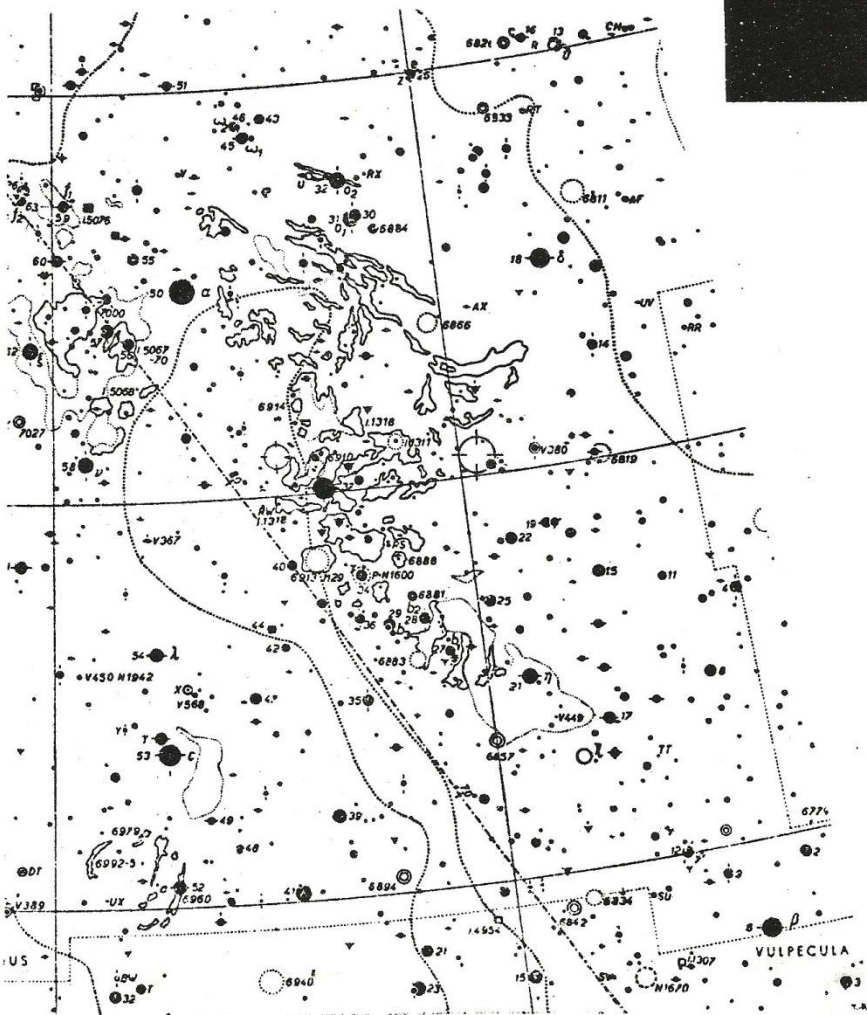


THE WASP



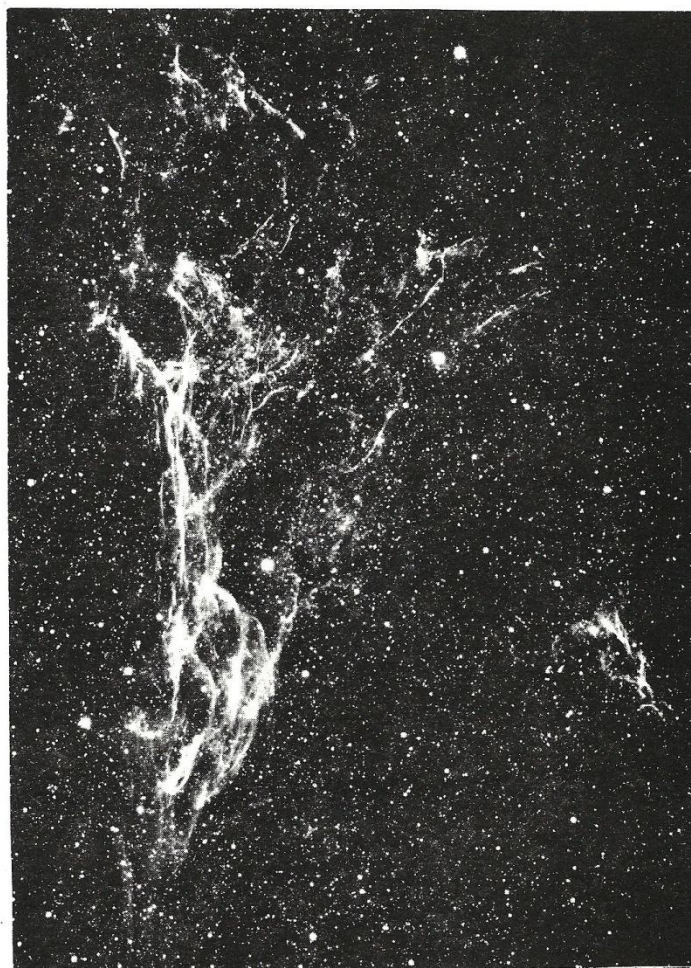
THE JOURNAL
OF THE WARREN
ASTRONOMICAL
SOCIETY



NOV. 1978



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



CYGNUS: possesor of some famous nebulae. Top right, the well known North American Nebula, which is 1600 light years distant. It's diameter is approximately 1.5 degrees. Below it lies the central portion of the Veil Nebula. Lower left is NGC 6960 with 52 Cygni shining with it. The Veil Nebula is about 1500 light years distant and is a good object in a RFT. The diameter of the Veil is roughly 2.6 degrees. For more info on Cygnus, see the editors article inside.

This Month... ➡ Nov 1978

Editor — Jeff Stanek
751-1673

Assistant Editor — Brad Vincent
751-8506

SOCIETY INFORMATION

The Warren Astronomical Society (W.A.S.) is a local, nonprofit organization of amateur astronomers. The Society holds meetings on the first and third Thursdays of each month. The two meeting locations are listed below:

1st Thurs.	Cranbrook Institute Of Science 500 Lone Pine Road Bloomfield Hills, MI	3rd Thurs.	Macomb County Community College — South Campus E Building Warren, MI
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Membership is open to those interested in astronomy and its related fields. Dues are as follows and includes a year subscription to Sky & Telescope Magazine:

Student — \$11.00	College — \$13.00	Senior Citizen — \$15.50
Individual — \$18.00	Family — \$23.00	

STARGATE LECTURE SCHEDULE

Chairman — Dennis Jozwik, 754-2037

Lectures are given at Stargate Observatory each weekend. The lecture will be either Friday or Saturday night, depending on the weather and the lecturers' personal schedules. If you cannot lecture on your scheduled weekend, please call the Chairman as early as possible so he may arrange for a replacement. Those wishing to use Stargate must call by 9:00 p.m. on the evening they plan to go out. The lecturers for the coming month are as follows:

Nov. 3/4Lou Faix
Nov. 10/11Dave Harrington
Nov. 17/18Dennis Jozwik
Nov. 24/25Pete Kwentus

WAS Exchange

FOR SALE ... Celestron 8 with: wedge, tripod, 3 eyepieces, aluminum dew cap, counterweights, prism diagonal, piggyback camera mount, off-axis guider, illuminated Eyepiece, telecompressor, tele-extender. and "T" mount, and ring for Canon body. New cost — \$1571.00, selling for — \$1150.00.

Also ... Celestron 5 plus photo accessories, selling for — \$600.00. Write or call Richard Hill, 3932 Todd, Midland, MI 48640, 1-517-835-5548.

FOR SALE ... 8" f/6 reflector with: 2.14" diagonal, mounted in 10" diameter tube — 50" long, no eyepiece focusing mount. Price — \$125.00. Also 4" O.D. — 24" long, black iron stand that is ready to accept 3 legs and Equatorial head (Pacific) for \$15.00; plus a 22½ lb. counterweight with 1" hole and screw clamp for — \$15.00. Contact Roger Civic, 776.8735.

FOR SALE ... 6" f/6 tube assembly. Includes excellent homemade mirror figured to 1/8 wave. Never used scope in mint condition. Will sell for best offer over \$150.00. Contact Jeff Stanek, 751-1673.

FOR SALE ... 6" f/10 telescope. Good condition. Mounted on lightweight tripod and equipped with clock drive. Price — \$250.00. Contact Joe Tocco, 573-8547.

INTRODUCTION TO THE NEW WASP

Welcome to the first official issue of the new WASP. We are now under new Management, so to speak, and a few items have been changed. The cover is unique this month, since we haven't had a star chart on it for quite a long time. We hope to get more of our astrophotographer members involved in getting us some amateur shots for our cover. You can use professional shots for just so long and it begins to look Like any other magazine. Therefore, my first call to arms goes out to the shutter-snappers out there. Let's get hot and get some pictures in here to dress up the cover.

My second call to arms goes to those with a touch of journalistic talent. It's a shame that a journal such as ours, in a club with 110 plus members, should run low on articles each month. It only takes an evening by the typewriter to kick out d Nobel Prize candidate. Our absolute deadline is the Cranbrook meeting before the general Meeting of the same month. This will be strictly enforced. If you plan on writing a series, try to have them ready for each issue. When people read a series, they expect it to move along month after month. It doesn't look good to miss a month.

Another change implemented with this issue is the old Club News page. It is now called "This Month ..." and the format has been improved. Those who want to place ads in the WAS Exchange are asked to limit them to no more than 5 lines. The lines can extend the length of the page with 10 space margins on each side. Please let us know if you sell an item so we can pull the ad. All we need is a few buyers who call up and find out the item is already sold.

Commencing with next month's issue, a new department will make its appearance. The "EDITOR-ial", as written by the editor, Jeff Stanek. this column will feature opinions, suggestions, and light criticism concerning the club and its business. The EDITOR-ial will be an occasional supplement to the WASP as the editor desires.

We hope you enjoy the new format of the WASP. Any suggestions or constructive criticism is always welcome. If you have any ideas you would like to see implemented, let us know. Contact the editor or myself, our phone numbers are on the front page.

Sincerely,

A handwritten signature in black ink that reads "Brad Vincent". The script is fluid and cursive, with the first letters of "Brad" and "Vincent" being capitalized and prominent.

Brad Vincent
Assistant Editor

MINUTES
OF THE
WARREN ASTRONOMICAL SOCIETY
MEETING
September 21, 1978

The meeting was opened by President Dave Harrington at 8:20 p.m. at Macomb Community College. Treasurer, Robin Bock, reported figures as follows:

Bank Balance:	\$266.00
Income:	\$ 78.55
Camp-out Expenses:	\$ 48.50
Expenditures:	\$ 40.35

Dave read a letter from the Detroit Astronomical Society thanking WAS for its invitation to the Camp-out on August 11-12. WAS members were extended an invitation to visit the Crowell Recreation center. Bylaws of the Astronomical League have been sent to Dave. Dave will ask for one month to reply acceptance or rejection. Further discussion of Bylaws will take place at the next meeting.

Ray Bullock discussed the Cranbrook "Members Night" meeting on October 6. WAS members are being asked to bring scopes and participate in the activities. Members interested were asked to sign up for what will be an interesting evening.

John Searles made an announcement about the Great Lakes Astronomical Society Regional Meeting at the University of Toledo. John will furnish information on the meeting at a later WAS meeting. John thinks there is a possibility that this will be the last GLAS regional meeting.

Frank McCullough spoke about occultation of stars in the Hyades.

Dave Jozwik gave a report of work done at the observatory and gave thanks to those members who helped with the clean up. Concern was expressed over damage done by vandals. It is suspected the vandals gained access to the observatory through the dome.

No floor announcements were made.

Don Misson gave a talk on "Digital Setting Circles."

After a short intermission, President Dave Harrington made an appeal for members to make contributions to the "kitty" for refreshments. Jeff Stanek - announced he is the new editor of the "WASP". Jeff requested members to submit articles for same. Robin Bock needs volunteers for refreshments for future meetings. The next speaker on the agenda was Louis Faix. His talk "Perseid Observation and Analysis" covered observations at the August 11-12 Camp-out. After Lou's talk, Bill Whitney showed some excellent slides of meteors -- almost!! In conclusion a NASA film "Space Shuttle" was shown. There was a good turnout of members and visitors at the meeting. Meeting adjourned at 11 p.m.

Respectfully submitted by



Connie Shannon for
Loretta Caulley, Secretary

THE AUGUST 17, 1978 MEETING OF THE WARREN ASTRONOMICAL SOCIETY opened at 8:35 p.m. with a welcoming introduction by President Dave Harrington. Robin Bock, treasurer, announced that our bank balance stands at \$246. The membership roster is now completed and appears in the WASP. Mr. Harrington thanked all who worked on it. These included Robin Bock, Debby Harrington and Loretta Caulley. John Rapin volunteered to provide refreshments for next month's meeting. Mr. Harrington thanked Jeff Stanek for editing the WASP in the absence of vacationing editor, Roger Civic.

The July Messier Contest winners were: First Place, Rick Hill and Second Place, Frank McCullough. A report on the picnic followed. Lou Faix, technical chairman, explained the new procedures, named the observers, reported on sun spot observation and telescope evaluation. Lou won first prize for his amateur telescope. Jim Jacks took first prize for commercial optics. Messier winners for the outing were: First, Rick and Delores Hill; Second, Frank McCullough and Rick Carter; and Third, Doug Bock. Trophies are being engraved.

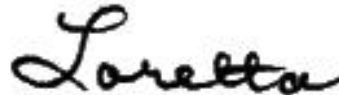
The Program followed with David Dobrzelewski's film presentation. Entitled, "Celestial Tapestry", it featured classical music and astrophotos. Lou Faix then presented a movie on X-Ray Spectography.

After intermission, Ray Bullock presented his excellent shots of planets in the Leo constellation. Bill Whitney presented pictures of the Andromeda Galaxy.

Pete Kwentus completed the program with a talk on camera techniques to be employed especially by photographers going to the February 1969 eclipse. His talk touched on image length, focal length, image size proportional to focal length, photographic equipment and a generous sprinkling of advice and admonition.

Ken Wilson, distinguished member at large of the Warren group, then presented slides of telescope enthusiasts in the San Francisco Area. The scenic background and commentary were enjoyable and instructive. The meeting was closed by Mr. Harrington at 11:05 p.m.

Respectfully submitted,

A handwritten signature in cursive script that reads "Loretta".

Loretta D. Caulley, Secretary

CYGNUS

Cygnus is a constellation that everyone can enjoy. For the nebulosity fan out there, there are many famous and beautiful nebula in Cygnus, such as: the North American Nebula (NGC 7000), the Veil Nebula (NGC 6960 and 6992), and NGC 6826 the so-called blinking planetary nebula. And for the star lovers out there, there are many open clusters in Cygnus like M29 and M39. Also in Cygnus, there are many beautiful double star systems such as: Beta Cygni (Albireo), and 16 Cygni. Cygnus also has many variable stars. I will now describe the most important parts of Cygnus in order of stars, nebulae, and unusual things.

Deneb- Alpha Cygni. Deneb is a blue-white supergiant. It's spectral class is A-2. Deneb is the 19th brightest star in the sky with a magnitude of 1.26. It is one of the greatest supergiants known, maybe equaled only by Rigel. Deneb's luminosity is 60,000 times that of our Sun. Deneb is 1600 light years away; at that distance, our Sun would be at 13.3 magnitude. Deneb is about 60 times the diameter of our Sun, and has 25 solar masses.

Albireo- Beta Cygni. Albireo is the best double star visible in northern latitudes. Albireo is also the best double star for small telescopes because in large telescopes, you lose the contrast of the stars. Although it seems that the stars are very close when you look through the telescope, they are actually 4400 A.D. apart. That is 55 solar systems lined up edge to edge. Albireo is a beautiful blue-gold pair. The gold star is 3rd magnitude and the blue star is 5th magnitude.

M29- A open star cluster located 2 degrees SSE of Sadr (the middle star of the cross). M29 is about 7200 light years distant. It is 15 light years in diameter. M29 shines at magnitude 7. M29 is a disappointing star cluster consisting of only 10 to 12 suns. It is embedded in the thick Cygnus Milky Way.

M39- Another open star cluster in Cygnus. It is a large cluster located 9 degrees ENE from Deneb. M39 is about 800 light years distant. It has a diameter of 7 light years. It is one of the brightest clusters for it shines at 5th magnitude, M39 is 30 minutes in extent.

NGC 7000- The famous North American Nebula. The North American is located 3 degrees east of Deneb, It is 1½ degrees in diameter, To get the best view of the North American, look at it through a 3 or 4 inch RFT (rich field telescope).

The North American is illuminated by Deneb. The nebula is 120 by 100 minutes in extent. The North American is a diffuse nebula measuring 45 light years in diameter. Another nebula, the Pelican nebula, is right next to the North American nebula.

NGC 6826- The famous "blinking" planetary nebula. This is one of the most unusual objects in the heavens. It is located $3/4$ of a degree east of the beautiful double star 16 Cygni. It shines at magnitude 8.8. If you look directly at the central star, the nebula is invisible. But if you switch to averted vision, you can see the bright blue nebula. If you do this action back and forth, you get the blinking process.

NGC 6960, NGC 6992- The famous Veil Nebula. The theory of how the Veil nebula came to be is that a great explosion took place probably a supernovae outburst in the distant past. That outburst is probably the present Veil nebula. So far, the Veil probably expanded for 150,000 years. NGC 6960 is seen with 52 Cygni, a 4th magnitude star. The third part of the Veil nebula is unnumbered. The Veil can be seen with 7 by 50 binoculars on a very clear night. NGC 6960 measures 70 by 6 minutes in extent, while NGC 6992 measures 78 by 8 minutes in extent.

Cygnus A- Is one of the greatest known radio sources in the Universe. It is the second strongest in the sky. It is a unusual galaxy about 500-700 light years distant. Cygnus A shines (well glows) at 18th magnitude. At first, scientists thought there was a direct collision; between two giant galaxies. But with research, they don't think that ever happened.

Cygnus X-1- This object is best known for being a "black hole" candidate. Although a black hole has never been discovered, Cygnus X-1 is the best candidate for one. Its mass is between 20-30 suns. Its distance is believed to be between 6500-8000 light years. Black holes have been argued since 1798 when Pierre LaPlace theorized about them.



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

VOYAGE TO THE LAND OF THE STRAIT

By Gemuel Lulliver

(In the following story, the names have been changed to protect the guilty. Any resemblance to real persons, living or dead, is purely intentional.)

I recently went on a voyage south of the border into the Land of the Strait. I visited a meeting of astrologers at the University of the Strait on their sabbath. I went in and sat down.

A few minutes later, in walked Dr. Wolfgang Heissluft, chief astrologer and Fuhrer. Someone-yelled "Achtung!" and everyone stood up and gave the salute of the Teutonic Order.

He gave a long-winded talk on how he had bad luck because an eclipse of the Moon took place in his "ascendant", which is the wrong sign of the Zodiac for such things to occur. Thus events in the heavens became a convenient scapegoat for his failures on earth.

The scribe of the Privy Council then asked if he could read a scroll which he had composed, honoring an empire of astronomers north of the border. The chief astrologer forbade him to read it to the handful at the sabbath meeting, because it did not have the imprimatur of the Privy Council. Furthermore, it was not in Teutonic writing. The speechless scribe returned to his chair.

I raised my hand and asked if I could make an announcement about a new comet. He said, "You're Muzzled!" I said, "Jawohl Mein Herr!" and meekly sat down. "Dass ist besser!" said Der Fuhrer.

Several months ago, High Priest Adolf Crabtree tried to get the faithful to make a pilgrimage to Gasa Lorna, a holy shrine in a strange land to the east. This was restricted by Crabtree to true believers of the faith. However, most of the faithful were getting too old and crotchety to attend. Also, their collection of shekels was under the wrong sign (negative).

A young monk, who got into the seminary at an early age, soon became very advanced. He brought his astrological charts to a workshop gathering and asked Adolf Crabtree if he could have a side chamber to work on them with others. Upon hearing this, Crabtree threw a tantrum. He ranted, raved, waved his arms and yelled that the Privy Council must approve of this. The young, inexperienced monk tried to reason with him, but was unsuccessful. A more experienced monk completely agreed with Crabtree and said, "Yes Sir! That's so right, Sire. It should have been submitted in Teutonic writing to the Privy Council." The high priest soon ran out of verbiage and calmed down. The young monk was then allowed to work on his charts with others in the social meeting hall.

VOYAGE TO THE LAND OF THE STRAIT

(continued)

The Privy Council, after consulting their astrological charts and Ouija Board, decide who is going to slumber on the subsequent Privy Council. They try to locate obedient, submissive and pious servants among the faithful.

One officious true believer per vacant chair is chosen, depending on his astrological and other (\$\$\$\$) signs. However, after the untouchables and infidels are eliminated, there are few monks to choose from. The favored monk must be a member of the true faith for one full saros cycle, and his faith must be verified by a magical number (7) of true believers. His astrological chart must be put in Teutonic writing and presented to the Privy Council.

In true Teutonic fashion, the sole candidate for each chair is enthroned by the multitude (½ doz.) by a show of stamping their feet.

THE APPRENTICE ASTRONOMERS NOTEBOOK

Lou Faix

Probably no other deep sky wonders are more observed by amateur astronomers than the Orion Nebula and the Andromeda Galaxy. Their incredible brilliance and enormous size make them prime objects for even the most modest telescopes. Both are best observed on a moonless clear night using a low power eyepiece. In the late fall both objects are conveniently seen on the same evening. Andromeda is directly overhead on the meridian at 11 :00 PM while Orion is high in the southeast by midnight.

The Andromeda galaxy was the only extra galactic object known to the ancients. Even in moderately light polluted suburban skies it is a naked eye object appearing as a fuzzy cigar shaped cloud about 10 west of the star Nu Andromeda. The Persian astronomer Al Sufi recorded his observations of the galaxy in 905 A.D. and called it the "Little Cloud". Simon Marius is credited with the first telescopic observations in 1611. Burnham quotes Marius as describing the galaxy as a soft glow like "the light of a candle shining through horn". Even with large modern telescopes this is still an appropriate description for visual observations. A good 6" reflector will reveal a dark dust lane on the northwest edge and a nearly star like nucleus.

For over 300 years after the invention of the telescope, the true nature of the galaxy was unknown. Not until 1924 did Edwin Hubble, using the Mount Wilson 100" telescope, firmly establish that the Andromeda Nebula was in fact another distant, massive, Milky Way network of billions of stars. At the Astronomical League convention in 1974, amateur Orville Brettman, from Illinois exhibited photos taken with a 12-½" reflector which clearly resolved the brighter O-B star clusters in the arms of the galaxy. This was a classic example of how faint images are detectable on smaller telescopes after they have been discovered on larger instruments. With this inspiration any amateur with a 6" telescope should consider this galaxy to be a prime photographic object. One of the star clusters near the southern top of the western arm is sufficiently bright to be ranked in the NGC catalog and bears the number 206. This cloud of stars is actually a super massive cluster 1400 x 2900 light years in size. On a good night I've seen it with a 10" Newtonian and would imagine it should be visible in smaller telescopes. Many of the individual stars in this group have luminosities in excess of 10,000 times greater than our own Sun.

The nucleus of the galaxy is officially dimensioned as $1\frac{1}{2} \times 2\frac{1}{2}$ arc seconds, or an actual diameter of fifty light years. Visually the nucleus is obscured by a much larger core structure. Photographically the nucleus stands out distinctly with exposures of five and ten minutes at f/5.6 on Fujichrome (ASA100). Exposures of 15 minutes or more cause the whole center region to be overexposed to the extent that the core is indistinguishable. The Andromeda galaxy is so large that just its central region is more massive than many E2 type galaxies, which it strongly resembles. Exposures of fifteen and twenty minutes also clearly begin to exhibit the two dust lanes in the nearer portions of the disc as well as dust nodules to the south of the central core. The twenty minute exposures also reveal faint blue/lavender points of light to the west and south of the core. These are in the general areas of the O-B star clusters resolved by Brettman but neither the exposure nor resolution has been adequate to positively establish these points as remote clusters or individual hot stars in our own Milky Way. In this regard the commercially available professional color pictures have been of little assistance as they are generally so overexposed as to preclude positive identification of the blue objects in my photos. Admittedly the use of color film precludes any chance of acquiring resolution equal to that achieved by Orville with fine grain black and white plate glass negatives. However, providing the film isn't exposed to the saturation point, color film does provide an opportunity to identify objects by their spectral type which cannot be done in black and white. Previous astrophotographic experiments have also shown that color film can be more effective in moderately light polluted skies as it can distinguish hues of color in objects which may have the same luminosity as the sky background. In such a situation black and white film only records a uniform shade of grey.

I'd like to invite all the shutter bugs in the Warren Society to photograph the Andromeda Galaxy in as many different ways as they can imagine. Perhaps some future meeting can be devoted to our own studies of this amazing formation.

FROM THE IAU CIRCULARS

By Ken Kelly

A positive leap second will be added to December 31, 1978 at 23H 59M 60S. This will be the eighth leap second added since Universal Time was synchronized with International Atomic Time on 1972 January 1. Two leap seconds were added that year, and one leap second has been added to Dec. 31 of each year since.

The length of the day is now about $1/365$ of a second longer than it was in 1900 due to friction from tides caused by the moon and sun. In fact, the earth has lost 50 seconds since 1903. This is reflected in the difference between Ephemeris and Universal Time, which is now about 50 seconds.

NOVA CYGNI 1978

When discovered on Sept. 10, this nova was magnitude 6.8; the latest estimate is magnitude 8.8 on October 4. Thus this nova is declining at the unusually slow rate of less than 0.1 magnitudes per day. Its position is 21H 40M 38.28S, $+43^{\circ} 48' 9.8''$ (1950). Comparison stars used for estimating its magnitude are HR 8272 and SAO 51226.

The estimated absolute magnitude is -6.7, implying a distance of 2000 parsecs. The color index has changed from +0.27 on Sept. 19 to +0.36 on Sept. 30, meaning that the star is red and becoming redder as it declines in magnitude.

COMET FUJIKAWA (1978n)

Fujikawa of Japan has discovered a comet-like object of magnitude 11 on October 9. Its position on Oct. 10 was 10H 23M, $+6^{\circ} 2'$ and heading north. The object is diffuse with a slight condensation.

COMET SEARGENT (1978m)

David Seargent of New South Wales, Australia discovered a naked eye comet on Oct. 1 at magnitude 5. It was at declination -37° , but by Oct. 19 it will be at declination -67° .

SATELLITES OF SATURN

By R2-D2

R2-D2 - YOUR FRIENDLY ROBOT - HAS PRINTED OUT THE POSITIONS
OF THE 7 BRIGHTEST SATELLITES OF THE PLANET SATURN AS VIEWED
FROM THE SPACESHIP CALLED "EARTH" - CLICK - CLICK - ONE SET
OF POSITIONS IS PRINTED FOR EACH EARTH DAY AT 10 HOURS
GALACTIC TIME - GLICK OTHERWISE KNOWN AS UNIVERSAL OR
GREENWICH MEAN TIME - CLICK - SUBTRACT 5 HOURS TO CONVERT TO
EASTERN STANDARD TIME - CLICK - CLICK - "AD" IS THE APPARENT
DISTANCE FROM THE CENTER OF SATURN IN SECONDS OF ARC - CLICK
- "PA" IS THE POSITION ANGLE IN DEGREES MEASURED FROM THE
NORTH POINT THRU EAST TO SOUTH TO WEST AND BACK TO NORTH -
CLICK - CLICK - R2-D2 AT YOUR COMMAND SIR - CLICK - CLICK -
BUZZZZZ

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	10	24	10.0	43805.9166	10.0	56.0	31.1	80.2	28.3	251.4	51.2	267.2	41.8	247.6	89.4	283.0	320.2	275.1
78	10	25	10.0	43806.9166	5.0	343.6	10.0	124.8	23.8	66.4	26.5	104.9	54.5	95.5	137.4	272.9	349.8	275.2
78	10	20	10.0	43807.9166	11.1	287.6	33.1	263.3	17.8	237.6	20.9	55.7	60.3	76.6	165.8	267.3	377.2	275.3
78	10	27	10.0	43808.9166	18.8	274.3	6.8	2.0	12.0	39.5	49.4	260.0	34.4	287.1	169.8	263.1	401.7	275.5
78	10	28	10.0	43809.9166	24.1	268.2	33.0	86.3	8.7	180.9	47.2	90.4	71.3	261.7	149.2	257.9	423.7	275.6
78	10	29	10.0	43810.9166	26.0	263.8	11.3	229.0	10.6	0.5	16.2	347.5	16.0	154.7	108.6	249.9	442.8	275.7
78	10	30	10.0	43811.9166	24.2	259.5	30.8	269.5	16.2	112.9	31.2	248.1	73.7	86.0	57.9	228.5	459.2	275.8
78	10	31	10.0	43812.9166	19.4	253.9	18.2	65.8	22.4	282.8	52.5	83.2	25.0	49.2	55.4	121.6	472.5	275.9
78	11	1	10.0	43813.9166	11.9	241.7	26.7	93.4	28.2	96.9	40.2	274.6	66.9	270.6	88.1	104.3	492.6	276.0
78	11	2	10.0	43814.9166	5.2	187.9	24.5	253.3	33.3	272.8	11.0	178.3	45.9	249.7	133.8	93.8	489.2	276.1
78	11	3	10.0	43815.9166	10.0	111.5	20.9	279.2	37.3	89.8	40.8	74.6	52.0	96.9	164.1	87.8	492.6	276.1
78	11	4	10.0	43816.9166	18.0	96.0	29.5	78.0	39.9	267.5	53.0	266.1	63.4	77.6	170.9	83.5	493.1	276.2
78	11	5	10.0	43817.9166	23.5	89.6	14.1	109.6	41.5	85.2	31.3	100.7	31.4	290.6	154.0	78.6	490.4	276.2
78	11	6	10.0	43818.9166	26.2	85.1	32.7	261.5	41.7	262.9	16.9	46.2	73.2	262.5	113.3	71.1	484.4	276.3
78	11	7	10.0	43819.9166	25.2	80.7	8.0	323.1	40.5	80.6	48.0	258.7	15.1	169.0	58.9	50.6	475.2	276.3
78	11	8	10.0	43820.9166	20.6	75.1	33.8	84.6	37.9	258.1	50.2	89.0	74.1	86.7	39.0	323.9	463.0	276.4
78	11	9	10.0	43821.9166	13.8	65.6	8.0	207.1	34.1	75.1	21.1	293.2	28.6	54.9	91.7	282.2	447.7	276.5
78	11	10	10.0	43822.9166	6.1	27.7	33.0	267.3	28.5	251.3	27.2	244.1	65.8	271.4	140.8	272.1	429.4	276.6
78	11	11	10.0	43823.9166	8.4	299.1	13.8	56.7	23.5	65.5	52.6	81.9	49.7	251.4	169.9	266.5	408.2	276.7
78	11	12	10.0	43824.9166	16.6	278.2	30.2	90.7	17.4	235.8	44.6	272.6	49.7	98.4	174.0	262.3	384.5	276.8
78	11	13	10.0	43825.9166	23.1	270.6	20.7	248.9	11.9	37.9	12.1	147.1	66.4	78.5	152.9	257.1	358.4	276.9
78	11	14	10.0	43826.9166	26.3	266.2	25.4	275.1	8.8	177.2	37.4	72.1	28.3	295.0	111.3	249.2	330.0	277.0
78	11	15	10.0	43827.9166	26.1	261.9	26.8	75.2	11.3	356.5	54.3	264.7	74.9	263.2	59.3	228.0	299.3	277.2
78	11	16	10.0	43828.9166	22.1	256.9	19.1	101.9	17.1	112.1	36.4	97.6	15.5	183.4	56.8	121.2	266.6	277.4
78	11	17	10.0	43829.9166	15.1	248.0	31.4	259.3	23.5	282.4	13.7	29.7	74.4	87.4	90.2	104.0	232.1	277.6
78	11	18	10.0	43830.9166	7.0	218.4	12.0	325.7	29.4	96.7	46.0	257.1	32.5	59.1	137.1	93.7	196.3	278.0
78	11	19	10.0	43831.9166	7.3	126.5	34.0	82.6	34.5	272.7	52.8	87.8	64.6	272.4	168.3	88.1	159.2	278.5
78	11	20	10.0	43832.9166	15.0	101.1	7.2	162.9	38.5	89.7	26.0	286.1	53.6	252.9	175.2	83.9	121.1	279.3
78	11	21	10.0	43833.9166	22.2	92.2	34.5	265.6	41.3	267.2	23.2	238.2	47.1	100.0	157.7	79.2	82.2	281.8
78	11	22	10.0	43834.9166	26.3	87.1	10.1	41.7	42.7	84.9	52.0	80.7	69.4	79.4	115.8	71.9	43.0	288.7
78	11	23	10.0	43835.9166	26.7	82.8	32.8	88.7	42.8	262.8	48.3	271.1	25.1	300.0	59.9	51.2	18.9	315.5
78	11	24	10.0	43836.9166	23.5	78.4	16.5	241.9	41.4	80.5	15.6	128.4	76.6	263.9	40.2	324.0	37.2	31.1
78	11	25	10.0	43837.9166	17.0	70.8	29.4	272.1	38.7	258.1	33.9	69.4	17.2	198.2	94.3	283.1	75.0	74.1
78	11	20	10.0	43838.9166	8.7	49.5	23.4	71.5	34.7	75.0	55.1	263.6	74.5	88.2	144.5	273.0	114.1	71.9
78	11	27	10.0	43839.9166	6.1	350.4	24.0	97.1	28.7	251.1	41.1	95.3	36.6	62.4	174.2	267.4	157.5	94.4
78	11	28	10.0	43840.9166	14.1	283.4	29.1	256.8	23.7	65.1	11.3	3.9	63.1	273.3	178.1	263.3	196.1	94.9
78	11	29	10.0	43841.9166	21.7	273.3	17.1	285.5	17.4	234.9	43.4	255.2	57.4	254.2	156.5	258.1	233.7	95.1
78	11	30	10.0	43842.9166	26.2	268.3	33.2	80.6	11.5	33.6	55.1	86.5	44.4	101.9	113.8	250.1	270.0	95.4
78	12	1	10.0	43843.9166	27.4	264.0	10.1	127.9	9.0	169.6	31.6	281.8	72.2	80.2	60.5	228.1	304.9	95.5
78	12	2	10.0	43844.9166	24.6	259.4	35.2	263.7	12.4	337.8	18.7	228.7	22.3	307.3	58.7	122.0	338.1	95.7
78	12	3	10.0	43845.9166	18.4	252.5	7.2	6.6	18.6	110.4	50.7	79.2	78.1	264.6	93.3	104.9	369.4	95.7
78	12	4	10.0	43846.9166	10.1	235.3	34.9	86.7	25.1	281.5	52.0	269.5	19.5	210.7	141.7	94.6	398.7	95.8
78	12	5	10.0	43847.9166	5.3	164.7	12.0	229.2	31.1	96.1	20.9	114.3	74.4	88.9	173.6	88.8	425.9	95.9
78	12	6	10.0	43848.9166	12.4	107.6	32.7	269.7	36.2	272.3	29.6	65.1	40.4	65.0	180.3	84.3	450.6	96.0
78	12	7	10.0	43849.9166	20.5	95.2	19.3	66.0	40.2	89.4	55.3	262.3	61.8	274.3	161.7	79.4	472.1	96.1
78	12	8	10.0	43850.9166	26.0	89.3	28.3	93.6	42.7	267.2	45.9	93.2	60.9	255.3	117.9	71.7	492.1	96.2
78	12	9	10.0	43851.9166	27.8	84.8	26.0	253.5	44.1	84.9	12.3	335.7	41.9	104.0	60.2	50.2	508.9	96.3
78	12	10	10.0	43852.9166	25.9	80.7	22.2	279.4	44.0	262.6	40.1	252.8	74.8	80.9	42.4	321.1	522.9	96.3
78	12	11	10.0	43853.9166	20.3	74.6	31.4	78.2	42.4	80.3	56.8	85.2	20.2	322.0	98.5	282.6	533.9	96.4
78	12	12	10.0	43854.9166	12.0	61.2	15.0	109.8	39.4	257.8	37.1	278.2	79.4	265.2	149.8	272.9	541.9	96.5
78	12	13	10.0	43655.9166	5.3	0.7	34.8	261.7	35.1	74.7	14.7	212.5	22.1	219.9	179.7	267.3	546.6	96.5
78	12	14	10.0	43856.9166	11.4	291.0	8.9	317.9	28.2	250.5	48.7	77.5	74.3	89.6	183.3	263.2	547.9	96.6
78	12	15	10.0	43857.9166	19.8	276.4	36.0	84.5	23.5	64.1	55.1	268.0	44.3	67.1	160.4	257.9	545.8	96.6
78	12	16	10.0	43858.9166	25.5	270.4	8.3	203.3	17.0	232.8	26.6	107.4	60.3	275.2	115.9	249.8	548.6	96.6
78	12	17	10.0	43859.9166	28.2	265.9	35.3	267.4	11.2	28.6	24.5	58.8	64.4	256.2	61.0	227.7	545.3	96.7
78	12	18	10.0	43860.9166	26.8	261.6	14.7	56.8	9.4	163.1	54.6	260.7	39.3	106.0	61.1	121.4	540.7	96.7



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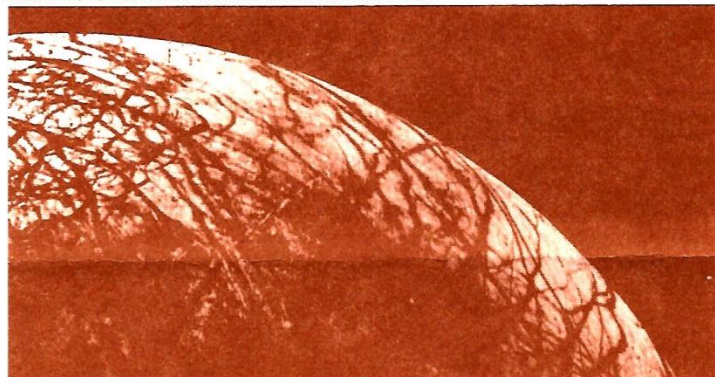
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NASA PHOTO COURTESY JET PROPULSION LABORATORY



This photograph of Europa, a moon of Jupiter, was acquired by Voyager 2 during its close encounter on July 9, 1979.

Mr. Loudon spent most of the past year at the NASA centers where these missions were flown, watching the avalanche of new data come in and learning first-hand from his fellow scientists what it means. Now he has returned to Michigan, to share the excitement of the new discoveries in a multi-media lecture series illustrated with spectacular slides, films, and tapes. About ninety percent of the material is new — that is, it was not known at the times of his previous lectures at the Institute — although the programs will be fully understandable even if you have not attended any of his earlier offerings.

Mr. Loudon is a lecturer, teacher, and commentator on space and astronomy for National Public Radio and the Canadian Broadcasting Corporation. He has astronomy degrees from the Universities of Pennsylvania and Michigan, and is staff astronomer for the University of Michigan's Exhibit Museum. He is a dynamic speaker with a rare gift for putting technologically abstract concepts into tangibly human terms.

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