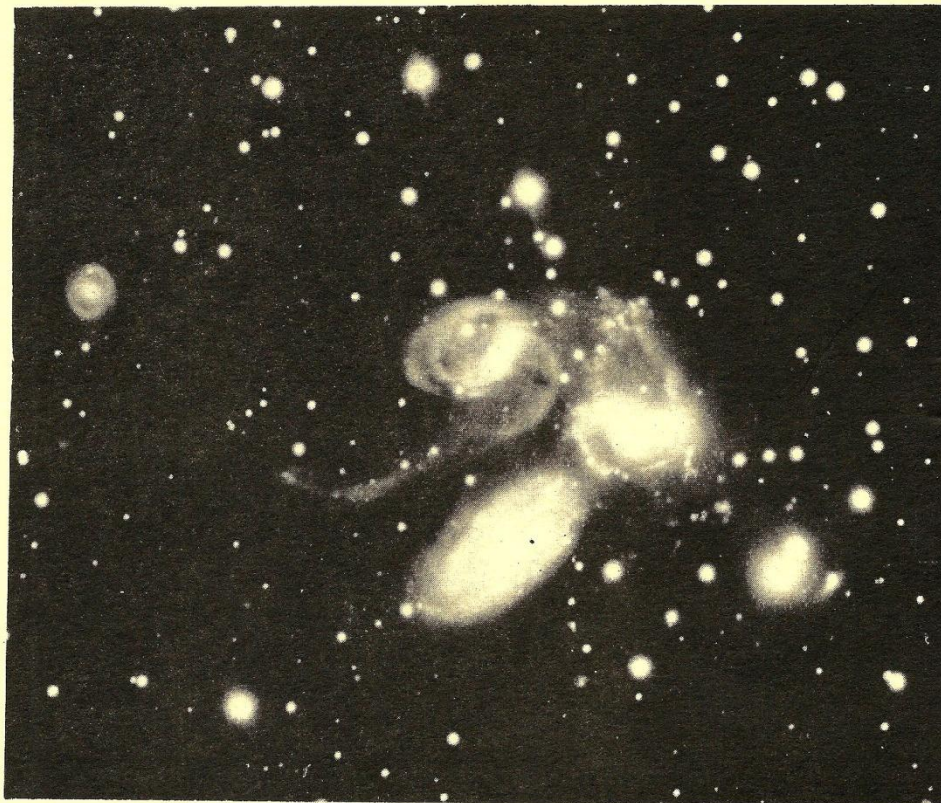


THE WASP

The Warren Astronomical Society
P.O. Box 474
East Detroit, Michigan 48021



Unusual Deep Sky Objects for Winter: Top right, the famous group of galaxies in Pegasus known as Stephan's Quintet. Left, the Horsehead Nebula in Orion, best example of a dark nebula. At lower right is M78, a reflection nebula also located in Orion.



Dec 78/Jan 79

THE WARREN ASTRONOMICAL SOCIETY PUBLICATION

EDITORIAL

BY JEFF STANEK

I am quite proud of the route this paper is taking. However, there is still room for improvement. In my opinion, a magazine's first impression upon people is its cover. When someone sees an amateur magazine with professional pictures, they suspect that no one cares for an amateur cover. The only excuse I can come up with is that everybody's camera is broke.

At the beginning of my editorship, I asked almost everybody to write an article for me. As you can see, a lot of people came through for me and wrote articles. This issue of the W.A.S.P. should be evidence enough for you. But there are still a lot of people who won't write an article. Unfortunately, all I can do is ask. And that is as far as I can go to ask for cover pictures. There are a lot of people in the club who are interested in astrophotography; all I am asking for is a picture from you shutter-snappers out there once in a while to use for the cover. I had a lot of luck in asking for articles, now let's get some pictures in here to me to use for the cover.

If you decide to write a article, it can be about anything you want: astrophotography, telescope making, informative articles, name it, I'll probably take it. Also, it can be any length you want it to be. The deadline for articles is the Cranbrook meeting before the Macomb meeting of the same month. All articles you write must be submitted to me first.

Now I would like to express my thanks to the people who have written articles for me. I really appreciate it and hope you will write some more articles for me in the near future. The W.A.S.P. has the potential for being a great paper; we have the people to run the paper, and people to write the articles. This is only the beginning, now I would like some articles from people who have never written one before or haven't in a long time. But of course, I still need articles from all you regulars out there.

Well, that's about all for this month. I'm grateful to you people who have written me an article for me this month. One last thing, don't say that this is a really big issue, say that this is a regular issue.

MINUTES OF THE OCTOBER 19, 1978 MEETING OF THE WARREN ASTRONOMICAL SOCIETY:

Our President Dave Harrington opened the meeting at Macomb Community College at 8:15 p.m. It was announced that Dr. Paul Strong would give a talk and film presentation on the "Solar Connection" Before the talk, however, Frank McCullough, chairman of the Christmas banquet, made known his plans for the annual occasion. This year, Antonio's was chosen as the site for the party. Located in Harper Woods, Antonio's features a varied menu including Italian cuisine and American specialties. Thursday, December 14 has been chosen for the date. Cocktails will be served 7:30 to 8:00 p.m., and dinner will start at about 8:15 p.m. Members were asked to deposit \$2 as soon as possible in order to assure their reservations.

For those desiring more specific information, Frank gave 8 Mile and Kelly Roads as the nearest crossroads with the Eastland Shopping Center located across the road.

The attendance book was then passed around for members and guests to sign. Robin Bock, hospitality chairman, requested help with refreshments either by paying or donating. Jeff Stanek, editor of our newspaper, told members of the availability of bumper stickers and emblems. The treasurer's report indicated that \$244.44 is the current balance. Mrs. Bock entreated members to bring their dues up to date.

John Searles announced that there would be a best amateur research paper award which will be presented at the Great Lakes Regional Convention which will be held at the University of Toledo next spring.

Dr. Paul Strong gave a well researched report on solar energy. Stressing practical importance, he ascertained the stability of the sun. He brought out the effect of the sun on Earth, Mars and Venus temperatures. The future use of solar energy, he said, could be projected through the study of cosmic seasons, M 51, and intensive study of solar variations. He advocated bringing society up to date on current trends and ideas on solar behavior in order to put it to practical application. He detailed the activity of our own sun with special emphasis being put on solar flares.

After intermission, Dennis Jozwik took the floor to give his talk and exposition on his astrophotographic experiments with red, green and blue colors of stars. His researched talk covered film qualities, color fluctuations and perceptions. The North American Nebula, California Nebulae. Orion Nebula, M31 Andromeda Galaxy were all viewed by members. A question and answer period followed. Future experiments would be conducted and documented by Mr. Jozwik for sharing with club members.

Our president cordially invited all members and guests to a social hour at Denny's Restaurant which is customary following the Macomb College meetings. The evening was adjourned at 10:45 p.m.

Respectfully submitted,

Loretta D. Caulley
Loretta D. Caulley, Secretary

Magazine Review

by Brad Vincent

TELESCOPE MAKING; Editor: Richard Berry; AstroMedia Corp., Milwaukee, WI; \$8.00/yr.

Another magazine dealing with the amateur astronomer has made its appearance. Unlike those with a price tag out of this world that repeats information already known, Telescope Making has promise. The first issue, I must admit, was a shock to my wallet when I saw it. Only 16 pages! After careful reading, I discovered the error of my ways.

Being a first issue, it was a bit short of articles. The editor wrote a short piece on a 4" f/10 reflector but the rest are by amateur and professional astronomers. In the editorial, Richard Derry emphasizes that TM is "the magazine by, for and about telescope makers!" This is true, as can be seen by the contents. Mention was made by Berry that they are looking for articles for the coming issues and he provided an address.

The five articles ranged from pitch laps to Schiefspiegler. Those interested in Cassegrain optical systems will find a complete explanation by Dr. R. A. Buchroeder. He starts with finding the basic ratios involved to a complete design of a Cass telescope. The figures may seem confusing to you after a first reading (I know I was baffled), but a careful review proves interesting. It also gives an idea of the complication involved in such a telescope.

We go from the modern to the unique, a 3 inch Schiefspiegler. Also known as a Tilted Component Telescope, this is a clever observing instrument invented by Anton Kutter of West Germany. The spherical primary is mounted back in the mount itself. The light is reflected forward and through the side of what appears to be a refractor. The secondary mirror at its end focuses the light back to the eyepiece, which in this case is over 2 feet away. The article is complete with pictures and a scale drawing. Those who attempt this noble venture have very good instructions plus reference to further details. Even if you don't plan on building such an instrument, the article makes very interesting reading.

Mountings are always a problem for the beginner, and there are many to choose from. Frank Sanders proposes a unique and novel design made completely of wood. The parts slip together easily and can be broken down into a neat package for traveling. Being mostly plywood and pine, the expense shouldn't be as much as that for a pure pipe mounting. Complete scale drawings and instructions make it easy.

Making a pitch lap is always fun. Nothing is comparable to the thrill of finding out the pitch was the wrong temperature when poured or discovering the lap is harder than diamond after it's hard. Mr. Sherman Schultz, Jr. teaches a telescope making class at Macalester College in Minnesota. He goes through a fast and neat process his class has found very successful. He and his class have tried numerous methods and find theirs the best. They have been able to correct a 6 inch standard f-ratio mirror in less than 500 strokes using this lap. I plan to use it on my mirror just to test his results, (probably around 1982).

The editor's article on a 4 inch reflector brings out yet another set of ideas. He has made it largely of plywood and constructed an inverted fork mount with a minimum of pipe. The plywood tube has proved a good thermal conductor for the author with no problems suffered on cold and hot evenings. Both his primary and secondary mirrors were obtained from Jaegers. This sounds like a fine trial for those interested in deciding on whether to try for a 6 or 8.

The back of TM contains a section called the Blue Pages. This is their version of classified ads. Instead of a ream of pictures and come-ons, we have several departments with names and addresses of companies which can help.

The magazine has promise. I learned a few interesting and useful things from the first issue. Being written by fellow amateurs and some pros brings it close to a club newspaper. I find this rather good. Two bucks an issue sounds high, but I think it's worth it.

ANNOUNCING

THE TENTH ANNUAL GREAT LAKES ASTRONOMY SYMPOSIUM
&
THE ANNUAL CONVENTION OF GREAT LAKES REGION OF THE ASTRONOMICAL LEAGUE

MAY 18-19, 1979

KEYNOTE AND AWARDS BANQUET ADDRESS BY

DR. FRANK DRAKE
DIRECTOR, NATIONAL ASTRONOMY & IONOSPHERE CTR
CORNELL UNIVERSITY

AWARDS

KENNETH E. CHILTON AWARD

To the amateur astronomer who contributed most
towards promotion of amateur astronomy last
year as voted by those at the conference.

BEST ASTRONOMICAL INSTRUMENT AWARD

To the amateur astronomer who constructs and
displays the best telescope or instrument as
decided by the judges at the conference.

BEST AMATEUR RESEARCH AWARD

To the amateur astronomer who has done the
most important research work as reported at
the conference and as decided by the judges.

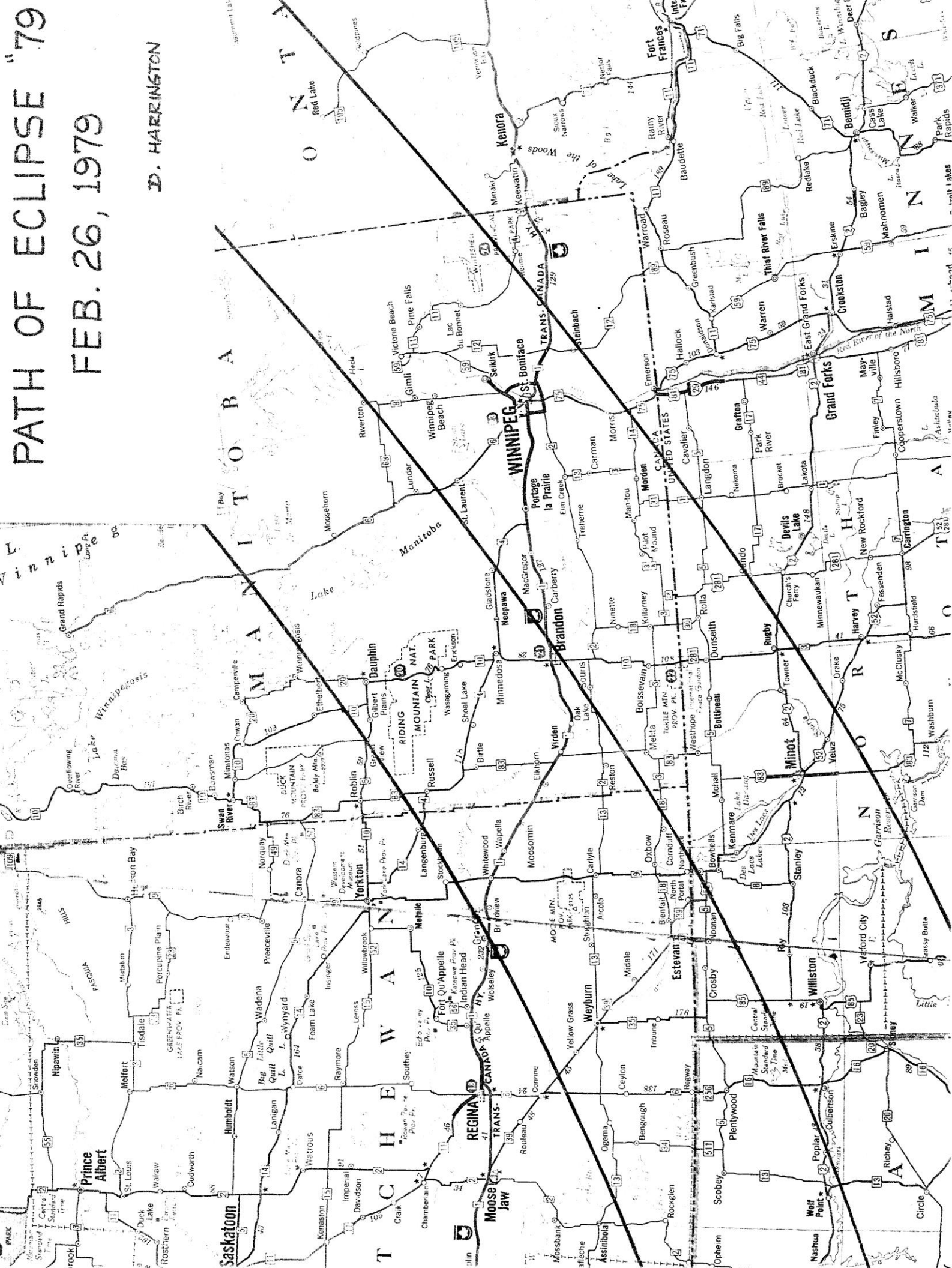
OTHER AWARDS AND DOOR PRIZES

120 ROOMS RESERVED AT THREE MOTELS UNTIL MAY 1

WICK COICHAGOFF, CHAIRMAN
% Rogers High School
5539 Nebraska Ave.
Toledo, OH 43615

PATH OF ECLIPSE "79 FEB. 26, 1979

D. HARRINGTON



An Extraordinary Lens for Astrophotography???

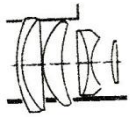
by Dennis Jozwik

Super fast telephoto lenses (F/1.5 to F/2.5) of good quality are a rarity, and super fast telephoto lenses which can be used for astrophotography and aren't prohibitively expensive are even rarer. Up until now, the only telephoto lenses which I found could be used wide open for deep sky photography were either Schmidt cameras or the 7 inch (178 mm) focal length Aero Ektar lens. The Schmidt cameras provide large apertures, fast focal ratios, and produce fantastic stellar images. However they are difficult to use because each photo requires an individual piece of film be cut and loaded into the curved film holder by hand. The Aero Ektar on the other hand is 2.8 inches in diameter and only works well wide open (at F/2.5) when adopted to a 35 mm camera--this is because the lens suffers from excessive vignetting when a larger size film is used with the lens working at F/2.5.

In an attempt to find a better lens, about 4 years ago I purchased a Soligar F/1.8, 135 mm preset telephoto lens. This lens has 5 elements, weighs about 2½ lbs., and currently costs about \$150 for the automatic version of the lens. The glass used in the lens I purchased had a green tint--which resulted in green tinted astrophotos. This lens also produced lousy star images when used wide open at F/1.8, and it didn't improve much when I stopped the lens down to F/2. Basically it suffered from severe inward coma and spherical aberration. So I sold the lens.

Still looking for a good astrophoto lens, a few months ago I purchased a Spiratone F/1.8, 135 mm automatic telephoto lens. This lens has 5 elements also, but it weights about a pound less than the Soligar lens. It is multicoated, for better transmission of all wavelengths of visible light, and the glass is white in color--in other words there is no color tint in the glass. The cost of this lens is about \$90. Test star photos made with this lens wide open, reveal it is much better corrected than the Soligar F/1.8; but it still does not produce as good an image as the 7 inch Aero Ektar across the entire field. In fact, this lens behaves rather strangely --in some parts of the field (not necessarily in the center) the star images are perfect, while in other parts (not necessarily near the edge) the star images are lousy.

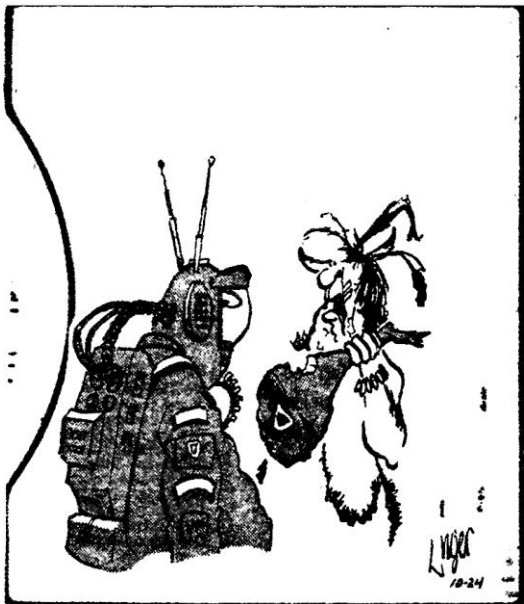
A few months ago, a fellow by the name of Rudy Kokich, in N.Y., started advertizing a 135 mm, F/1.8 lens in Sky and Telescope for \$135. This lens has 6 elements (see figure), is multicoated, and weighs 2 pounds, 13 oz.--it's a monster. Originally these lenses were sold by Spiratone, under the trade names Lentar or Spiratone; but they are no longer carried by that firm. Instead Spiratone carries the lens mentioned in the previous paragraph.



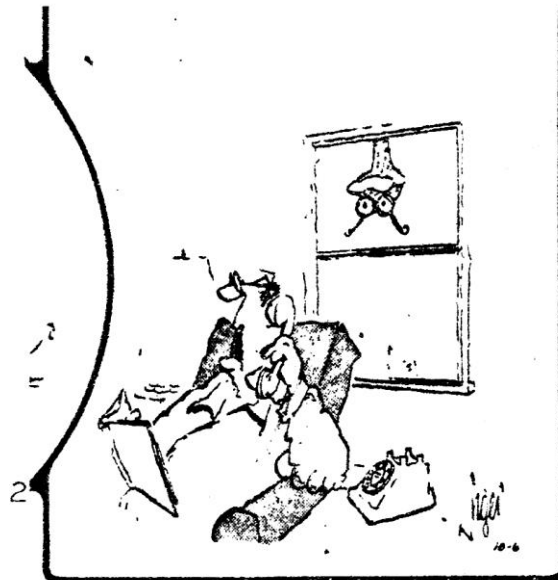
Rudy Kokich stated in his literature that "the lens is sufficiently well corrected to allow use of full aperture". He also states that the "large 3 inch aperture has perfectly imaged stars from edge to edge". These statements sound incredible, but star tests reveal they are true! The fact of the matter is that one amateur in this area purchased this lens and his star photos reveal perfect images at F/1.8 from center to edge. It could be that the one extra element in this lens is making all of the difference, or it may be that this lens was designed to work best when focused at infinity and wide open, or it may be both of these things.

The question now remaining is will all of these 6 element 135 mm lenses perform equally well? At this writing I don't know, but at the meeting tonight I will compare my lens with two others owned by members of the D.A.S.

If you are interested in one of these lenses, see page 460 of the Nov. 1978 S&T. Two items I should mention: this lens is not fully automatic as the ad states, but rather it is a preset lens; and if you wish to use this type of lens it must be used completely away from city lights - even Camp Rotary is too bright!

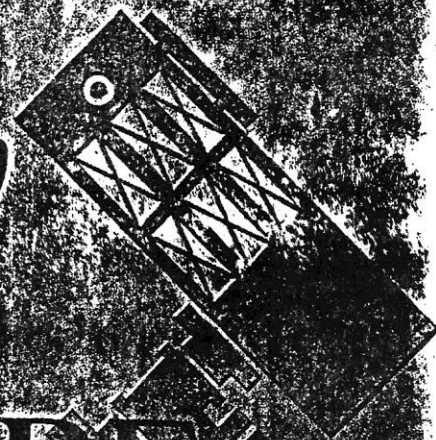


"You come 50 million miles and all you can tell me is, 'Stick that meat on the fire; it'll taste better?'"



"Harry across the street says we've got a big silver thing parked on our roof."

SKY and TELESCOPE



OBSERVER'S PAGE

Universal time (UT) is used unless otherwise noted.

ARE THE PERSEIDS IMPROVING?

"IT IS WELL KNOWN that the annual Perseid meteor shower is associated with Periodic Comet Swift-Tuttle (1862 III)," writes John A. Russell, emeritus professor of astronomy at the University of Southern California. "Brian Marsden has predicted a likely return of this 120-year comet around 1981. Charles Kowal notes that although historical records are unclear as to whether or not the Perseid shower is enhanced near the time of the comet's perihelion, it will be interesting to monitor the shower carefully for the next few years."

Persons who observed the Perseids this past August may agree with Mr. Kowal's statement. In 30 years of observing this meteor shower, Dr. Russell has "never

seen the Perseids as strong as they were on the morning of August 12th." During 4.6 hours on the night of maximum, he was able to photograph 19 meteor spectra, using a single spectrograph.

In Michigan, 14 members of the Warren Astronomical Society observed the Perseids between 2:30 and 7:00 UT on the 12th. Two persons were assigned to the same sky region, thus assuring uninterrupted coverage since one kept a constant vigil while the other recorded. Peak shower activity was centered on 6:00 UT when 68 meteors were seen in an hour. A fairly constant rate of 7.3 sporadic meteors per hour was also logged. The Warren group noted the mean magnitude of the Perseids to be 2.2, and most of them appeared to be white.

YEA TEAM"

Frank - can I change position?
No Roger
That's a 747

I'm Cold - I'm Wet
I'm having fun?

Who stepped on
My potatoe chips

Five hours
till dawn

Doug!
Stop Shoring

If its 0100 UT in Greenwich
then its ---
Mark!
N-N-N

This Coffee
is terrible

Who's Dog is
on my blanket

CASSIOPEIA
The Lady in the Chair

Cassiopeia is a beautiful constellation of the Northern Hemisphere. Five bright stars almost exactly form the letter "M" or "W" depending on the time of viewing. Seasonally Queen Cassiopeia's ill-starred formation is autumnal. It is located between Cepheus and Perseus and, can be lined up with Polaris in Ursa Major. It is now overhead and forms the letter "M". Rich in legend, it is to the Greeks that we learn the most interesting story. Seems that the beautiful Cassiopeia was married to the great Cepheus, King of Ethiopia. This high ranking couple were the parents of Andromeda. Queen's Cass's faults nearly did her in. This foolish woman boasted that her beauty excelled that of the sea nymphs. The sea nymphs tattled to the god, Neptune who ruled the sea. Favoring the nymphs, Neptune decided to punish Conceited Cassiopeia. Andromeda, their lovely daughter, was thereupon chained to a rock on the seashore. She was to be a dandy dessert for a local monster who terrorized the Ethiopians with his cruelty and great appetite. Andromeda's escape is the subject of another story that properly will be told at a later date when referring to her constellation.

Poor Cassiopeia was then subjected to the eternal indignity of being placed in a starry chair which circles the Pole Star. She can be seen nightly standing and revolving on her head. She is truly a casualty of mythology and has been called the "Heaven-troubled Queen" and "Unhappy Cassiopeia". If Neptune had not been so vengeful, we amateur astronomers would be missing a very fascinating constellation full of gorgeous double stars, magnificent clusters, and Nova 1572. NGC 663, rich in stars, was discovered by Caroline Herschel in 1783. M52 was first noted by Caroline's great brother, John, in 1788.

Cassiopeia makes an excellent timepiece. With practice, modern star gazers can tell the exact time by observation of the movement of its stars in reference to the Pole Star. The tactless Cassiopeia has been thus immortalized for her foolish tongue and lack of humility. We astronomers can only marvel at her unique and rich telescopic fields. She has so redeemed herself with people of diverse cultures who have admired her scientifically, artistically and esthetically.

Loretta D. Caulley

THE APPRENTICE ASTRONOMERS NOTEBOOK

Lou Faix

Perhaps this column should have a subtitle:

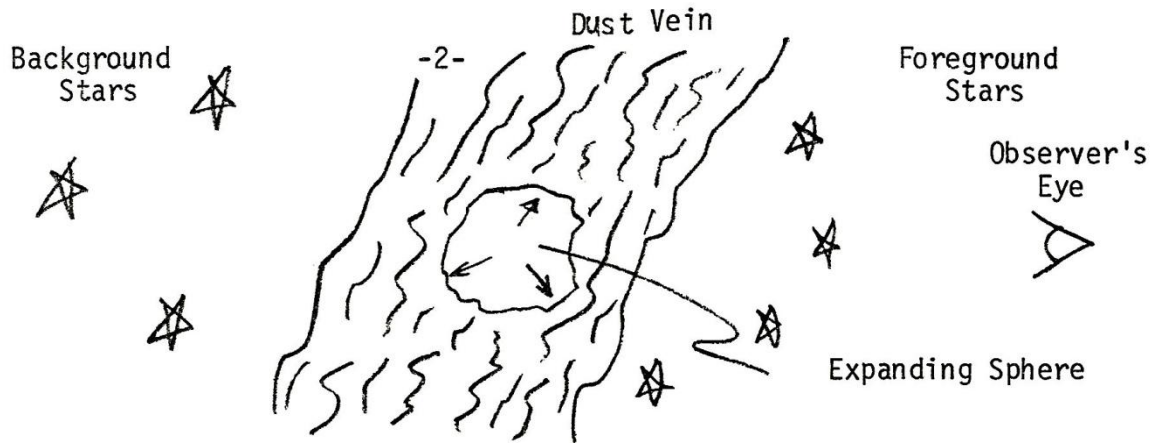
"MY APOLOGIES, MR. BURNHAM"

There are three reasons for writing this particular edition of the AAN:

- 1) To illustrate the pitfalls of jumping to conclusions.
- 2) To demonstrate the trouble you can get into by using your mouth more than your brain.
- 3) To show how applying a little high school math can make an amateur astronomers observation more comprehensible and meaningful.

A few months back at a Cranbrook meeting of the WAS, I was discussing some of the extraordinary gaseous nebulae found in the summer sky. In particular we illustrated and discussed the great Veil, or Loop, Nebula in Cygnus. Of special note was the western extension (NGC 6960) observed in the vicinity of the bright star 52 Cygni. On a clear moonless night with a moderate size telescope, an amateur observer will note that there are more faint stars to the east of nebula cloud than there are to the west. In Burnham's Celestial Handbook, Volume II, there is an especially fine series of photographs of the entire nebula structure taken with the 60 inch reflector at the Mount Wilson Observatory. Even casual analysis of those photos make it obvious that there are more stars visible within the nearly circular boundaries of the nebula than there are outside its boundaries. Truly a curious visual phenomenon!

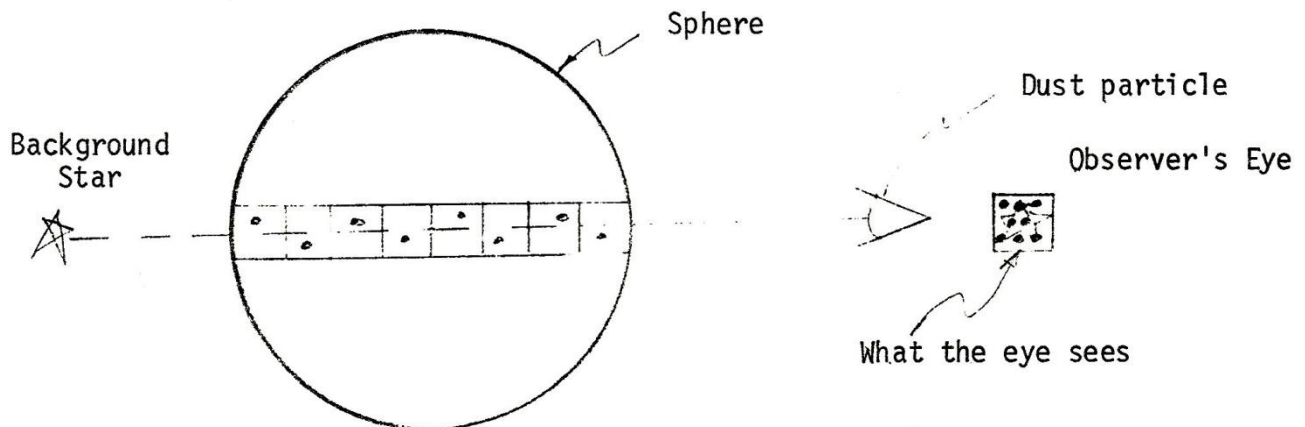
It's a universally accepted belief that the Veil Nebula is the remains of a supernova explosion that probably occurred 30 to 40 thousand years ago. Strong support for this belief is gathered not only from the objects spherical shape but also from its current measured expansion velocity of 45 miles per seconds. Essentially the nebula is an expanding bubble in space. Millenniums after the initial blast, the shock waves are still rushing outwards and like an ocean wave, are sweeping ahead of it all the dirt and debris that lies in its path. On page 805 of this classic work, Mr. Burnham points out that the supernova obviously occurred inside one of the dust lanes of our Milky Way and that the sweeping action of the expanding shell accounts for the increased transparency of the sky through the nebula.



Stars between the dust veil and an Earth bound observer are generally bright due to their proximity and are about equally distributed inside and outside the perimeter of the Loop. Stars which lie on the far side of the dust veil are fainter not only because of their greater distance but also because of the obscuring effect of the opaque dust. Mr. Burnham suggested that the expanding nebula was opening up a window in the dust veil and hence the greater visibility to the fainter background stars.

With little real analysis of the problem, I leaped to conclusions and rejected that explanation as contrary to common sense (mistake #1). Superficially it seemed that just rearranging the dust in space shouldn't change the overall opaqueness of that dust. After all, there was just as much dirt (or maybe more) after the blast as there was before. I erroneously reasoned that if there was a spherical fish bowl of dirty water, drying out the water and leaving the same amount of dirt uniformly deposited on the glass wouldn't make the bowl any more transparent. - WRONG - WRONG - WRONG - You may remember the presentation where I expressed my sleazy line of logic (1) and criticized Mr. Burnham's too brief explanation (mistake #2) for all the world to hear; I apologize to you Mr. Burnham, where ever you are. (Grovel, crawl, grovel)

It's really amazing what a little rational analysis and high school math can do. Let's take another look at the problem. Assume a spherical object, like a balloon or a fishbowl, filled with a uniform cloud of dust. Let there be one particle of dust for each cubic unit of space. Let the sphere have a radius of four units. Now if we were to look straight through the center of the sphere our line of sight would pass through eight cube units of space. Therefore, there would be light dust particles along our line of sight and our vision would be dimmed accordingly.



Now imagine that we take all the internal dust and spread it out uniformly on the surface of the sphere. How many dirt particles will be in our line of sight now? To do this we must first determine the total number of dust particles inside the sphere. Since we started by assuming one particle per cubic unit we must determine the Volume of the sphere which is:

$$V = \frac{4}{3} \cdot \pi \cdot r^3 \text{ where } r \text{ is the radius (4)}$$

$$V = \frac{4}{3} \cdot \pi \cdot 4^3 = 268.02 \text{ units or particles}$$

Secondly, we must determine the surface Area of the sphere which is:

$$A = 4 \cdot \pi \cdot r^2$$

$$A = 4 \cdot \pi \cdot 4^2 = 201.06$$

If the dirt is uniformly distributed on the surface, the amount of dirt per square unit is:

$$268.02/201.06 = 1.333 \text{ particles/square}$$

Since our line of vision must pass through two surfaces there would be 2.66 dust particles in our line of sight. This is only one third as much obscuration ($2.66/8 = 1/3$) as when the dirt was spread out inside the sphere.

$$\frac{V = \frac{4}{3} \pi r^3}{A = 4 \pi r^2} = \frac{r}{3}$$

If visibility is improved threefold a background star would appear 1.55 magnitudes brighter.

$$m^{2.51} = 3$$

$$m = 1.55 \text{ (do this with logarithms)}$$

If the faintest stars we could see were to increase in brightness threefold, the distance to the most remote stars we could see would increase by the ratio of $\sqrt[3]{3}$ or 1.732 times. Remember that light intensity diminish by the inverse of the square of the distance. Double the distance and the light is one fourth as bright. If we assume that stars are uniformly dispersed in space, and they are not, the total number of stars we could count with a threefold increase in vision would be the ratio of the increased spherical volume:

$$(\sqrt[3]{3})^3 = 5.196$$

In actuality the Mt. Wilson photos display approximately a threefold increase in the number of faint stars visible through the Veil Nebula.

Mr. Burnham – you're right on-

SKY CALENDAR DECEMBER 1978

Information for helping teachers and students observe the sky

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
<p>PLANETS (In order of appearance during the night): JUPITER is nearly twice as bright as Sirius, the brightest star. Jupiter rises in ENE within 4½ hrs after sundown on Dec 1 and within 2 hrs after on Dec 31 (see Dec star map). It passes S 7 hrs after rising. SATURN rises just N of E about 3 hrs after Jupiter and within 1½ hrs after Regulus. Saturn is high in S as morning twilight begins. VENUS, rising 2½ to more than 3½ hrs before sunup, is spectacular morning object in SE. Look for MERCURY in a.m. twilight 21°-25° lower left of Venus beginning Dec 12. Don't confuse Mercury with Antares. See diagrams.</p> <p>Evening (SSW): 3 Note pair of 3rd-magnitude stars Alpha and Beta Capricorni near moon. α Alpha, β upper one, is naked eye double star. Binoculars or telescope needed to split Beta.</p> <p>Venus attains its greatest possible brilliance this week. At magnitude -4.4 it is about 140 times as bright as Spica, the 1st magnitude star to its upper right.</p> <p>• Castor</p> <p>• Pollux</p> <p>4 hrs after sunset: East</p> <p>Jupiter</p> <p>• Procyon</p> <p>• Moon</p> <p>Morning: SSE</p> <p>Evening: SW</p> <p>• Spica</p> <p>• α</p> <p>• β</p>	<p>PLANETS (In order of appearance during the night): JUPITER is nearly twice as bright as Sirius, the brightest star. Jupiter rises in ENE within 4½ hrs after sundown on Dec 1 and within 2 hrs after on Dec 31 (see Dec star map). It passes S 7 hrs after rising. SATURN rises just N of E about 3 hrs after Jupiter and within 1½ hrs after Regulus. Saturn is high in S as morning twilight begins. VENUS, rising 2½ to more than 3½ hrs before sunup, is spectacular morning object in SE. Look for MERCURY in a.m. twilight 21°-25° lower left of Venus beginning Dec 12. Don't confuse Mercury with Antares. 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Magnitudes of the Planets: Venus -4.3 to -4.4 to -4.3; Jupiter -2.0 to -2.1; Mercury: Dec 13 +0.8; Dec 18 +0.2; Dec 31 -0.2. Saturn +1.1 to +0.9. Motions during December: Venus goes 17° eastward in Libra and passes 2.8° N of 3rd-magnitude Alpha Dec 18 (see diagrams). Mercury during Dec 15-31 goes 13° eastward from Scorpius into Ophiuchus. Mercury passes 7° N of Antares Dec 23. Jupiter, in the same binocular field as the Beehive Cluster in Cancer, goes 2° west. It passes 27' (nearly ½°) N of 4th mag Delta Dec 15, and at month's end is only 1° S of the Beehive. Saturn, in Leo about 14° east of Regulus, goes 0.5° east Dec 1-25, then begins retrograde. 4.6-magnitude Chi Leonis is 33' from Saturn late in month.

SKY CALENDAR JANUARY 1979

Information for helping teachers and students observe the sky

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
<p>Diagrams labeled Moving or Evening show sky during mid-twilight about 3/4 hour before sunrise or 3/4 hour after sunset, respectively, from latitude 40° N. Diagrams for Jan 13, 16, 27, 28 are for other times, as noted.</p> <p>In two weeks, Pluto moves inside the orbit of Neptune and becomes the eighth planet until 1999.</p> <p>Regulus * Morning: Face west Jan 14-16. Moon Tues morn</p> <p>Moon Monday morning</p> <p>Moon Sunday morning</p> <p>Morning: SSW 21</p> <p>Moon at Last Quarter (90° west of sun)</p> <p>New Moon 1:20 a.m. EST Jan 28. Try to see very young moon. Look close to horizon above sunset point about 15 min later. Moon about 16 hr old from E Coast, 19 hr old from West. 1/2 hr after sunset.</p>	<p>Look at Jupiter with binoculars in late evening. Note cluster of stars 1° north (upper left) of Jupiter: the Recluse! The quadrilateral of 4th and 5th magnitude stars surrounding it provides a useful reference for plotting Jupiter.</p> <p>Evening: East 8</p> <p>Pleiades</p> <p>Moon</p> <p>Morning: Face west Jan 14-16. * Aldebaran</p> <p>15 SE. Venus Match Venus pass Antares this week (closest Wednesday, 8° apart).</p> <p>16 Sunset: 4 1/2 hrs after sunset: East. Regulus * Moon</p> <p>17 Morning: MSW * Saturn Moon Regulus *</p> <p>18 Top view of solar system today. Venus at greatest elongation west of sun. Angle at Earth = 47°.</p> <p>19 Sun enters Capricornus. That constellation is hidden in the sun's glare, but Cancer is in opposition to the sun and visible all night. What bright "star" is visiting Cancer until it leaves evening sky in July?</p> <p>20 Morning: SSW Moon</p> <p>21 Try to see very old moon. Look very close to horizon half an hour before sunrise, 25° S of E and 36° lower left of Venus. Moon about 19 hr before New from East Coast, 16 hr before New from West.</p>	<p>January 2, morning: Venus Face SE.</p> <p>* Antares</p> <p>* Mercury</p> <p>January 10, morning: SE. Venus * Look for β Scorpii 3° S (lower right) of Venus. Can you still see Mercury? Antares *</p> <p>January 17, morning: MSW * Saturn Moon Regulus *</p> <p>January 24, morning: SE * Venus Moon Antares *</p> <p>January 25, morning: SE * Venus Moon Antares *</p> <p>January 26, morning: SE * Venus Moon Antares *</p> <p>January 27, morning: SE * Venus Moon Antares *</p> <p>January 28, morning: SE * Venus Moon Antares *</p> <p>January 29, morning: SE * Venus Moon Antares *</p> <p>January 30, morning: SE * Venus Moon Antares *</p> <p>January 31, morning: SE * Venus Moon Antares *</p>	<p>Quadrantid meteor shower activity peaks sharply tonight. Maximum numbers of meteors may be seen in Canada and northernmost U.S. around midnight E.S.T. Shower continues until dawn tomorrow.</p> <p>Have you ever seen moon within 24 hrs of New? If you see it Jan 27 or 28, please send report. Include date, time, instrument used, description of moon, and your location. See SKY AND TELESCOPE: 4/78 p 358; 6/77 p 440; 2/72 p 95; 8/71 p 78.</p> <p>One week from today, Venus at greatest elongation (maximum angular distance, 47° west or upper right of rising sun). At sunrise it will be nearly 30° up in SSE. Telescope will show its half-lit phase: ϕ Venus remains morning star until July.</p> <p>Evening: ENE 12</p> <p>* Castor</p> <p>* Pollux</p> <p>Full Moon tonight</p> <p>January 6, morning: SE Venus</p> <p>January 13, morning: SE Venus</p> <p>January 20, morning: SSW Moon</p> <p>January 27, morning: SE Venus</p> <p>January 30, morning: SE Venus</p> <p>January 31, morning: SE Venus</p>	<p>PLANETS (in order of appearance during the night): Bright JUPITER rises in ENE about 2 hours after sunset Jan 1. Watch it rise nearly 5 minutes earlier each night. What will be the last date you will actually see it rising? By January 12 it rises within an hour after sundown, and by the 24th it is visible all night. About twice as bright as Sirius, Jupiter is the brightest "star" in the sky until Venus rises. SATURN rises just N of E about 3 1/2 hours after Jupiter, or 5 hours after sunset Jan 1, decreasing to 2 1/2 hrs by Jan 31. Saturn comes up within 3/4 hour after the time of this month's map. Look lower left of Regulus as on diagram for Jan 16. When both are well up, Saturn outshines Regulus. VENUS gleams in SE for over 3 hours before sunup. MERCURY can be seen in twilight Jan 1-12, 25°-30° lower left of Venus. Don't confuse with Antares. See Jan 2, 6, 10. THROUGH THE TELESCOPE: Jupiter shows 4 satellites and cloud belts. Saturn's rings, now tilted 4°-5°, become edge-wise in October. Venus shows waxing phases.</p>		

FROM THE IAU CIRCULARS

By Ken Kelly

HYDROGEN ALPHA EMISSION OBJECT

Highly variable radio emission has been discovered from an object in Aquila called SS 433. The source is non-thermal and has an angular diameter of less than $0''.1$ at 8.1 GHz. Unusual changes are occurring in its optical spectrum. Fe X has been noted, also Fe VII (Iron ionized 6 times). No explanation has yet been given of the nature of this unusual object.

NEW GALAXIES OF THE LOCAL GROUP

Three dwarf galaxies that are probably new members of the local group have been discovered by Kowal, Lo and Sargent at Hale Observatories. They are of 18 to 20 magnitude, and are very faintly visible on the blue Palomar Sky Survey prints. The brightest is in Pisces, and 21st magnitude stars have been resolved.

1978 SB

A fast moving object with unusual orbit was discovered on Oct. 4 at the Crimean Observatory. The eccentricity is 0.84, which is highly unusual for a minor planet; it is more like that of a comet. The perihelion point is at 0.35 A.U., which puts it within the orbit of Mercury. The aphelion point is at 4.1 A.U., which puts it in the outer part of the Minor Planet belt.

AAVSO ALERT NOTICE NO. 24

213843B NOVACYGNI1978: We have just been informed by Dr. Edward Ney that infrared emission has now been observed from this nova and the emission is increasing. This indicates the formation of dust shell around the nova. Both with NQ Vul (Nova Vul 1976) and Nova Ser 1978, the detection of infrared followed by its increase in infrared emission was coupled with a significant drop in brightness in the visual light. This has been attributed to the growth in the size of dust grains in the shell. The same thing is expected to happen with Nova Cyg 1978.

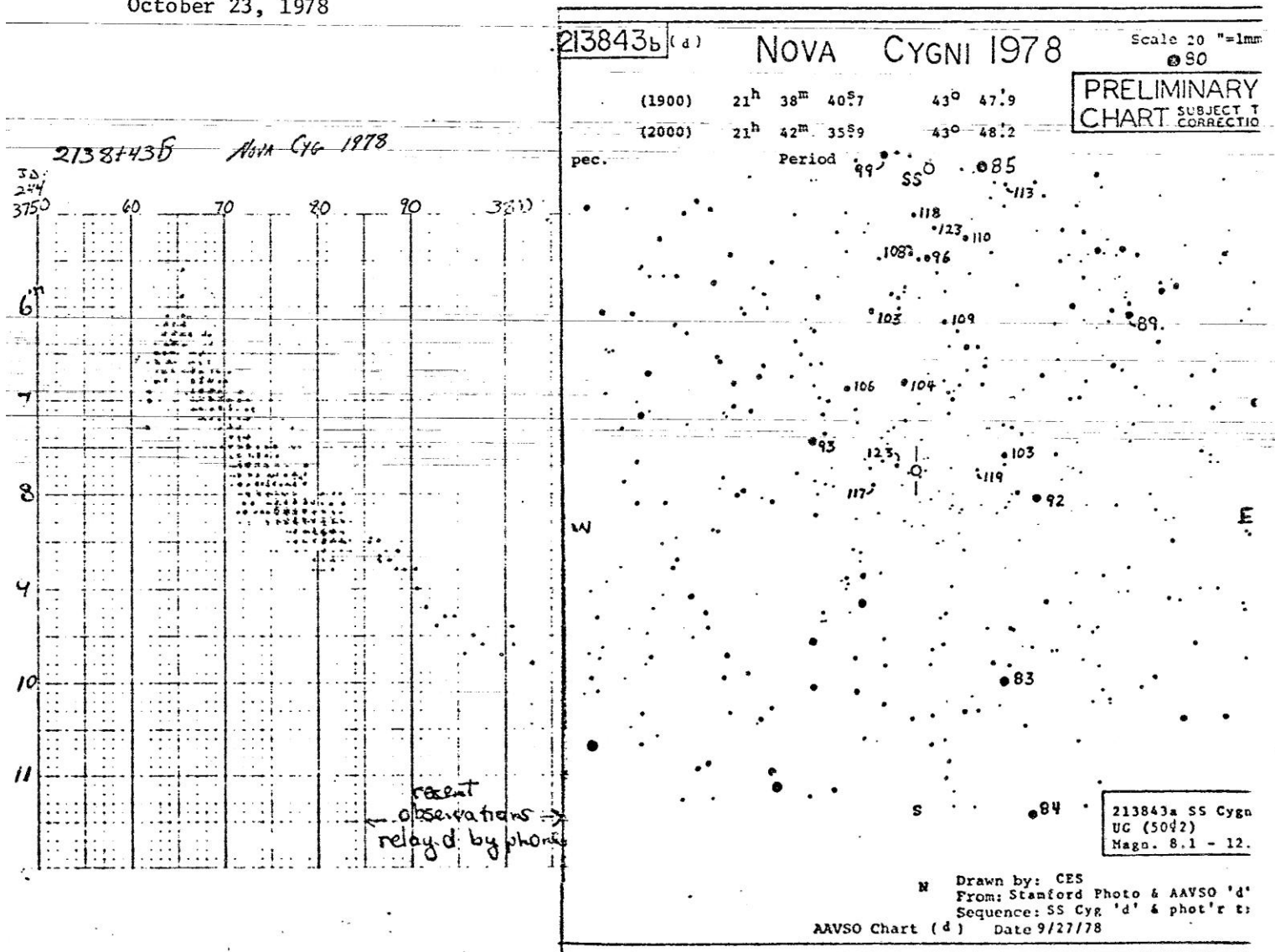
Our observers are urged to keep a very close eye on the nova and to inform me if significant attenuation in brightness is observed. Below is our preliminary light curve, and the recent chart of the field.

Many thanks for your phone calls and postcards on the behavior of the nova.

Clear skies and good observing.

Janet Akyuz Mattei

October 23, 1978



DATE AND UTC.				JULIAN	MIMAS		ENCELADUS		TETHYS		DIONE		RHEA		TITAN		IAPETUS	
YR	MO	DY	HR	DATE	AD	PA	AD	PA	AD	PA	AD	PA	AD	PA	AD	PA	AD	PA
78	11	16	9.0	43828.8750	25.3	260.7	13.8	110.8	12.6	125.8	32.6	100.2	17.0	198.2	38.9	150.4	268.0	277.4
78	11	17	9.0	43829.8750	20.4	254.9	33.4	261.8	18.8	289.0	16.8	45.2	73.4	88.2	88.4	104.6	233.5	277.6
78	11	18	9.0	43830.8750	12.8	243.5	7.9	328.4	25.1	100.7	48.6	258.6	36.0	62.4	135.3	94.0	197.8	278.0
78	11	19	9.0	43831.8750	5.5	195.8	34.5	84.8	30.9	275.5	51.2	89.0	62.2	273.3	167.5	88.3	160.8	278.5
78	11	20	9.0	43832.8750	9.1	117.1	8.6	210.4	35.7	91.9	21.9	292.4	56.5	254.2	175.5	84.1	122.7	279.3
78	11	21	9.0	43833.8750	17.3	97.8	33.4	267.8	39.4	269.0	27.3	243.7	42.7	101.9	159.0	79.5	83.8	281.6
78	11	22	9.0	43834.8750	23.7	90.5	15.1	59.4	41.8	86.6	53.4	81.9	71.1	80.2	117.9	72.3	44.6	288.4
78	11	23	9.0	43835.8750	26.8	85.9	30.1	91.3	42.9	264.5	45.7	272.6	22.0	307.3	62.2	52.9	18.8	313.1
78	11	24	9.0	43836.8750	26.3	81.9	21.6	249.5	42.6	82.2	12.5	145.3	76.9	264.6	38.7	328.7	35.8	27.2
78	11	25	9.0	43837.8750	22.0	76.7	25.4	275.6	40.9	260.0	37.7	72.0	19.2	210.7	92.0	283.8	73.6	75.3
78	11	26	9.0	43838.8750	14.7	67.3	27.7	75.6	37.9	77.3	55.3	264.7	73.3	88.9	142.8	273.3	112.3	70.9
78	11	27	9.0	43839.8750	6.6	33.9	19.0	102.7	33.6	254.1	37.5	97.4	40.1	65.2	173.4	267.7	155.9	94.4
78	11	28	9.0	43840.8750	8.1	303.1	32.2	259.7	28.2	69.7	13.4	26.0	60.5	274.4	178.5	263.5	194.5	94.9
78	11	29	9.0	43841.8750	16.5	279.5	11.7	336.5	22.3	243.1	46.4	256.9	60.2	255.4	157.9	258.3	232.2	95.1
78	11	30	9.0	43842.8750	23.0	272.0	34.7	82.9	15.8	51.0	54.1	87.6	40.9	104.2	115.9	250.6	268.5	95.3
78	12	1	9.0	43843.8750	26.9	267.1	7.3	168.9	10.4	204.7	27.3	285.3	73.7	81.0	62.7	230.2	303.5	95.5
78	12	2	9.0	43844.8750	27.0	262.8	35.1	265.9	9.5	337.5	22.8	237.0	19.6	328.8	40.2	150.4	336.7	95.7
78	12	3	9.0	43845.8750	23.2	257.8	10.7	44.6	13.9	122.5	52.7	80.5	78.1	265.2	91.4	105.5	368.2	95.7
78	12	4	9.0	43846.8750	16.2	249.5	33.2	89.0	20.3	287.5	49.8	270.8	22.1	220.6	139.8	94.9	397.5	95.8
78	12	5	9.0	43847.8750	8.3	227.0	17.3	243.0	26.8	99.8	16.8	125.5	72.9	89.6	172.7	89.0	424.8	95.9
78	12	6	9.0	43848.8750	6.6	136.6	29.6	272.5	32.6	275.0	33.7	68.8	44.0	67.3	180.6	84.5	449.6	96.0
78	12	7	9.0	43849.8750	14.9	102.6	24.3	72.0	37.4	91.5	56.1	263.4	59.0	275.4	163.0	79.6	471.9	96.1
78	12	8	9.0	43850.8750	22.5	93.2	23.9	97.6	40.9	269.0	42.6	95.0	63.6	256.3	120.1	72.2	491.4	96.2
78	12	9	9.0	43851.8750	27.0	88.0	30.0	257.1	43.3	86.6	11.4	359.5	38.3	106.2	62.6	51.9	508.2	96.3
78	12	10	9.0	43852.8750	27.7	84.0	16.9	286.3	44.3	264.3	43.6	254.8	76.1	81.6	40.8	325.9	522.3	96.3
78	12	11	9.0	43853.8750	24.7	79.3	34.0	80.8	43.8	82.0	56.4	86.3	17.7	12.1	96.1	283.3	533.6	96.4
78	12	12	9.0	43854.8750	18.1	72.0	9.7	131.0	41.8	259.7	33.1	281.1	79.2	265.9	148.0	273.1	541.6	96.5
78	12	13	9.0	43855.8750	9.6	52.9	35.9	263.9	38.5	77.0	18.3	226.4	25.5	226.9	179.0	267.6	546.5	96.5
78	12	14	9.0	43856.8750	5.9	328.2	7.4	6.6	33.9	253.7	51.3	78.9	72.6	90.3	183.7	263.4	547.9	96.6
78	12	15	9.0	43857.8750	13.9	284.9	35.6	86.7	28.2	69.0	53.4	269.2	47.9	69.1	161.8	258.2	546.0	96.6
78	12	16	9.0	43858.8750	21.4	274.8	12.7	231.3	22.1	241.8	22.1	112.6	57.2	276.5	118.1	250.3	548.8	96.6
78	12	17	9.0	43859.8750	26.7	269.1	33.1	270.0	15.3	48.3	28.9	63.9	67.0	257.2	63.2	229.3	545.5	96.7
78	12	18	9.0	43860.8750	28.3	264.7	20.2	66.8	10.2	198.8	56.0	261.9	35.5	108.8	60.0	122.5	541.0	96.7
78	12	19	9.0	43861.8750	25.7	260.2	28.5	93.9	10.2	329.7	47.7	92.7	78.4	82.2	95.3	105.1	531.8	96.8
78	12	20	9.0	43862.8750	19.6	253.6	27.0	254.0	15.3	119.8	13.2	328.1	16.8	23.3	145.1	94.7	519.3	96.8
78	12	21	9.0	43863.8750	11.0	237.9	22.2	280.0	22.0	286.1	39.7	252.1	80.2	266.4	178.4	88.9	503.7	96.9
78	12	22	9.0	43864.8750	5.4	172.3	32.0	78.2	28.5	99.1	58.0	84.8	28.8	231.8	185.6	84.3	484.9	96.9
78	12	23	9.0	43865.8750	12.1	109.3	15.3	109.8	34.4	274.5	39.1	277.6	72.2	90.9	166.4	79.4	463.1	97.0
78	12	24	9.0	43866.8750	20.6	96.1	35.5	261.7	39.2	91.2	13.9	207.6	51.8	70.7	121.3	71.7	438.3	97.1
78	12	25	9.0	43867.8750	26.5	90.0	8.7	323..	42.8	268.5	48.7	77.0	55.3	277.8	61.9	50.2	410.8	97.2
78	12	26	9.0	43868.8750	28.7	85.5	36.8	84.7	44.9	86.1	56.6	267.7	70.2	258.1	43.6	321.1	380.5	97.3
78	12	27	9.0	43869.8750	26.7	81.1	8.7	207.2	45.6	263.8	28.5	106.0	32.8	112.4	101.3	282.6	347.5	97.4
78	12	28	9.0	43870.8750	21.4	75.6	35.8	26.7	44.8	81.6	24.1	57.4	80.4	82.9	154.1	272.9	312.0	97.6
78	12	29	9.0	43871.8750	13.1	63.2	15.5	58.2	42.5	259.2	55.3	260.5	16.5	5.2	185.0	267.3	374.7	97.7
78	12	30	9.0	43872.8750	5.6	8.5	32.5	91.1	38.7	76.3	52.0	90.9	80.8	267.1	188.6	263.2	235.4	98.0
78	12	31	9.0	43873.8750	11.0	293.0	22.5	249.0	33.5	252.8	17.6	348.4	32.5	236.5	165.0	257.9	194.4	98.4
79	1	1	9.0	43874.8750							35.1	248.6	71.3	91.7	119.3	249.8	152.0	99.0
79	1	2	9.0	43875.8750														
79	1	3	9.0	43876.8750														

FEBRUARY ECLIPSED SKY PREVIEW -Ray Bullock

Those fortunate enough to go to Brandon, Manitoba for the Total Eclipse of 1979 will have more to look for than the solar corona during totality. The stars of the late summer/autumn will be visible (in the dead of winter!) as will three planets; Mercury, Venus and Mars. In addition, any comets which may be approaching the sun from the far side could be visible.

The next 'Comet of the Century' could well be on its way now. However, since comets can appear in any part of the sky; the sun could be preventing the detection of that comet, should it be in line with the sun. During totality it may appear as a fuzzy patch of light near the sun.

The sun will be at 22h 36m right ascension, $-8^{\circ}44'$ declination, located in Aquarius. Seen from Brandon, the sun's altitude will be 25° azimuth 145° . (90° is due east, 180° due south.)

Mercury will be 54m east of the sun, just barely into Pisces at 23h 30m R.A., -3° Dec.

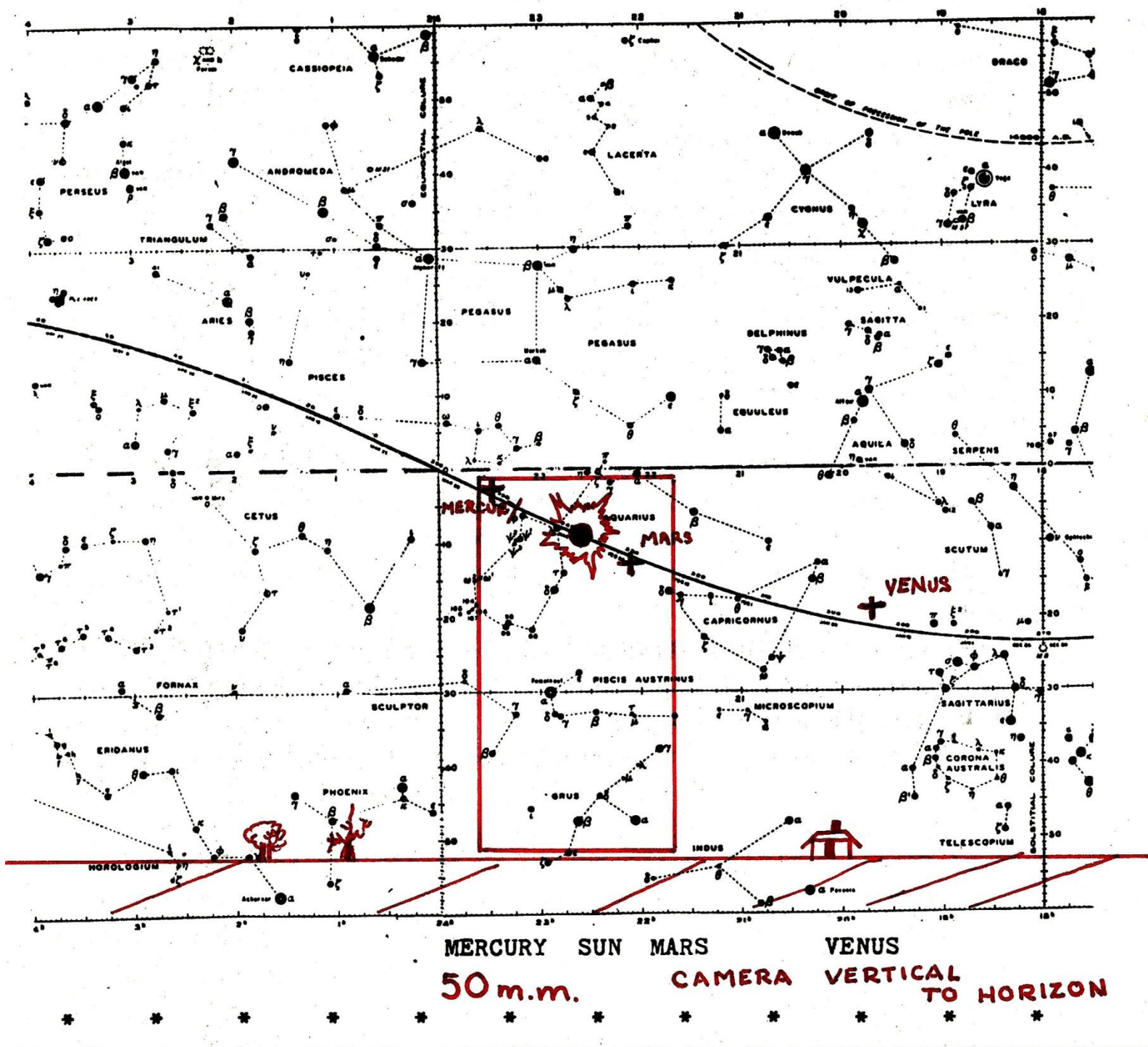
Venus is 2h 53m west at 19h 43m R.A., -19° Dec. in Sagittarius.

Mars, closest to the sun, only 30m west, at 22h 06m, -1° Dec. also in Aquarius.

Jupiter and Saturn, in Cancer and Leo respectively, will not be visible.

First contact is at 15h 33m 26s Universal Time (9h 33m 26s Central Standard Time). Totality begins at 16h 42m 56s UT (10h 42m 56s CST) and will last for 2 minutes 50 seconds, ending at 16h 45m 46s UT (10h 45m 46s CST). Eclipse concludes (fourth contact) 53 seconds before 12:00 noon at 17h 59m 07s UT (11h 59m 07s CST), just in time for lunch.

The star chart on the back of this page shows a portion of the {missing text from this point on-scanning team}



Quasars in the Sky with Uncertainty

They are called quasistellar sources, and the prefix suits them. As if. Roger Blandford of California Institute of Technology, a prominent observer of their behavior, began a talk with the phrase "spontaneous cosmic comedians."

Whatever you say about them, however you model them, wherever in the universe you put them, they are still very quasi.

When quasistellars, or quasars or sometimes QSO's for short were first discovered about 20 years ago, "quasi" meant that they looked like stars. Most of them do. They are compact looking objects that could pass for stars, but unlike well-behaved stars that are being neither spontaneous nor comedic, quasars stand apart from galaxies. If one considers their energy output or the radio emissions of some of them, quasigalaxies might be a better term. And in fact lately the stellar part of quasistellar is getting raggedy at the edges: Astrophysicists tend to throw BL Lacertae objects into the quasar bin. BL Lacertae objects are irregularly shaped and do not look like stars. And interest now extends to compact galaxies, such as Seyferts and Markarian objects. The title tends to become "Objects with Active Nuclei."

But what sort of active nuclei? If it is a little hard to define quasars by the way they look, it is much harder to agree on what it is that drives them. The question of where they are cosmologically is not completely settled, and it, too, affects to some extent the question of what they are.

Blandford was leading off a discussion of what are called accretion disk models, essentially those with black holes in the middle, at a Summer Workshop on QSO's and Active Galactic Nuclei that lasted for most of July at the University of California's campus at Santa Cruz. The black hole models are popular now, as are black hole models of almost everything else astrophysicists can make a black hole model for. With perhaps less Einsteinian panache one can try to explain a quasar by postulating a spinar at the core of it. A spinar is a large and very massive star or group of stars that coalesce together without becoming a black hole and rotate in unison. In addition to these two there are white holes. White holes are, as A. Starobinsky of the University of Moscow described them, time-reversed black holes. Among other things, that means that if a black hole is where things disappear from the universe to points unknown, a white hole is where things enter from somewhere. The listening astrophysicists reacted to Starobinsky's talk as if it were very old-fashioned, and a number of objections were made including the telling one that after a certain time

*Twinkle, twinkle little quasar.
How I wonder if your rays are
Made in an accretion disk.
Is there deep within your inner
Works a black hole or a spinar,
With a field where protons frisk?*

BY DIETRICK E. THOMSEN

white holes come to look just like black holes so how can you tell? White holes used to be something of a white hope in cosmology. Here they had this lone proponent.

The years of observing quasars have yielded large catalogues of data, but to some extent, says Blandford, however an astrophysicist may interpret particular data depends on the model he or she favors. The data are not always unambiguous judges of the models, but they are numerous and varied enough to set quite a number of constraints on the models one might choose to make.

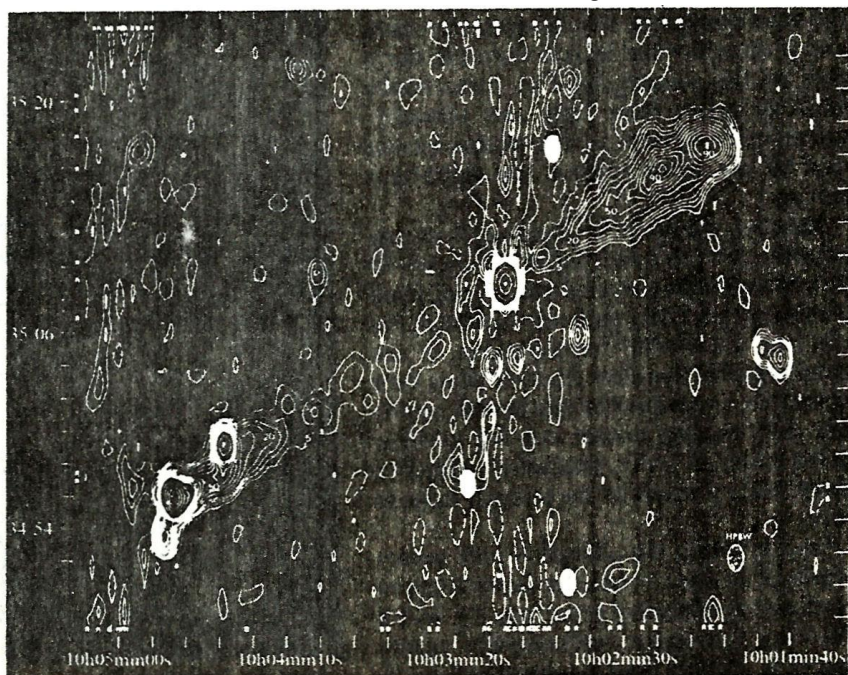
First of all, the things have a certain appearance, and whatever it is that the model says is in the heart of the quasar must make that appearance come to pass without being too severely tortured. The most spectacular of the geometric constraints on quasar models is one that is not immediately apparent to the eye, the large double radio sources that seem to be attached to some of them. Characteristically the radio sources consist of lobes of matter (which would have to be tenuous clouds of electrically charged particles to , emit radio) lying on either side of the visible quasar.

3C236 is a galaxy, but the two-lobed structure of the radio source associated with it is characteristic of many quasars, too. This map was made by A. G. Willis, R. G. Strom and A. S. Wilson of the Leiden Observatory.

The geometry leads to the assumption (seldom questioned) that the matter in the radio lobes has been driven out of the visible object. This requires a driving engine operating along the axis of the radio lobes. An object that rotates on that axis, gathers up matter and spews it along the axis seems right. It has to stay on the axis. It must be a good gyroscope, to use Blandford's term, and, as he says, black holes and spinars make good gyroscopes.

The mechanism must also focus the outgoing material into a very narrow cone. There are jets that appear to be coming from the centers of some of these objects that are only 3° to 5° wide. This argues also for a compact object. If a rotating disk, for instance, were spewing material in the direction of its axis, it might achieve 30° or 45°. There is thus a very narrow channel along the axis of the typical quasar out of which the matter comes. It is tempting to think that in the case of the BL Lacertae objects, where there is evidence that conditions very close to the core are being observed, observers are seeing down along this axis.

Blandford cautions that this analysis applies strictly only to about five percent of all quasars. The other 95 percent are "radio quiet" and show no evidence of this kind of morphology. Nevertheless, he goes on to suggest some fiducial numbers for the compact mass in the center: about a billion solar masses, slightly less than that recently discovered in the galaxy M87 (SN: 5/13/78, p. 308), and 3×10^{14} centimeters in extent. This basic central condensed object seems to be surrounded by a kind of "photosphere; a collection of filaments of matter that emit light with broad bands in



its spectrum. From the light it can be determined that these filaments have a temperature of about 10,000° K. They occupy a region that is characteristically a tenth of a parsec across, a characteristic size for one of them being 30 billion kilometers. Their existence and characteristics lead to the conclusion that the object is embedded in some kind of gas that exerts a pressure on them, an intergalactic medium.

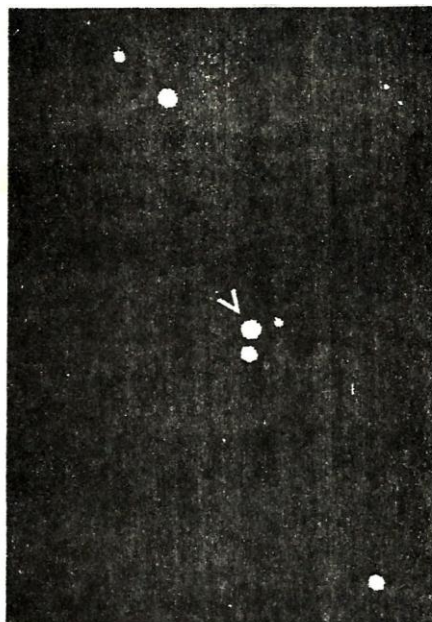
Whatever the nature of the engine in the core of the quasar, it is limited in the rate at which it can pump out energy by a basic principle of physics, Eddington's limit. For an object of a billion solar masses, the maximum rate is 10^{47} ergs per sec. For an efficient mass to energy converter, the rate at which new mass must be accreted to make that rate of radiation is 10 solar masses a year. It is this infalling matter that proponents of accretion disks use to get the light and X-rays emitted by quasars.

The infalling matter is usually depicted as arranged in an astronomically thin disk that partakes of the rotary motion of the central mass (we can now probably say "black hole" for the duration of the next paragraph or two), so that the motion of any single piece of matter on the way in is a kind of lazy spiral. Compression heats this disk, and the hot electrons in the disk are responsible for the light, etc., that gets radiated.

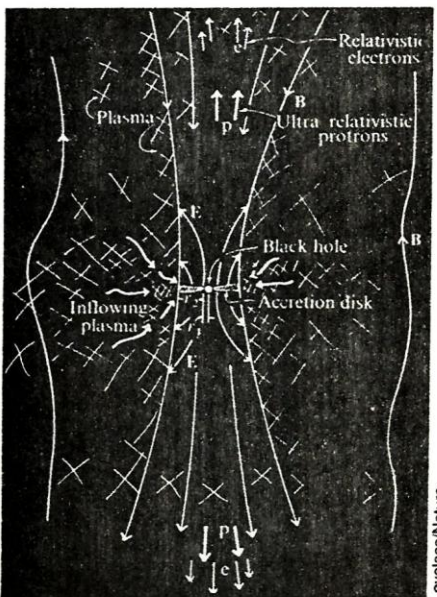
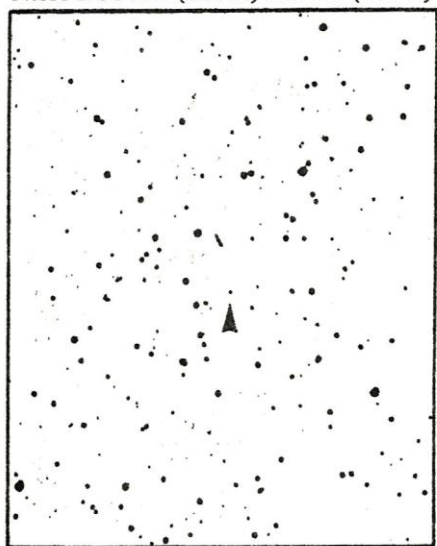
The exact structure and details of behavior in the disk can lead to very complex discussions based on particular aspects of quasar spectra—for example, on the basis of certain data and certain assumptions, it is possible to deduce 10,000 gauss as a characteristic strength for the magnetic field in the disk—but there are a few very important criteria. The first is size. We know from other measurements the range of size for stars, and we think we know it fairly well for galaxies. The size of the light-emitting part of a quasar can be estimated because its light output can vary sharply over just a few days. Any disturbance that could cause such a variation of the whole body has to propagate across it, and it must do that in less than the duration of the variations. The disturbance can't go faster than light, and probably grows much slower, so the visible quasar can be no more than a few light-days across.

Another question is cooling. It seems possible for the particles in an accretion disk to cool themselves down by radiating the energy that they gain (by friction in the disk) to the 10,000° temperatures of the inner regions. The slow descent takes care of that. In a variation of this model, which has the infalling matter coming straight down from all sides (accretion sphere), there doesn't seem to be enough time to cool.

On the whole the accretion disk seems best to Blandford. It has the capabilities to produce the observed spectrum. He favors the black hole as the central motor, saying that it is stabler than a spinar and more



They are hard to tell from stars by looking. These are 3C147 (above) and 3C9 (below).



Model of black hole pump by Lovelace.

efficient. His opinion is not universally acclaimed. S. I. Blinnikov of Moscow State University remarked: "I'd like to discuss the models for quasar energy sources not connected with accretion onto black holes. The quasar source is not consistent with accretion on a black hole."

Franco Pacini and M. Salvati of the European Southern Observatory (which is located in Chile) would agree with him. Their recent work has been concerned with showing how pulsar radiation could be derived from non-accretion sources, that is, from within the object itself. "The energy comes from a central mass vortex," Salvati says. "It can be a spinar ... or even a black hole, like those Dick Lovelace [of Cornell University] just talked about." But that energy is transferred to the outside world by a giant electromagnetic field. It is the relation between the central mass, that field, and the particles that do the radiating of the light and radio that makes the model.

The field accelerates the particles, which exist in the "atmosphere" of the central mass. These particles then become the radio lobes or, staying nearer to the center, radiate much of the rest of the observed spectrum. Blinnikov places similar stress on electromagnetism: "The existence of the magnetic field is necessary to explain the radio lobes and the non thermal spectrum."

Although it seems clear from Pacini's remarks that he prefers a spinar of some kind as the engine for his quasar, he does allow a black hole without an accretion disk. It has almost been a reflex to associate accretion disks with black holes, possibly because accretion disks are something to fall down a black hole, and what is a hole for but falling down? But friends of black holes with or without accretion disks have one final argument in their favor: stability. A black hole of a billion solar masses, the size Blandford estimates, will last, if not forever, at least longer than we can know how to worry about. A spinar may not. Presumably a spinar would form from the coalescence of a gang of stars of more normal size. Such a thing might come to spin so fast that it would be completely flattened possibly to a disk, Blinnikov points out. Would the disk then fragment? What would be the role of the magnetic field in this case? (Magnetic fields don't go away.) Would it contribute to collapse? And to go back a few steps, how about the formation of the spinar. If such a large and heavy gang of stars comes together, why don't they go all the way and become a black hole? What's to stop them at the spinar stage? There's a lot of touchy general relativity to be worked out here and Blinnikov's "Moscow group," among others, is working on it. Until somebody gives convincing answers, not all astrophysicists will be willing to believe a spinar can form. On the other hand, they all believe a black hole can form. Or do they?

Hale Observatories

National Geographic Society Palomar Sky Survey

Lovelace/Nature