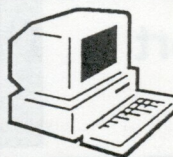


President's Report

by Dave Scherping



If you have access to Internet, see the
Prairie Astronomy Club web page:
<http://infoanalytic.com/pac/>
E-mail us at: pac@infoanalytic.com
Omaha Astronomical Society web page:
<http://www.top.net/cdchenev>
NEKAAL web page: <http://world.std.com/~wic/>

AUGUST/SEPTEMBER MEETING NOTICES:

GENERAL MEETING
TUESDAY, AUGUST 27th, 7:30 p.m.
at Hyde Memorial Observatory

ATLAS SITE WORK BEE
SATURDAY, SEPTEMBER 7th, 2:00 p.m.
(For site preparation before the club picnic)

CLUB PICNIC AND STAR PARTY
SATURDAY, SEPTEMBER 14th, 6:30 p.m.
Picnic at Hyde Memorial Observatory
Star Party afterwards at Atlas Observing Site
(weather permitting)

MAHONEY PUBLIC STAR PARTY
FRIDAY, SEPTEMBER 20th
at Mahoney State Park
on the Soccer Field

NSP3 was a huge success. I'd like to thank all of those who volunteered their time and efforts into making it one of the best star parties ever. I couldn't begin to list all of those who helped out. I've heard nothing but great reviews from those who attended.

Apart from NSP, let's not forget the upcoming work bee at the Atlas Site on September 7th at 2:00 P.M. and the PAC picnic on September 14th. We need at least 6-8 people for the work bee, and especially someone with a pickup truck to make a trip to the dump. Please call me if you are going to the workbee, so we can have an idea of what can be accomplished and I'll pass along any late information.

On September 20th the PAC & OAS will again sponsor a public observing night at Mahoney State Park. This will be the last one for this year. We typically have one hundred to two hundred visitors and need all the scopes we can get. Call me at 477-2596 if you need additional information.

Home, Home on the Net...

by Ben Rush

I've been working with Mark Dahmke recently in designing the new Prairie Astronomy Club Homepage. We are anticipating a small address change, although, we will leave something at the original address to re-direct you to the correct place.

The new homepage will be a updated and be more easily navigated with imagemaps and more subpages. There will also be the appearance of a new section entitled "For the Public", which is a public oriented kind of "What's Up" section. It will feature links, information, etc. that the public will be into. I have also posted an advertisement on the bulletin board at Hyde Memorial Observatory about the homepage to get more of a public interest. Hopefully, with this new homepage, we can raise a few more eyebrows, but it won't be at it's best unless you let me know what you think about it. So, keep your eye open for the new version and keep me posted at my NEW email address: Kwende@inetnebr.com

The October *Prairie Astronomer* issue will have the updated club membership list in it. The information included will be the member's name, address, city, state, phone number and, if applicable, e-mail address.

Please review the information in the last published membership list (April *P.A.* issue) to see that it has correct information. Notify me about any corrections or changes and if you wish not to have your address or phone number published, then let me know that too.

Names and addresses of newer members will be the same as what appeared in the "Welcome New Members" sections unless I'm otherwise notified.

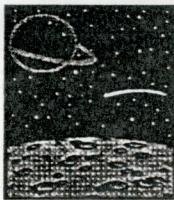
In the case of a family membership, a primary name or two names may be listed, such as "Barney Rubble" or "Barney and Betty Rubble".

Copies of the April issue with the last published list will be available at the August 27th PAC meeting for your inspection.
- Bryan Schaaf

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Observing Chairman's Report by Douglas Bell



For September 1996 Observing:

New Moon:	September 12, 1996	Top 40:	The coat hanger
Lunar object:	Kepler rays	Deep sky:	NGC 7789
Planet:	Lunar eclipse	Challenge:	Central star in
Messier monthly:	M 57		M57

Tip of the month: Schmidt Cassegrains should occasionally have their focus racked all the way in, then all the way out and back. It distributes the grease on the main mirror bearing and helps keep focusing smooth and image shift down.

Quote: "NASA has made a startling discovery that points to the possibility that a primitive form of microscopic life may have existed on Mars more than three billion years ago." - Daniel S. Golden, NASA Administrator

Lunar feature: Kepler rays
The rays are an astoundingly bright feature and a good full Moon object. It'll give you something to show the people after the eclipse is over.

Planet of the month: A lunar eclipse
Shiiiiine on, shine on har-vest Moooo-oon. A warm autumn evening, a harvest Moon and a perfectly timed lunar eclipse. What could be better? This one should be just right for Mom, Dad, the kids, and the neighbors. Make some new friends and introduce someone to astronomy. Don't forget to tell them that a lunar eclipse is perfectly safe, many people don't know. Totality starts at 9:19 p.m., September 26th.

Messier Monthly: M 57
Since we don't have a planet for Planet of the Month, why not a planetary? Autumn seems to be the time of year for planetaries so here's another for your collection.

Top 40: The Coathanger
OK, so who said everything has to be an actual object. Put a gazillion stars in the sky and our brain will form some of them into familiar shapes. This asterism is an easy binocular object in southern Cygnus. Do you really have to ask what it looks like?

Deep Sky: NGC 7789
A nice open cluster (in Cassiopeia) without a "M" in front of it.

Challenge: M 57 central star
Some people make a sport out of nothing but finding central stars in planetary nebulae. Here's a Messier with a difficult one. You'll need plenty of aperture, dark skies, and a good night. For an extra challenge, leave the OIII filter at home.

Astro trivia: What did the Mayas know about Venus that the ancient Greeks completely missed?

Last month's answer: NSP is the best time traveling place I know. Somewhere on the short drive between Merritt Resort and the observing field is the line separating Central and Mountain time. I usually arrive at the site about 50 minutes before I left.

Iowa Astronomy Club Needs Help

July 25, 1996

Hello Fellow Amateur Astronomers,

On Sunday, July 21st, the Des Moines Astronomical Society's observatory was burglarized and several items were stolen. Included in the loss was a SBIG ST-4 CCD (SN# 419306817), an 8" Parks Newtonian/Cassigrain, a Celestron C5 telescope and tripod, several eyepieces, and much more.

We are attempting to alert the amateur astronomy community of this loss in the event someone is approached to purchase these items from the central Iowa region. We are led to believe the people responsible for this crime are astronomers (sad as it is) because the items taken are not your everyday street merchandise. The observatory has a computer, TV/VCR, and slide projector which were not touched.

The most frustrating angle of this theft was the loss of a physically-challenged member's telescope. We stored the scope at the observatory for his convenience and he was very active with our public night program. The scope, a Celestron C5, was removed from its case, taken along with his tripod and eyepieces.

I'm writing to advise your club members to be on the look out for any of these items being sold in national astronomy publications or at astronomy gatherings, ie., swap meets, conferences, star parties. If you feel a sale is suspicious, please notify me either through email or telephone. My number is 515-255-1585.

Thank you,
Brian Butcher
President
Des Moines Astronomical Society
butcherbr@dmps.des-moines.k12.ia.us
<http://www.geocities.com/paris/2313/dmas.html>

1996 GREAT PLAINS STAR PARTY
Scopeville, Kansas, September 12 - 15, 1996
Presented by: Kansas Astrophotographers and Observers Society
Questions? Contact Dan Johnson - Chairman (913) 897-0235

The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc. Membership expiration date is listed on the mailing label. Membership dues are: Regular Members...\$15/yr.; Family Memberships...\$17/yr.; Address all new memberships, 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: President Dave Scherping (Lincoln) 477-2596, Treasurer John Bruce (Lincoln) 483-0389, Secretary Bryan Schaaf (Lincoln) 438-4285. All newsletter comments and articles should be sent to: Bryan Schaaf, 1309 W. PLUM, LINCOLN, NE 68522 (or E-mail to schaafb@aol.com) ten days prior to the club meeting. Club meetings are held the last Tuesday of each month at Hyde Memorial Observatory in Lincoln, Nebraska.

MEETING ADJOURNED...



Secretary's Report by Bryan Schaaf

The July 30th PAC meeting at Hyde Memorial Observatory was sparsely attended with only about twenty people. Most of the chairs were unoccupied, but three persons arrived after the beginning of the meeting.

"What's up?" Jupiter is the most conspicuous celestial planet shining brightly in the southeast to south skies throughout the evenings. Comet Hale-Bopp is gradually appearing brighter and when the tail points more sideways to our line-of-sight it will look more like a comet.

Club officers acted on last month's motion which "empowered the executive board to sell the property (Atlas Observing site land) as it so decides". The 20th Century Castle's "option to buy" papers were signed a day previous to the meeting. The action DOESN'T mean that the property is sold. It merely means that 20th Century Castles has the option to buy the property for \$20,000, at least, within the term of one year. No representative from the organization has even seen the site land, let alone made any decision whatsoever.

NSP is just around the corner (already happened as you read this) and PAC registrants are outnumbered by registrants of the Omaha Astronomical Society. At last count the number of registrants was 218 not counting all family members per registration, so the number is likely a lot more, perhaps 250, and the number is expected to grow.

Mark Dahmke and Doug Bell have worked a lot on a press release and distributed it to all the major TV networks and newspapers. There will be a "NSP live" web site also (read about these and other post NSP news elsewhere in the Prairie Astronomer newsletter).

Lou Dorland, in charge of door prizes, mentioned many such prizes and some are:

Observing Guide to Comet Hale-Bopp, Starry Messenger subscription, purchase certificate from Scope City, 2 Telrads, RealSky CD, red beam flashlights, Will Tirion Sky Atlas maps, camera film certificate, Astronomy Magazine subscription, several eyepieces of various sizes, Visions of Mars CD-ROM, Distant Suns CD-ROM, EXT Astro Telescope (\$500 value), Burnham's Celestial Handbook (three volumes), A Starry Room (book by Fred Schaaf) and other books, broad band filter, ST4 CCD software and more prizes that Lou mentioned but the secretary couldn't write them down quick enough!

There was information mentioned about NSP speakers and catered meals also.

The 12.5 inch Newtonian club telescope that has resided near Hickman for many years was transported to Tom Miller's shed for the time being by John Bruce and Jerry Williams recently. No calls were made to people that a month before volunteered for the project because the telescope move didn't require so much help. The telescope shed that housed the telescope, however, still needs to be dismantled and disposed of or moved.

Chris Alberts described a paper planet game that he invented and passed out the papers to a few members. His father, Russ won the game. The winning prize was a quarter provided by Dad.

Jack Dunn has been working on a new planetarium show about Comet Hale-Bopp. He said most of the content is from Adler Planetarium and is very good. It includes interesting quotes from many different astronomy celebrities talking about comets. It will show very soon at Ralph Mueller Planetarium.

Martin Gaskell, with a little help from the children present, provided the program; a demonstration of telescope mirror making. Martin brought along a couple of mirrors in progress and a grinding stand made by a friend from Trinity Baptist Church (who clearly needs to become a PAC member!). Martin emphasized that building a grinding stand is not essential and that a mirror can be made on a kitchen table or a corner of a workbench.

Martin gave some recommendations for books to get. The classic is "Amateur Telescope Making" edited by Albert Ingalls. Williman-Bell has just reprinted most of this, but the original is available in the club library. The most advanced book on the subject is "How to Make a Telescope" by Jean Texereau, but Martin said that this book had the disadvantage of making mirror making look too difficult. Instead, for a beginning book, he recommended getting "All about Telescopes" by Sam Brown (Edmund Scientific).

For people wanting help with mirror making Martin recommended the ATM archives at <http://www.system.missouri.edu/ics/staff/Andy/ATM/> You can also subscribe to these by sending an e-mail message with no subject and just "subscribe atm" (with no quotes) in the body of the message to "majordomo@short.net. There is a lot of new stuff out that is not in any books yet.

Martin and his over enthusiastic little helpers showed the basic grinding stroke using #120 Carborundum powder to do to first stage of smoothing of a 12" mirror. This was done with two Pyrex disks. Martin then explained that the disk that does not become the mirror (the "tool"), can also be used to make a mirror, so it is possible to make TWO mirrors with a Willman-Bell mirror making kit. To do this you need to make another tool. Martin showed one he had made by epoxying some bathroom tiles to some thick pieces of plywood. His helpers then demonstrated using this to rough-grind an 8.5" mirror destined to be the upgrade mirror for TelPoke. Working at it full time an 8" mirror can be made from start to finish in just two days. The final stages of testing a mirror and doing the final figuring were not demonstrated, but Martin emphasized that they were not difficult.

The meeting ended with club members trying out grinding the two mirrors. He said that anyone who would like to try their hand at some grinding is welcome to give him a call (464-9664) and arrange to come around some time.

Comet Hale-Bopp was easy to see at NSP.

It was in the southeast corner of the constellation Ophiuchus when NSP commenced on August 10th and in the center region of Ophiuchus when it ended. By the eye alone it appeared as a small blob of hazy light like a globular cluster, but through a telescope the blob became a large fan-shaped coma with a short tail. From now until April of next year it will gradually grow in apparent size as it approaches Earth and the tail becomes more sideways to our line of sight. -Bryan Schaaf

The Prairie Astronomy Club September 1996

S	M	T	W	T	F	S
1 Pioneer 11 spacecraft, first Saturn flyby, returned first closeup images, 1979	2 Venus passes 9 deg. S. of Pollux, Midnight	3 Viking 2 landing on Mars, 1976 Karl Harding discovers asteroid Juno, 1804	4 LAST QUARTER MOON 2:06 PM Galileo craft orbital trim maneuver #10 Comet Hale-Bopp 17h 37.0m -06o23' mag. 5.37	5 Scheduled launch of Progress M-33, Russia Voyager 1 launched, 1977	6 Galileo spacecraft 2nd Ganymede flyby	7 Asteroid 1996 EN near Earth flyby (0.1466 AU)
8 Moon at apogee, 253,400 miles 8:47 PM Moon passes 6 deg. S. of Mars 2 PM Moon passes 3 deg. S. of Venus 6 PM	9 Asteroid 1994 PC near Earth flyby (0.1706AU) Galileo O.T.M. # 11 E. Barnard discovers Amalthea, moon of Jupiter, 1892	10 Ariane 4 scheduled launch of Echostar 2	11 ICE spacecraft, first flyby of a comet, Giacobini-Zinner, 1985	12 NEW MOON 6:07 PM Scheduled launch STS-79, Atlantis Space Shuttle, 4th Mir docking Gemini 11 launched, 1966, with R. Gordon and P. Conrad aboard	13 Mercury-Atlas 4 launched, 1961 (unmanned) Luna 2, first craft to Impact Moon, 1959	14 Asteroid 1996 EN near Earth flyby (0.1466 AU)
15 Moon passes 5 deg. N. of Neptune 6 AM Autumnal Equinox, 1st day of Fall in the northern hemisphere 1:01 PM Jupiter passes 1/2 deg. north of M22	16 Asteroid 1989 RS1 near Earth flyby (0.1937 AU)	17 Mercury at inferior conjunction	18	19 William Bond discovers Hyperion, moon of Saturn, 1848	20 FIRST QUARTER MOON 6:23 AM	21 Moon passes 6 deg. N. of Jupiter 1 AM Comet IRAS closest approach to Earth (0.9715 AU)
22 Moon passes 5 deg. N. of Neptune 6 AM Autumnal Equinox, 1st day of Fall in the northern hemisphere 1:01 PM Jupiter passes 1/2 deg. north of M22	23 Johann Galle discovers Neptune, 1846	24 PAC MEETING 7:30 PM AT HYDE MEMORIAL OBS. Moon at perigee, 226,800 miles 4:44 PM	25	26 FULL MOON 9:54 PM- LUNAR ECLIPSE, totality begins 9:19 PM, mideclipse 9:54 PM, totality ends 10:29 PM Saturn at opposition & only 2.3 deg. from Moon	27 Jupiter occults SAO 180954 Sept. 27th-Oct 1, Antique Telescope Society, 5th annual convention, Bath & London, England	28 Look for Mercury due east in the dawn sky at end of September. Best chance to see it all year! Luna 19, Soviet Moon orbiter launched, 1971
29	30	<p>A TOTAL ECLIPSE of the Moon occurs on the evening of September 26th -27th. The partial eclipse begins at 8:12 p.m. Totality begins at 9:19 p.m.; mideclipse at 9:54 p.m. Totality ends at 10:29 p.m.; partial eclipse ends at 11:36 p.m. The departing penumbra might be last visible at 12:05 a.m. Saturn (mag. 0.5) is at opposition just four hours before the Moon and will be only 2.3 deg. east-southeast of the Moon at the time of totality. Saturn this month rises before evening twilight ends. The rings are narrowly tilted only 5 degrees from our line-of-sight. Mars (mag. 1.5) appears to the left of Venus (-4.2) in the early morning as September begins and they are within 3 degrees of each other during most of the first week. Venus will appear about 3 degrees south of M44, the Beehive Cluster, on the mornings of the 12th through the 14th. Mars will scoot along the south edge of M44 on the 21st. By the end of the month Mercury (mag 0.0) will be plainly visible due east in the dawn sky. Comet Hale-Bopp begins the month about 3.5 degrees south of globular cluster M14 (mag. 7.6) in Ophiuchus traveling northwest until it begins a turn to the northeast by the end of September. Using just your eyes, try seeing Comet HB (mag. 5.4) between Gamma and Eta Ophiuchi during mideclipse of the Moon. Jupiter (mag. -2.4) shines brightly in the south evening sky in Sagittarius meandering near 6th magnitude globular cluster M22 all month. <i>Clear skies!</i></p>				

Questions & Answers

Conducted by AstroMan

Thank you for
the questions!

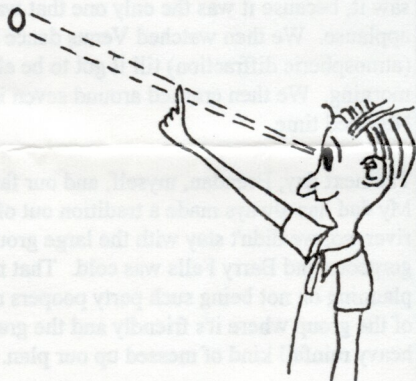


Q: When the moon is near the horizon it looks bigger than when it is overhead. Why?

A: The moon appears bigger when it is near the horizon, because near the horizon there is terrestrial scenery like distant houses, buildings, trees, etc. that provide your brain with the opportunity to make simple size comparisons. We know the actual size of a distant house, for example, and can see that the apparent size of the moon overwhelms the apparent size of the house. Your brain tells you that the moon is LARGE.

When the moon is high in the sky, well away from the horizon and terrestrial scenery, your brain no longer has the opportunity to make a simple size comparison and tells you the moon is SMALLER. The brain is no longer tricked by the optical illusion of a larger than normal size moon.

There is a simple test you can do to prove to yourself that the moon size "illusion" is just what it is. Stand so you are facing the moon. Close one eye and, with your arm outstretched, sight past your little finger at the moon. You will see that the width of your finger will easily exceed the moon-width*. When you sight in this manner the moon will appear the same size during two such sightings on the same day regardless of whether the moon is near the horizon or in any other position in the sky.



The same sort of test can be done by sighting through a narrow tube of paper that's about 10 inches long.

To see how much the moon's apparent size DOES change, try making such sightings when the moon is at *perigee*, when the Earth-Moon distance is smallest, and at *apogee*, when the Earth-Moon distance is greatest (see the PAC calendar for when these occur). The difference is distinguishable over a period of about two weeks.

Q: Can you explain transparency and seeing? And while you're at it, why do people say that my scope needs an hour to cool off before it will work right?

A: "Seeing" is a term used by astronomers that refers to atmospheric turbulence. "Good seeing" means that the telescopic observer can see images that are sharp and steady. "Poor seeing" means that the images are blurred and in random motion due to random refraction of the light caused by turbulent air in the atmosphere. Poor seeing yields a sky characterized by a sort of haze that is very noticeable in telescopic

*The phase of the moon is not an issue here, by the way. The moon-width as it is expressed here refers to the entire circle image, not just the portion illuminated by the sun.

images. During exceptionally good seeing observers can clearly see minute planetary or stellar details that are invisible or very difficult to see other times.

Generally there are five categories of "seeing". They are: I. good (best), II-III. typical, IV. poor, and V. extremely bad. Observers sometimes rate seeing (on any given night or even hour, as seeing can deteriorate or improve quickly) using numbers on a scale of one to five or one to ten with one being the best.

During "typical seeing", when images are fairly steady it is oftentimes possible to glimpse moments of good seeing. For seconds at a time the air in the path of light sometimes momentarily steadies allowing a patient observer the chance to see exceptional details, such as cloud band details or a moon transit of Jupiter, for example. It often pays off to wait patiently at the eyepiece looking for several minutes until seeing momentarily improves and details suddenly "pop" into view.

On a night when local atmospheric conditions afford good seeing throughout the sky in general, this is called "sky transparency". Such a time can occur after a rain has cleansed dust and pollutants from the air.

A telescope needs to be "cooled off" before it will work right. This means that the air inside the telescope tube and telescope material surfaces must cool to the temperature of the outside air. When a telescope is taken outdoors from a warm house to cool night air, there is still warm air inside the tube. If you try to observe immediately, you'll notice a disappointing blurry image because the light entering the tube is scattered by the extreme change of air temperature. It takes about 45 minutes to an hour for the telescope temperature to equalize with the night air temperature.

Telescope lenses and mirrors are effected by temperature differences as well. The primary mirror of a reflecting telescope, for example, can render a poor image because it is slightly distorted by the difference.

Q: Do you know of any good books on how to build a high quality truss tube scope?

Yes. There's a good book entitled "A Guide to Building Truss Tube Telescopes" by Randy Cunningham, available through AstroSystems (303-587-5838). It's 63 pages includes a parts description, drawings, terminology, formulae, optical design, mechanical design, assembly and more. It costs \$19.00.

Questions about astronomy or PAC can be confidentially sent to AstroMan in care of Bryan Schaaf (see address and phone number at the bottom of page 2).

A Total Lunar Eclipse will occur on the evening of **September 26th**.

Watch for the Moon to enter the Earth's umbral shadow at approximately **8:12 P.M.**

Totality will begin at **9:12 P.M.**

Mid-eclipse will be at **9:54 P.M.**

Totality will end at **10:29 P.M.**

The Moon will leave the umbral shadow at **11:36 P.M.**

PERSEID METEOR SHOWER REPORTS

by Martin and Barbara Gaskell

Apparently the burst in the Perseids (2-3X normal rate) occurred at August 12.06 UT so we missed it in Nebraska. However the intrepid Gaskell family meteor observers made a careful magnitude study on August 11/12 (CDT) and our main result just got published in the International Astronomical Union Circulars. This is that the Perseids were about two magnitudes brighter than the historic mean at this time. The only other time the Perseids were that bright was during the 1993 outburst following the passage of P/Swift-Tuttle. This change in magnitude distribution is something that does not seem to be in the literature yet (or if it is, I haven't come across it).

In more technical terms, the "population index" has flattened from the normal 2.4 or so to about 1.6. This means that the central ribbon of the Perseids has selectively lost its smaller particles. - Martin

We had a fun night camping out at Behlen Observatory to watch the meteor shower (pretty tame camping). We all lay out on a big tarp about fifteen feet from the door of the observatory with our blankets and pillows and counted meteors. Timothy was afraid of the dark and worried that a meteor might land on his head, so after begging the rest of us to go inside, he finally settled for snuggling under a blanket and looking at the ground, while mildly wondering why he didn't ever see any. Daniel thought the whole thing was wonderful and the next day was inventing all sorts of ways for making our own meteors [Get a tall ladder, lean it against a tree, climb real high and drop a rock from up there. "Mommy, is there enough friction to catch a rock on fire if you dropped it from the top of a tree? No? Maybe we could light it with a candle first before we dropped it? No? How about dropping it from the State Capitol building? No? An airplane? No? Well alright then, maybe I'll grow up to be an astronaut and we'll take a rock up in the space shuttle, and throw it out the window towards the earth?" "Yes, Daniel, that would actually work". Whew!]. Laura fell asleep in my arms. After a while the boys fell asleep too. Martin and I were left holding hands trying not to wake everybody else up with our oo's and aah's. Finally, we carried all the blankets and sleeping children inside and camped on the floor of the large lecture room. We did this to get away from the mosquitoes but the bugs turned out not to be very bad this year and it probably would have been just as nice to have slept outside. There weren't a whole lot of meteors compared with 1993, but the ones we saw were bright, and a few were truly spectacular. -Barbara

ASTROMAN'S NSP DECATHLON

(based in-part on actual NSP experiences)

EVENT #1: Swim across Merritt Reservoir with your scope on your back. (points deducted for getting the scope wet)

EVENT #2: Climb a 250 ft high sandhill. (points deducted for each cactus in your rear).

EVENT #3: Swim back to get eyepieces, repeat events #1 & 2, then observe all 100 Messier Objects.

EVENT #4: "Dobsled" down the sandhill.

EVENT #5: Swim & run the 30 miles to Valentine, (up to 3 hours allowed to get a burger at Snake Falls Restaurant)

A SIRIUS TALE

by Ben Rush

I was able to make it to the star party for Wednesday and Friday night and I have to say that I did have a very fun time. Being my second time around, I had a little better idea of what to expect, of the number of people and of the terrain in which I would be observing.

Basically, the first night, Brendan Goble and I found ourselves a little hill to observe upon. Not twenty minutes later, both he and I dubbed the hill, "Death Mountain", along with some others including "Hill of Horror", "Mt. Suicide", and "Prickley's Peak". It wasn't that we didn't enjoy the hill. It had one of the best views of the entire area, but it was just getting up and down that was the problem. As the night went on, Brendan and I observed a lot of Messier's, a few NGC's and one or two IC's.

Really early morning, he and I both took a breather and did what teenagers do best, eat. Downing our third bag of chips, he and I were nearly dropped to our knees at a rather incredible meteor. I'm not sure how many were lucky enough to see it, but it was amazing and it had to have lit up the sky for several seconds afterwards. I know some others saw it, because it was the only one that was followed by serious applause. We then watched Venus dance around the sky for a while (atmospheric diffraction) till it got to be about five or six in the morning. We then crashed around seven in the morning; our usual NSP bed time.

The next day, Brendan, myself, and our families went on the Niobrara. My dad has always made a tradition out of the path he takes down the river, so, we didn't stay with the large group very much. The river was gorgeous and Barry Falls was cold. That night, Brendan and I were planning on not being such party poopers and go observe with the rest of the group where it's friendly and the grass is mowed. Unfortunately, heavy rainfall kind of messed up our plan.

Brendan and I swear up and down next year, we're bringing a radio telescope.

I will definitely go to next year's NSP and encourage all others to attend also. A lot of great memories will come out of it. Bring a friend; the more, the better.

EVENT #6: Rent a canoe and a bike and canoe 15 miles down the Niobrara River, running an obstacle course between the water balloons and buckets of water coming from observers on the bridge. (Extra points for standing under Smith Falls...brrrrrrr!)

EVENT #7: Ride the bike back to Merritt Reservoir. (Extra points for returning the canoe)

EVENT #8: Run the 200 yard dash with the "Clear Skies Coordinator" on your back and throw him in the lake, as payment for the cloudy skies on Tuesday night. (extra points if he howls like a coyote).

EVENT #9: Set out a dozen trot lines for catfish. (extra points for actually catching one)

EVENT #10: Remove grasshoppers from telescope, then stay up all night (again!) and complete the Herschel 400 list. (extra points for drawing them)

DOUBLE STARS TO FOLLOW, PART IV:

ZETA AQUARII AND MU CYGNI

by Martin Gaskell

This is part IV in my series on double stars that you can actually see do something. Part I was in the July 1994 newsletter (p. 4), part II was in March 1995 (p. 3) and part III was in April 1995 (p. 2). If you've not saved your old issues of "The Prairie Astronomer" (shame on you!), all three articles can be found on the club's web page (address on the cover of this newsletter).

I've given stars for the winter (Castor), spring (Gamma Virginis and Xi Ursa Majoris), and summer (70 Ophiuchi). Now it's time to cover the late summer and fall, but don't forget 70 Ophiuchi. I have measured it as late as the latter half of September.

ZETA AQUARII

Zeta Aquarii, the central star in "the water jar" asterism of Aquarius is a magnificent double star with a separation of almost exactly two arc-second. The two components are almost exactly the same brightness (4.42 and 4.59 V). See if you can tell which is the brightest of the pair! At a casual glance I can't! The near equality of the magnitudes makes Zeta Aquarii an easy pair to resolve and measure (and a good one to show to your neighbours too).

Zeta Aquarii was apparently first observed to be double by Christian Mayer, the director of the Mannheim Observatory, in 1777. It was also "rediscovered" by William Herschel a couple of years later. If you observe it this year you will be seeing it on exactly the opposite side of the orbit.

Because Zeta Aquarii has not been seen to go through even half an orbit, the size and shape of the orbit, and hence the orbital period are uncertain. When only about a third of the orbit had been observed, estimates of the orbital period ranged from 400 to 1600 years. As we have approached following the star for half an orbit, the uncertainty in this will be reduced. The latest orbit calculation I know of (the one in Norton's 2000) is by R. S. Harrington in 1968 and is almost 30 years out of date. It gives a period of 856 years.

The Zeta Aquarii system is 76 light years away. The components orbit each other in an elliptical orbit that takes them almost four times closer at their closest together than at their furthest apart. Even at their closest together though they are further apart than the sun and Pluto. The last closest approach ("periastron") took place in 1957, but because of the tilt of the orbit, the stars appeared to be closest together for us in 1977 when they were 1.77" apart.

The components of Zeta Aquarii appear to be revolving around each other clockwise. At the end of 1955 they were due E-W and in the fall of 2008 they will be due N-S. They are currently rotating in position angle about 1.5 degrees per year. To appreciate this from one season to the next you will need some kind of measuring scale, but over a few years it will be obvious just from simple sketches. Although the motion is not as spectacular as 70 Ophiuchi's, with cardboard micrometer measurements it should be possible to detect motion of Zeta Aquarii even during a single observing season.

At the top of the next column is an ephemeris for the next few years so that you can check out your position angle estimates.

Zeta Aquarii ephemeris

Year	PA	Sep.
1996.7 (Sep. 15)	196.3	2.02"
1997.7	194.8	2.04"
1998.7	193.4	2.06"
1999.7	191.9	2.09"
2000.0	190.6	2.12"

Although the stars will eventually be about 6.4" apart (at the end of the 23rd century!) the separation is not changing much right now. The change per year is less than the measurement error for my cardboard micrometer. However, there might be deviations from this ephemeris at a level that could be detected by a cardboard

micrometer, because there is reportedly a third component orbiting star B with a 25.5 year period. This would produce a wobble of up to 0.1" about the ephemeris of the AB pair given above. I've not been able to check up on current opinions on the reality of this third component. Many claimed third components of binaries have later proved to be over interpretation of residuals. Xi Ursa Majoris, which I featured in part III of this series also has a reported companion producing a wobble of about 0.05" (something I should have mentioned in that article). These tertiaries are of too low luminosity to be seen directly. The putative tertiary in the Zeta Aquarii system has a mass of 0.28 solar masses and is probably a red dwarf or a white dwarf. It is about 9 astronomical units from star B. That is the same separation as the Sun and Saturn.

One of the reasons for studying double stars is to learn the masses of stars. The A component of Zeta Aquarii has a mass of about 1.1 solar masses and the B component a mass of 0.9 solar masses. In mass therefore these stars are very similar to our sun. However, these stars are about 7 times more luminous than our sun (2 magnitudes brighter in absolute magnitude), so they are more evolved. The hydrogen in their cores is exhausted and they are becoming red giants. The spectroscopic interpretation of both stars as subgiants supports this interpretation.

Finally, a piece of Zeta Aquarii astronomical trivia: Zeta Aquarii is currently south of the celestial equator. In the year 2004 it is going to be exactly on the celestial equator and after that it is going to be a northern hemisphere object.

MU CYGNI

For those of you who want a little more of a challenge, try Mu Cygni. It was also discovered by Christian Mayer. It is about the same distance as Zeta Aquarii, the real and apparent sizes of the orbits are similar, as are the periods, but the stars of Mu Cygni are of unequal brightness (4.7 and 6.1). It is the magnitude difference that makes Mu Cygni more of a challenge. The magnitude difference is similar to the one in 70 Ophiuchi, but the stars appear closer at the moment. It is beyond the range of a cardboard micrometer on TelPoke.

The orbit of Mu Cygni is a little more eccentric than the orbit of Zeta Aquarii and it is within 13 degrees of being edge-on to our line-of-sight. This means that there are two times per orbit when the stars appear closest. One was in 1937 when the stars were 0.55" apart. The next is going to be in 2017 when they will be 0.82" apart. The system is now closing from a separation of 1.86" in 1972. The stars were also at their closest in space in 1962 so they are revolving around each other quite quickly, at about 1.3 degrees per year. Like Zeta Aquarii, this is a case where a careful sketch will reveal a change in PA over five to ten years. In 1951 the stars were due E-W; in 2015 they will be due N-S. See the brief ephemeris for Mu Cygni on the last page.

(Continued on page 8)

Mu Cygni ephemeris

Year	PA	Sep.
1995.0	312.5	1.37"
2000.0	320.1	1.20"

This ephemeris was calculated before the ellipse of the orbit was well defined, so there will probably be deviations from it at a level measurable with a cardboard micrometer.

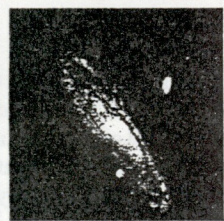
BUILD YOUR OWN CARDBOARD MICROMETER

In this series of articles I have often mentioned my cardboard micrometer. If you want to build one and missed my program on this, the basic idea can be found in volume 1 of the Webb Society Observers' Handbooks ("Double Stars"). This book is in the club library. I make my degree scale on my computer printer using the Sky & Telescope BASIC program. The dot-matrix printer version of this is available from Sky Publishing, and in the last few months Sky & Telescope has published a new laser printer version. I hope that someday I will finish an article describing the details of my observing procedures. If you're impatient, the Webb Society Handbook should tell you all you need to know. Give the club librarian (Bryan Schaaf, 438-4285) a call and check it out!

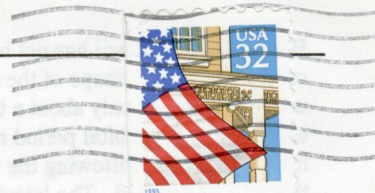
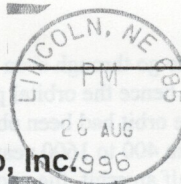
SKETCHING POSITION ANGLES

Try sketching the orientation of the pair relative to the east-west drift direction of the stars. I tried this in August with Zeta Aquarii. Then I took a protractor and measured the position angle on my sketch. I was within a few degrees of the right position angle. It's not as good as a micrometer measurement, but since the pairs I've described this month are each moving by about 15 degrees per decade, you will be able to detect the motion over a five to ten year period. Just try to be careful and then don't lose your observing notebook.

If you have an eyepiece with a cross-wire in it, you can tape a degree scale on the outside of it and use it to measure the position angle more precisely.



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