". If there is scattered light from an OPD greater than 1/16th wave or from a central obstruction spreading light out of the airy discs you are not getting that perfect contrast situation.

A 1/16th wave OPD refractor (zero central obstruction) gives 100% contrast efficiency (CE) if there is effectively no chromatic aberration. A long-focus Newtonian reflector with a small diagonal (15% obstruction) gives 76% CE. A short-focus Newtonian or a superb SCT with 1/16th wave OPD gives 52% CE. But in the real world a typical SCT is 1/4 wave overall and gives 20% contrast efficiency.

In a typical reflecting system the components may be 1/10th wave. But the primary mirror adds its errors to the wavefronts TWICE and you also have to add in the errors of the corrector, the secondary mirror, and the star - diagonal to get a total of a quarter or even a third of a wave. A 1/16th wave OPD SCT would have to have each element as good as 1/40th wave, a precision level found on the market only in Questars. The requirement for a 76% CE Newtonian would be similar, though there is one less surface. These systems give bright but spread-out images and the OPD is never specified.

We can now compare telescopes on the basis of CONTRAST EFFECTIVE APERTURE. What apertures are needed in different systems under ideal atmospheric conditions to equal the performance of a 4-inch 1/16th wave apochromatic refractor, which lacks achromatic aberration and gives 100% contrast efficiency? A conventional long-focus achromatic refractor of very high quality would need to have only a fraction of an inch greater aperture, but the best of planetary Newtonian telescopes would have to have a full inch larger aperture. A Questar-quality compound scope would have to have a 5.6-inch aperture to equal the 100% CE of the 4-inch apochromat, and the typical SCT would need an aperture of 9.4 inches! A short-focus reflector of about 7 inches aperture could have a 4-inch contrast effective aperture.

[Terrence will continue next month with part III of his presentation.. Ed.]

Notes From The 2nd V.P.

by Ron Debus

At our November meeting, I brought literature on club T-shirts, jackets, and regular shirts. Our president asked if I could get some samples so our members could get a look at what we're buying. I spoke with Jim and Dave Dier who own a sporting goods business, and they gave me permission to bring the samples to the December meeting. I don't think we will have any problems with the quality.

There is a chance that there will be a price change after January 15, 1988, but not any thing major. Size will be an important factor, since the chance of returning the items is small. I hope the PAC members don't impeach the club officers for spending their money!!

Also, at the November star party (at the Atlas Site), we had a number of guests, a few scouts and some kids from the Lincoln High School Astronomy Club. For those of us who had our scopes there to accommodate these people, we gave them a terrific show. I spoke with the president of the high school club, and he said the kids didn't realize there was so much to see! See you all at the December meeting... Let's have a good turn out!

P.S. Thanks you for listening.

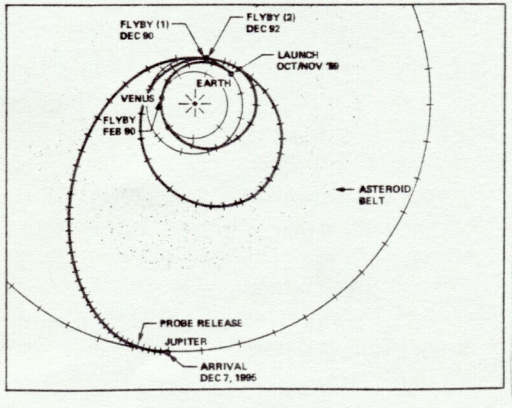
Galileo Goes On...

from Scinec News Magazine

The December 12th issue of Science News reports that the Galileo mission to Jupiter has been set to begin with the October 1989 launching of the shuttle Discovery. To avoid damage to the shuttle, the orbiter/probe will not be launched with the high-energy Centaur rocket, as was planned, but with a smaller launch craft and trajectory which will use the gravitational fields of Venus and Earth. Using this approach, the mission will increase in length from the planned 18 months to about 6 years.

Galileo will fly once around Venus, and twice around Earth once it is launched from the Discovery [See diagram below]. NASA scientists hope that this longer re-vamped mission will allow them to gather more information, including inner-planet data, asteroid data, info on the moon's dark side, as well as a wealth of information from Jupiter. The craft will orbit Jupiter 10 times (in 22 months) and take pictures which will have 20 to 100 times better resolution than those taken by Voyager 2 in 1979. It will also deploy a probe which will enter Jupiter's atmosphere and relay 75 minutes worth of information back to the orbiter before being destroyed.

Once Galileo's instruments wear out and stop functioning, it will remain permanently in orbit around the planet.



At The Last Meeting

by Ellen Owen

Del Motycka, the newly elected club President, called the meeting to order at 7:33:05. There were 22 members present and 4 guests present. Del mentioned his pleasure at being nominated and elected to his position, and expressed excitement for the activities in the year to come.

Ellen Owen presented a very brief Secretary's report, consisting of a re-cap of the election results from the October meeting, and the previous meeting minutes. She also expressed her gratitude for her nomination and election, and is looking forward to the chance to help out in any ways she can. (And she does thank you all!)

Norma Coufal presented her end-of-the-year Treasurer's report. She indicated that there was nothing unusual to report, and explained some of the cost items listed in the report. Cash flow was basically routine except for the money used for the Atlas Site, surveying, and excavation. It was mentioned that the newsletter is donated entirely by John Lortz (Thank you, John!!). Lee Thomas reminded the club that there was still a balance in the savings account of about $2000.00. After some brief questions for clarification, David Knisely moved, and it was seconded, that the report be accepted. Motion carried.

There were several items on the agenda for Old Business. Ron Veys presented the new "Wonders Of The Universe" calendars, which cost $7.95 retail (with a minimum order of 25), $4.00 if ordered earlier, and $5.00 if ordered from now on. Ten of the calendars were pre-orders at a non-returnable rate; the rest are at returnable rate. Dan Neville presented the Observer Handbooks. Dan has lists of members who have ordered the Calendars and Handbooks. Some members have not paid for their orders yet, and should see Dan about this.

Norma Coufal presented checks to Del Motycka and herself for work at the Atlas Site (seeding).

Earl Moser donated a door prize, a roll of Fuji film which he won as a door prize at the Mid-States Convention.

Dave Knisely thanked all participants in the most recent star party. There were about 25 in attendance. The next star party will be held at the Atlas Site on the evening of Friday, December 18. Please come!

Guests at the meeting were introduced (two of whom have now joined the club!). They were Robert Wanser, from the new Lincoln High School Astronomy Club; Ruth Ann Ervo, from Arkansas; Mel Thornton, who has a new telescope; Phil Ruschetti, a new/old member who is now back in Lincoln. Welcome to the new members!

Under New Business there were several topics for discussion. Del Explained that the access shaft has been demolished, and that he has checked with a probe for solidity. It appears to be solid, although not all of the dirt was used up in the filling process. The original contractor went bankrupt, but the new contractor honored the agreement made with the original company. The new company probably incurred a loss due to the difficulty of the task, the time and machinery used. The Club did withhold $100.00 from final payment to insure the completion of the task in the way we wanted. If further settling occurs we will probably have to repair the site ourselves. Del recommended payment of the bill. Lee Thomas so moved, the motion was seconded and carried.

Ron Debus, our new Program Director (or 2nd V.P.), thanked the club for his nomination and election. He remarked that Comet Bradfield was spectacular at the recent star party. He indicated that about a month ago he visited with Jim Diers (a company north of Cornhusker Highway), who has the club logo for T-shirts and jackets. Ron has literature and prices for the various items. Several years ago, John Lortz checked into the prices for golf shirts, which would have cost about $10.50. Ron said that there is quite

continued from page 14
a variety of items available at fairly low cost.

12 - 35 orders	T-shirts	$4.75
12+	Haynes T-shirts	5.30
12 - 35	Nylon/flannel lined Baseball Jacket	18.00
	Satin/flannel jacket	26.00
	Satin/quilted lined	30.00

Ron also mentioned that these items can be ordered in combination, in order to meet the order requirements (Isn't that clever?). If we order 36 - 71 items, or any combination of items, we get an additional price break. Ron will meet with Del and Dan to figure out a payment plan, and he will try to provide a sample for us to examine at the January meeting. Ron veys stated that Jim Diers will put the design on a shirt or jacket that you already own, but it does cost $5.00 for the set-up. Dave Knisely suggested that we wait until January; he believes that more shirts and jackets will sell when we all have recovered from our Christmas spending sprees. (Maybe we better order them in July!) Lee Thomas has the remaining inventory of caps, etc., and will bring them in at the next meeting. Twelve members indicated that they were interested in purchasing a shirt or jacket. It would take about 4 - 6 weeks for the delivery of the goods. The club thanks Ron for his investigation!

Dave Knisely reminded the club members that the next star party will be held Friday, December 18, at the Atlas Site.

Rick Johnson spoke briefly about the up-coming December meeting and requested a change of meeting date to accommodate a former member who will present a program for the meeting. Larry Steppe will be in the area. He is a past president of the club, and now works for the National Observatory at Kitt Peak. He is currently designing the 10m telescope at Mauna Kea, 24" telescopes, and he has some interesting tales to tell. Alternate dates were discussed. Donn Baker moved, it was seconded, that the meeting be moved to Monday, December 28, 1987 at 7:30 p.m. The motion carried. Ellen Owen was instructed to inform John Lortz of the change so that the newsletter could carry the information.

Del Motycka suggested that the club select a site manager for the Atlas Site. There would be (of course) no remuneration for the job other than a free key. The requirements of the job would be to oversee the site and organize clean-ups, etc. Dave Knisely requested some clarification on the structure and the responsibility of the job. The site manager would not be in charge of paying taxes or anything of that nature. The job would be more in the line of helping to take care of the site, and perhaps sealing the access shaft with concrete, creating a windbreak using cedar seedlings already on the site, clean-ups, mowing and spraying weeds (with a crew to help, of course). Del offered a brush mower, but it will need a new motor--you might be on the lookout for one that will fit (see Del). Dave Knisely questioned whether the post would be elective or appointive in nature. Lee Thomas stated that we could not elect a site manager under our current by-laws, but that the club could elect a manager, and that name could be presented to the board as a recommendation for the position. The general feeling of the group was that a site manager would be a good idea, and this topic will be pursued at a later meeting. A notice will be placed in the next newsletter.

The program featured "Earl's Best," by Earl Moser, with Dave Knisely assisting. It included all types of celestial sights taken over a period of more than 20 years. (It was fun trying to identify the object, event, or constellation shown.) Earl casually mentioned that these were "Splendors of the Sky," which seemed an appropriate title. Thank you Earl!

The meeting was adjourned and refreshments were served.

Some Thoughts From the Editor....

I just wanted to thank all of this month's contributors to the newsletter. You may have noticed that this month's letter is a bit longer than usual (4 pages longer, actually). Well, I'm not trying to spoil you or anything, but whenever I've got lots of things to put in, why not expand a bit. I normally plan that the newsletter will be from 8 to 16 pages, depending upon what I can find, and also on how much time I have to put it together. So, you can expect at least an eight page letter each month.

Oh, and there's some good news. I've recently been employed by a software developing firm here in Omaha as a database designer/programmer. What this means to me is more evenings free and weekends free to be an astronomy person. What it means to you is that your newsletter may soon be printed on a laser printer. The firm has three printers which I will have access to, and I plan on printing out the Prairie Astronomer in the after-hours on the laser.

Keep those great articles coming! Oh, and if you have any suggestions, criticisms, etc., please let me know. This is YOUR newsletter!

John Lortz

The Prairie Astronomer

c/o Prairie Astronomy Club, Inc

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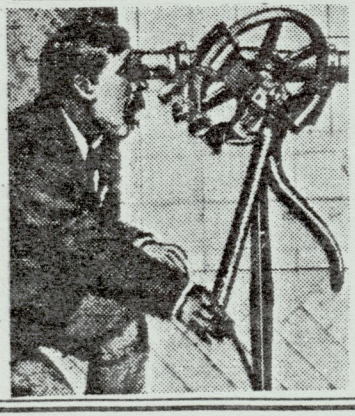

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PAC Meeting December 28th