

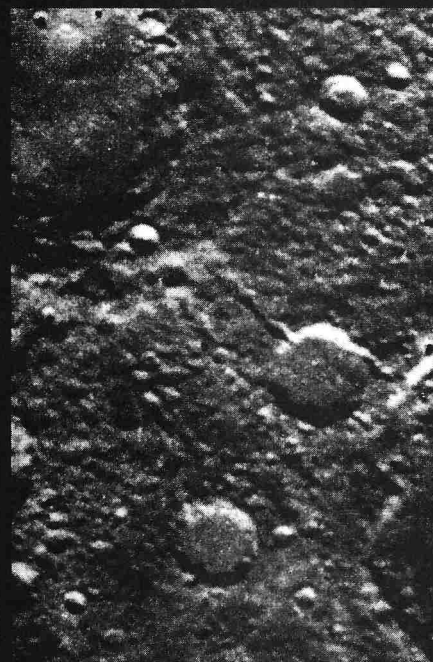


VESPA

THE JOURNAL OF THE WARREN ASTRONOMICAL SOCIETY

Mercury's Surface Features

Intercrater plains appear to be the most ancient features on Mercury's surface. Heavily pockmarked with many small secondary craters, this gently rolling landscape stretches between large craters and impact basins, offering stark contrast to the smooth floored younger craters. Intercrater plains seem to be the "field" against which other features formed, and are thus probably the oldest features on the planet.



Young craters — formed during a "recent" period of bombardment — are clearly surrounded by blankets of material ejected from the craters following impact. Larger craters display central peaks or groups of peaks, terraced walls and no ray systems. Accordingly, they are believed to be younger than those of the heavily cratered terrain.



Heavily cratered terrain contains craters in quantities and sizes that are remarkably similar to the lunar highlands. As on the moon, some craters are isolated while others overlap in groups. Ejecta blankets and secondary craters are not easily identifiable. Possibly the secondary craters on Mercury's intercrater plains originated at the same time these heavily cratered regions were formed. Many crater floors in these regions contain material from the surrounding intercrater plains. However, fewer secondary impact craters on these floors than on the plains leads to the conclusion that the floors are younger than both the craters themselves and the surrounding field of intercrater plains.



AUG. 1977

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

The Warren Astronomical Society (W.A.S.) is a local nonprofit organization of amateur astronomers. Membership is open to all interested persons. Annual dues are as follows; Student- \$9.00, College- \$11.00, Senior Citizen- \$13.50, Individual- \$16.00, Family- 21.00, the membership fees listed here include a one year subscription to Sky & Telescope Magazine.

Meetings are held on the first Thursday of each month at Cranbrook, and the third Thursday of each month at Macomb County Comm. College, in the student union building.

The EDITOR:	Roger A. Civic, 26335 Beaconsfield Roseville Michigan, 48066- 776-8735
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Assistant to the-Editor:	Mike Newberry, 623-7284
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OBSERVATORY SCHEDULE

Lectures for the coming month are listed below.

Aug 5/6 Don Misson..... 776-0424

Aug 12/13 Dave Harrington..... 879-6765

Aug 19/20 Dennis Jozwik 754-2037

Aug 26/27 Kim Dyer 835-2037

The lecturer may select either the Friday or Saturday, depending on the weather and their personal schedule.

In the future, some of our younger members will be assisting the senior lecturer. These members are, Bob Dennington, Dave Locke, Doug Holmes and Joe Tocco.

•buy- sell- trade•

The L.F.K. Astrophotographic Guide. Special price to Club members ...\$1.00
Contact Larry Kalinowski, 776-9720.

WANTED: A new or used 8" mirror blank or tool to be used as a tool to grind my mirror with. Call, Chris Edsill at 774-0007 with offer.

FOR SALE: 10" Newtonian telescope. Factory mirror, yoke equatorial mount that is portable. 70 power eyepiece. For only \$300.00, also a 40mm Polaris finder scope-12X, \$25.00. 18mm Kellner eyepiece, \$18.00. All in good condition. Call Doug Tracy- 882-4499

STARGATE OBSERVATORY CODE OF CONDUCT

Use of the Stargate Observatory is a privilege of membership in the Warren Astronomical Society. We enjoy this privilege because the W.A.S. continues to meet the commitment of providing lecturers each weekend to Camp Rotary. As a result of meeting our commitment, we may use the observatory on almost any clear night of the year. Also, because our observatory is located on the Camp Rotary grounds, it is unique in that someone watches over it on a 24 hour basis, 7 days a week, and at no cost. Because the use of the observatory is a privilege and not a right, and the camp ranger is responsible for watching over the observatory; we must observe certain rules of conduct when we wish to make use of the Stargate Observatory facilities.

1. Any club member wishing to use the observatory must call the Observatory Chairman, or the W.A.S. President, or the W.A.S. 1st Vice President (in that order) before 8 P.M. on the evening they are going out to the camp. (Lecturers are exempt from this requirement on their scheduled dates only.) When you call you must provide:
 - A. Your arrival time prior to 12 A.M.
 - B. The names of all persons coming out with you. (You may bring non-member guests if you have prior approval.)
 - C. A description of the car(s) you will be arriving in.
 - D. What facilities you plan to use at the observatory.

Notify a club officer in the order given above and only in that order. The contacted club officer in turn will notify the camp ranger. If you cannot reach one of the above club officers, do not go out and do not call the ranger direct.

Use of the observatory will be allocated on a first come first served basis. If you should happen to be the second or third person to request use of the observatory on a given night, you will be asked to contact the person who called first and obtain their permission to come out and share the observatory. (Some people may not want company. Also, the first person to call is the individual responsible for the observatory on that night--unless he or she has made prior arrangements with the contacted club officer.) Those who wish to bring out their own equipment, and not use the observatory telescope, may come out anytime. However, they must still contact a club officer before going out to the camp.

2. Lecturers are obligated to show up on one clear evening during their scheduled weekend or find a replacement lecturer for that weekend. After a replacement has been found, the Observatory Chairman must be notified of the change.
3. If you need a key to the observatory, you will be loaned a key. The only individuals who are authorized to loan out keys are the three club officers mentioned in Item 1. Lecturers' keys are not to be loaned out. Loaner keys must be returned within 24 hours, so that they are available for others to use. The only individuals authorized to have keys in their possession are the club officers and the active lecturers.
4. When you go out to Stargate, have your W.A.S. membership card with you. Even though the camp ranger has been notified you are coming out, he may still ask you to show your card to him.
5. If you should come out to the observatory without prior notification, you will be challenged by the camp ranger. Your membership card will do you no good in this situation. For security reasons, the ranger has been authorized to ask you to leave the camp grounds. If you do not leave immediately, he may have you arrested. (It should be noted that the camp ranger is often armed when approaching strangers at night.)
6. When you are in the camp, drive slowly (less than 10 MPH). Remember, there are frequently many small children in the camp.
7. When at Stargate, stay in the immediate vicinity (within 100 feet) of the observatory. You are not allowed to visit the camps or cabins unless you have been invited by the adult leaders. You may, however, notify the various camp groups that the observatory is open--that is, if you are a lecturer. No one is allowed to roam around the camp grounds or set up their telescope in any location other than at the observatory without the permission of the camp ranger.
8. While at the observatory, keep all noise to a minimum--especially after 11 P.M~ and during the warmer months. Be careful of loud talking or yelling, slamming car doors, and loud radios. remember, sound travels easily in the damp still night air.

9. Upon first entering the observatory, sign in on the log book. State the date, your arrival time, and who is with you. After you have closed up the observatory for the night, list the time.
10. When you leave the camp ground, you leave for the night. Coming and going in the middle of the night will not be tolerated. And don't wake the ranger up to tell him you are leaving.
11. When you are ready to leave for the night, make sure:
 - A. All litter has been picked up and disposed of both inside and outside of the observatory.
 - B. The dome opening has been fully closed and is pointing South.
 - C. All electrical items have been unplugged from the power outlets (except for the clock) and all lights are out.
 - D. The telescope is in a horizontal position on the East or West side of the polar axis. Insure that no one will hit their head on the telescope or the counter weight.
 - E. The telescope's covers have been put back on.
 - F. Both observatory doors are locked.
 - G. The mercury vapor lamp has been turned back on.
12. If any problems are encountered while at Stargate, contact the Observatory Chairman on the following day or as soon as possible.

FAILURE TO OBSERVE THIS CODE OF CONDUCT CAN RESULT IN THE
SUSPENSION OF YOUR OBSERVATORY PRIVILEGES.

Observatory Chairman	Dennis Jozwik	754-2037
President	Louis Faix	781-3338
1st Vice President	Frank McCullough	791-8752

The following are the minutes of the general meeting of the Warren Astronomical Society, held June 16, 1977 at Macomb Community College:

The meeting was opened by President Lou Faix. After welcoming new members, Lou called upon Gary Morin for the Treasurer's Report. It was learned that the books now balance with \$338.55 in the account. Gary requested that all members check their Sky and Telescope addresses against the roster. His report closed with a plea for all members to pay their dues.

Lou announced the appointment of Frank McCullough as program chairman. The Cranbrook July meeting will feature a Messier contest. Diane McCullough will present a talk on meteors, while Roger Civic will explain planets and their movements. The July meeting at Macomb College will feature Mr. Paul Strong and his discussion of the October Eclipse cruise. Chris Edsel is scheduled to explain Lunar Phenomena.

The new Observatory Chairman is Dennis Jozwik while Gary Morin will act as its Librarian. Mike Newberry has been appointed assistant editor of Vespa, the club newspaper. His primary responsibility will be the recruitment of articles from members. Diane McCullough has graciously accepted the post of Hospitality Chairperson.

The election of National Officers of the Astronomical League followed. The Society voted for these candidates: President, B. E. Williams O--R. E. Fried, 3; for Vice President, J. Del Wiseman, Jr. 1 and Hollis Schmohe 1; for Secretary, Rollin P. Van Zandt 3; for Wilma Cherup, for 23 years the Executive Secretary of the Astronomical League is retiring. Her post will be filled by Richard Wendt of Racine, Wisconsin.

Dennis Jozwik announced the observatory will be closed from June 27 to July 11. During this time, Lou Faix will correct the optics. Gary Morin will paint the walls. Roger Civic is donating white paint. Volunteers are needed for July 4th weekend. Members are invited to give ideas and suggestions on improvements. Dave Dobrzelewski has been given the added duties of lecturer.

President Faix then discussed security problems at Camp Rotary. He will give members a list of recommendations at the July meeting. He advised all to call ahead for reservations and to assume the responsibility of proper procedure and conduct at the Camp. Suggestions are invited.

Frank McCullough will be the new editor of "The Star", a twice yearly publication on astronomy. Members will receive copies. Gary Morin then gave a report on the Great Lakes Regional Convention to be held July 8, 9 and 10 at Oakland University. The need for teams for the Great Telescope Race was pointed out. He then discussed the prizes, programs and banquet to be held at Meadowbrook Hall. The need for displays and projects was explained. Reservations must be in by July 5.

There will be a new policy Format. Shorter meetings, Astro-photos, the possibility of a name change for the newspaper were discussed. Lou Faix will conduct a contest for the purpose of choosing the new name.

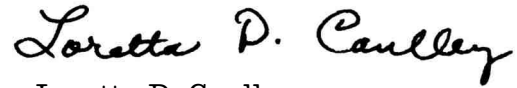
Loretta Caulley gave a biographical report on Caroline Herschel, first woman astronomer.

A fee of \$20 or \$30 will be charged by lecturers assigned through the Society.

Lou Faix closed the meeting by pointing out that the Warren group won the prizes at the recent Dayton meeting. He then raffled off the astro-color posters.

The meeting came to a close at 10:30 p.m.

Respectfully Submitted,



Loretta D. Caulley
Secretary

NEWS NOTES***

The Great Lakes Regional Convention, held July, 8-9-10, at Oakland University was a roaring success. The DOAA Slide show was one of the best presentations this person has ever seen. On Saturday the Warren Astronomical Society took on all comers and won the final round of the infamous Star Bowl. The Convention was very well attended and that nite the banquet was a star studded affair at beautiful Meadowbrook Hall. I am sure all who came enjoyed.

MORE... BUY-SELL-TRADE

FOR SALE.. Mamiya 2¼" X 2¼" C3-30 Professional, with an 80mm f/2.8 lens this camera is in mint condition, it sells new for \$340.00. You can own it for only \$260.00. Call Peter Kwentus 771-3283

WANTED... An equatorial mount for a 2.4" or 3" refractor, Unitron or Tasco. Please contact, Robert Knoll 647-6698.

All W.A.S. members, you too can have an ad to buy, sell, or trade something Astronomical in the WASP, just contact the Editor or asst. Editor, Mike Newberry.



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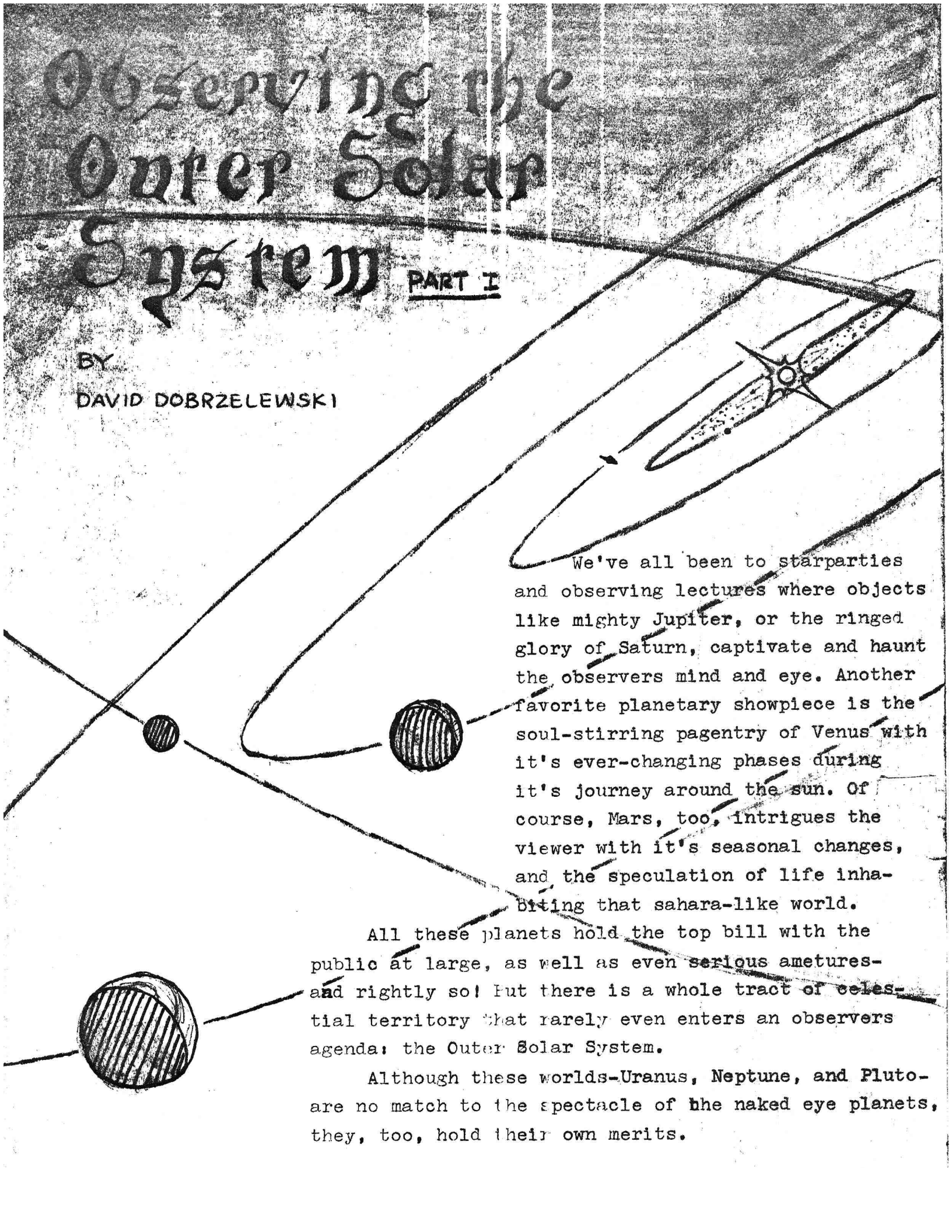
INFORMATION CALL
FRANK MCCULLOUGH
791-8752

Observing the Outer Solar System

PART I

BY

DAVID DOBRZELEWSKI



We've all been to starparties and observing lectures where objects like mighty Jupiter, or the ringed glory of Saturn, captivate and haunt the observers mind and eye. Another favorite planetary showpiece is the soul-stirring pagentry of Venus with it's ever-changing phases during it's journey around the sun. Of course, Mars, too, intrigues the viewer with it's seasonal changes, and the speculation of life inhabiting that sahara-like world.

All these planets hold the top bill with the public at large, as well as even serious amatures—and rightly so! But there is a whole tract of celestial territory that rarely even enters an observers agenda: the Outer Solar System.

Although these worlds—Uranus, Neptune, and Pluto—are no match to the spectacle of the naked eye planets, they, too, hold their own merits.

I myself have observed the outer solar system for over a year now, and the balance of this article is based on my own observations. I write, not only to pass along to everyone my own endeavors in the realm of the trans-Saturnia, but to hopefully aid those interested in exploring the outer solar system with some helpful hints (and also to show that us Polish astronomers ARE good for SOMETHING!!)

One favorable aspect of the outer planets is their motion on the celestial sphere on a grand scale. Uranus, Neptune, and Pluto each move comparatively small distances in the course of a given year, because of their distances from the sun. These planets are also accessible up to ten months out of every year, since the Earth clips along in its orbit around the sun, the sun will appear to overtake the outer planets at almost the same places every year, in a given span of years (say, a decade). In effect, for example, Uranus could be approaching conjunction (when a planet seems to pass behind the sun; another way to imagine it, would be to say that the sun lies on a line containing the two planets involved). The observer has to wait about two months from when he/she last saw Uranus in the dusk twilight until it again emerges from the sun's glare before sunrise. Mars serves a prime example for how planetary motions can cause problems. The planet of war was last positioned in the evening sky around Christmas, 1975. It is only in early 1977 that it is high enough in the pre-dawn sky for observing! This, of course is because of Mars' orbital velocity, which is only slightly slower than Earth's, which in turn means it takes Earth a lot longer to catch up to it.

The outer planets are particular favorites of my own, for two reasons, One, they are challenging to both observer and telescope. Two, I am intrigued by their incomprehensible remoteness, and excited at my conquest of them. They are truly guardians of the uncharted depths of the solar family's boundaries.

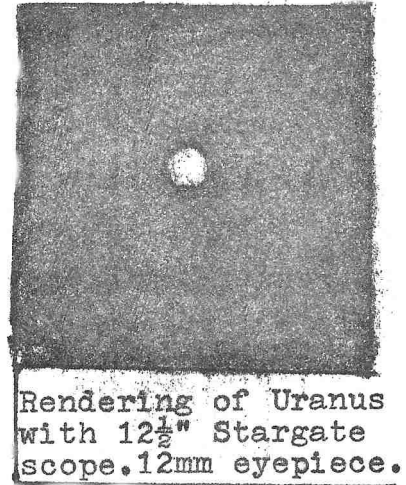


Basic Observational Data.

	symbol	discoverer	M_V (opp.)	ang.dia. (opp.)	mean daily motion	known moons
Uranus		Herschel (1781)	5.7	3".8	0'.6	5
Neptune		Leverrier (1846)	7.6	2".5	0'.36	2
Pluto		Tombaugh (1930)	14.5	0".25	0'.24	?

Uranus

Let's start with the lop-sided world of Uranus. At magnitude 5.7, Uranus is the brightest of the outer worlds. This distant world was discovered in 1781 by William Herschel on a routine scan of the skies. Herschel was a double star observer-among other things-and during one of his observations in Gemini, the planet Uranus randomly entered the field of view. Thinking it was a comet, he followed its motion for several weeks. He then calculated an orbit for the Object, and found it to be nearly circular, and lying outside the orbit of Saturn. "Gadzooks!" he said, "I've discovered a new planet!" Since then, Uranus has traversed the ecliptic only twice around, and in 1977 can be found in the constellation of Lybra. At this time, (and for another year, really) it's favorably placed near the 2.9 mag. star, Alpha Librae. Making a triangle that connects Alpha, and Mu (the latter, being just above the former, as seen through the telescope), Uranus is a greenish star of about Mu's brightness, and to the west. In January, 1977, I observed Uranus to form a short isosceles triangle (a triangle with two sides equal in length) with Alpha and Mu. Since then, it could be seen retrograding (moving in the opposite direction to its normal motion) away, to form a presently elongated obtuse triangle (a triangle with no sides the same length).



But Uranus itself also deserves attention. The planet shows a cold, forbidding jade-colored disk about 4" arc in diameter. A 6-inch telescope shows this quite well. After the yellows, oranges, reds, and browns of the naked eye planets, it is a treat to view the cool green of Uranus. It is a quite pronounced color, even in its star-like images in small scopes, (such as 2" to 4"). Detail, however is a formidable, perhaps even impossible endeavor. The fact that atmospheric detail is so difficult to observe is attributed to two main factors. One, Uranus' bands and zones are not very distinguished; there is only a very subtle contrast between the various regions on the disk. Secondly, we are tremendously distant from the planet; hence, a comparatively small disk as seen from Earth will result. So that if even an observer with a bird's-eye view (i.e., on a subordinate moon, for example) is afforded little striking detail, an observer on Earth certainly will have a view that is poorer still.

Actually, it is an unfortunate circumstance, in more than just the above respect. As was said earlier, Uranus is a lop-sided world. Quite interestingly, the planet's polar axis is tilted so steeply, that it's north celestial pole lies south of its ecliptic! Uranus' tilt is actually 98 degrees from the pole of the ecliptic, meaning that twice each Uranian year, (every 40

Earth-years) we on Earth view either pole of the planet. Were Uranus closer to us, and the cloud contrast greater, we would be in an excellent position for studying the polar atmospheric structure and behavior of another planet.

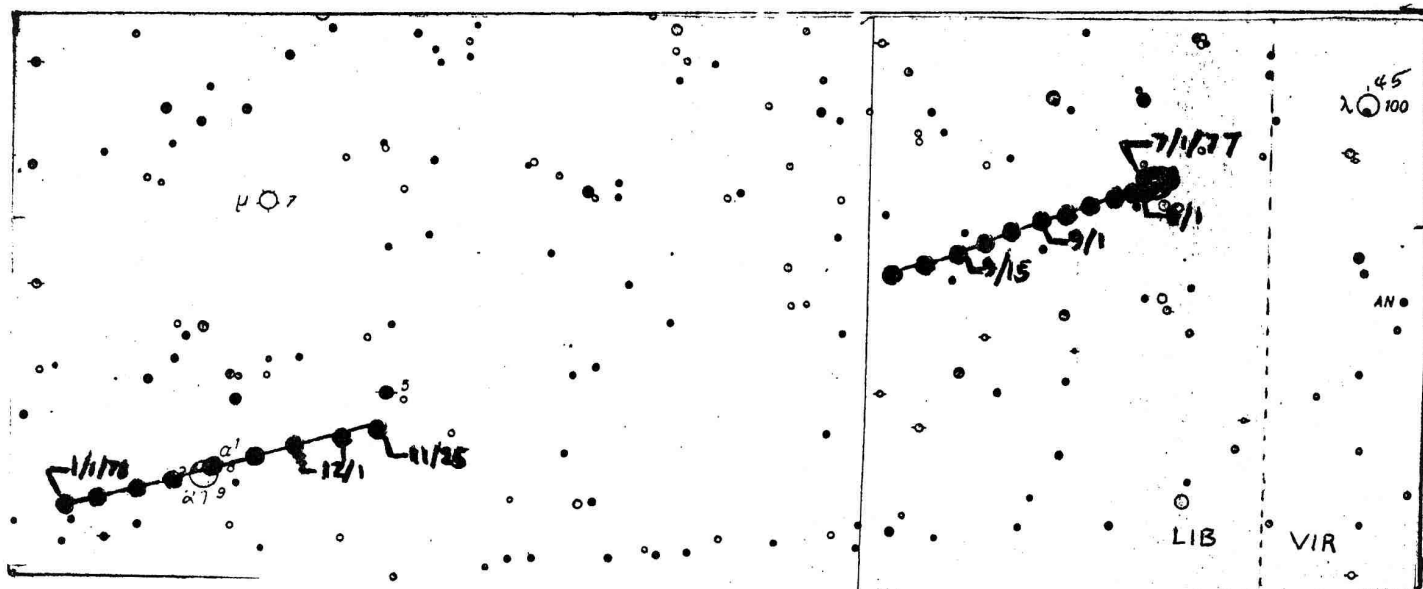
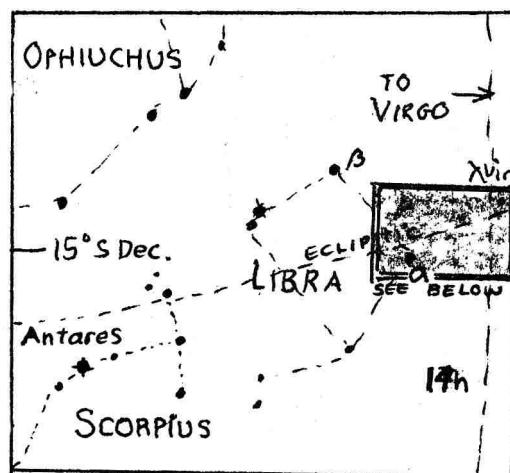
Its moons, though comparatively easy, are still a challenge. However, a large aperture telescope (say, a 12-inch or larger) can be employed for locating these elusive objects. The moons of Uranus, of which there are five, all range from 14th to 17th magnitude, so that a 30-inch 'scope is required to view all the moons. But again, a 12-inch can pick up the two brightest moons, Titania and Oberon, both 14th mag.

Photographically, as I have experienced, is surprisingly possible with Uranus. Anything that will support film will capture the planet, Tri-X film worked for me. With an f/2 lens, a 10-second exposure of Libra showed it. Also on Tri-X, a 7-second exposure on the Stargate 12½" at prime-focus really burned an image in!

For observing the planet, hopefully the chart below can be of assistance. Uranus reaches stationary about mid-July, when it is about one degree to the ESE of 4.5 mag. Lambda Virginis. Uranus then resumes direct motion back toward Alpha. Conjunction occurs Nov. 11. The year's event occurs on the third weekend in Dec., when Uranus passes within 1½' of Alpha. The telescopic threesome is tightest on Dec. 18 (before dawn).

ABOVE: Diagram of general area of sky in which to look for Uranus.

BELOW: Each dot represents 5 days. Reproduced from Atlas Eclipticalis.



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The Apprentice Astronomers Notebook

Lou Faix

There may be all kinds of ways to enjoy the science of astronomy; pushing glass around a barrel, tinkering with a gear or a soldering iron, curled up with a good text, thumbing through a photo album, mingling at a symposium, watching a slide show, or scratching on the paper table cloth over a late night coffee at the I-HOP. Few are as rewarding as being at the business end of your own telescope's eyepiece. Nothing brings home the reality of infinite space and eternal time as well as seeing it; seeing it real, alive and with your own eyes.

With a little determination (and a lot of persistence) I hope to write a brief monthly article about some object worth your observing time. The W.A.S. does a lot of things but one of the things it does best is share. With your indulgence I hope to share with you notes from my observing logbook. Don't look for heavy science or even meager discoveries. It will all be old stuff.

Rather, these articles will be one amateur's visual impression of the fascinations with the night sentinels. Hopefully you may be motivated to dust off the old glass tube and take a peak yourself.

On June 20th, I took my first glimpse of a strangely little known object NGC 6572. An article listing in the Astronomy magazine prompted my search. It's a most extraordinary planetary nebula. Exclusion from old Chuck Messier's list is easy to understand. Scanning at low power, its nearly star-like appearance would be easy to pass over. A determined look at each bright star, however, makes its vivid blue-green color conspicuous. At fifty power the tiny 13x 16 second diameter doesn't appear much larger than a comparable star. However, the objects extreme intensity bears magnification very well and at 125X the elliptical shape is obvious. Color intensity also seems to improve with magnification and at 500X I can only describe it as captivating.

NGC 6572 is located in the constellation Ophiuchus at 18h11m R.A. and +6° 50' Declination. For star hoppers that's one degree east and three degrees south of 72 Ophiuchus which is the eastern corner of a triangle formed with alpha and beta.

The elliptical planetary glows with an intensity most uncommon for this class of objects. Unlike the more famous Ring Nebula (M57) the central area is the brightest with only gradual dimming towards the edge. Its rated visual magnitude of 9.5 is misleading as the planetary is easily found in a 3" aperture finder. A twelfth magnitude central star was not observed, just should be detectable at Stargate.

At a distance nearly 4000 light years, the eerie blue-green object has had a measurable expansion in recent years. Astronomy provided the following descriptions of earlier observers:

Webb: "Small-very bright."

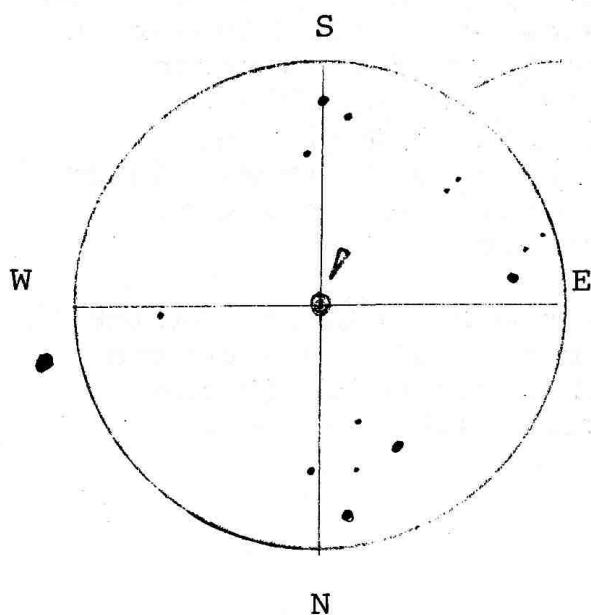
Struve: "One of the most curious objects in the sky."

Herschel:
(John) "Slightly hazy."

D'Arrest: "A little elliptical, five or six second diameter, bluish green."

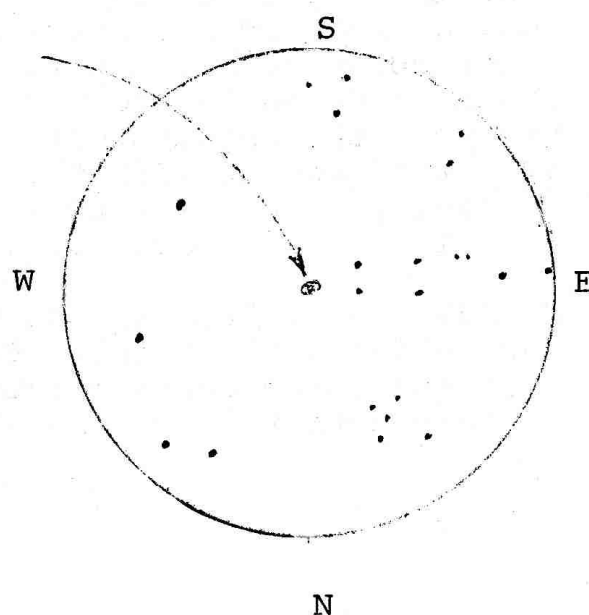
Barns: "A curious bright gaseous unit, makes isosceles triangle with two eighth magnitude stars, bluish."

10X FINDER



NGC 6572

50X (0°45' FIELD)



STARGATE OBSERVATORY NEWS

We have two new lecturers who will be appearing out at the observatory in the near future. They are Dave Dobrzelewski (I hope I got that right) and Mike Newberry. Good luck to both of you because when the camp is full you'll need it.

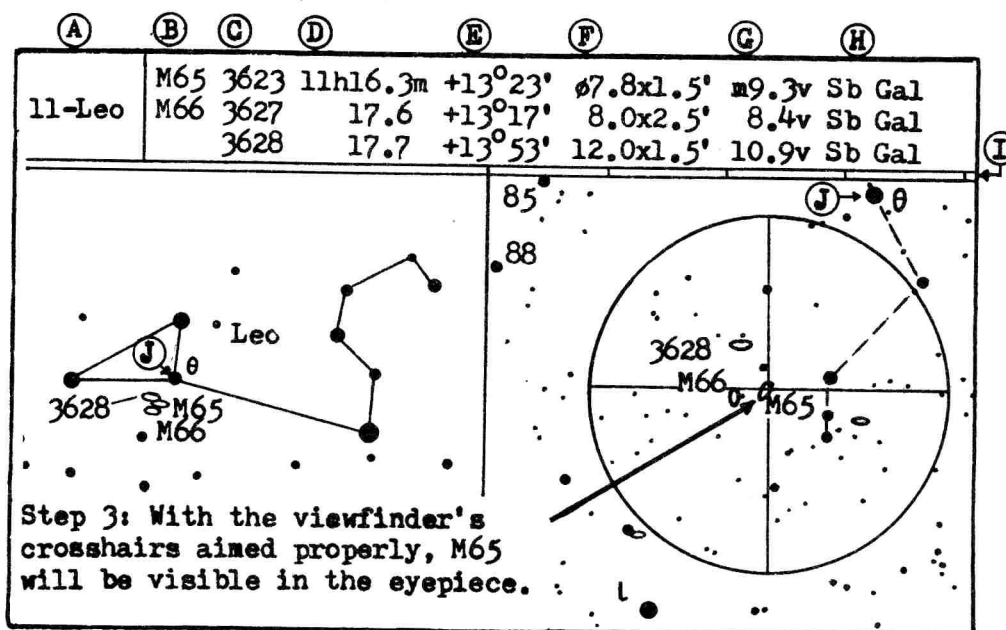
Both mirrors of the observatory telescope have been sent out for re-aluminizing. They were sent out to Skokie, Ill. early this month. They should be back any day now, and I expect we will have the telescope operational again sometime early next month (August). While the mirrors are gone the mirror cells are being worked on by an outfit called Faitus Enterprises.

The club has just purchased two sets of Astro Cards. These are index card finder charts. The two sets are: the Messier Objects and the Finest N.G.C. Objects. There are 75 star charts per set. After I have filed them by season and constellation they will be available out at the observatory. A typical Astro Card is shown on the next page. The next two pages give instructions on how to use these finder charts. If you plan to make use of these cards, I would recommend you save these instruction sheets.

Dennis Jozwik

HOW TO USE ASTRO CARDS

- Step 1: Use the left map to locate constellations and "Guide Stars."
 Step 2: Center the viewfinder's crosshairs on the "Guide Star."
 Step 3: With the right chart, use the "Guide Star" as a starting point, moving the crosshairs to the area where the object is indicated on the map.



The left map shows stars that are visible to the naked eye. The right map closely resembles what is seen in the viewfinder.

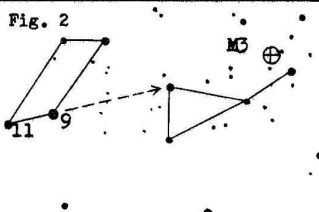
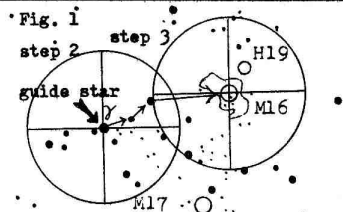
EACH CARD HAS THE FOLLOWING INFORMATION:

- (A) File-Guide (R. A. and Constellation)
- (B) Messier or Herschel Number
- (C) Number in Dreyer's New General Catalog (N.G.C.)
- (D) Right Ascension (Epoch 1950)
- (E) Declination (Epoch 1950)
- (F) Apparent diameter in minutes (') or seconds (") of arc.
- (G) Apparent visual (v) or photographic (p) magnitude.
- (H) Type of Object.
- (I) Chart Scale (One degree tick marks)
- (J) "Guide Star," is the only star shown in the left map with a number or Greek letter. The "Guide Star" is shown again in the right map.

INSTRUCTIONS

1. Use the left chart to locate constellations and "guide stars." The "guide stars" are the only stars on the left map with a number or Greek letter.
2. Center the viewfinder's crosshairs on the "guide star." (See fig. 1)
3. With the right chart, use the "guide star" as a starting point, moving the crosshairs to each bright star in a path toward the deep-sky object. This is called "star hopping." With the crosshairs centered on the indicated area, the object should be visible in the eyepiece. Be sure that the viewfinder is aligned with the telescope before you begin your observing.

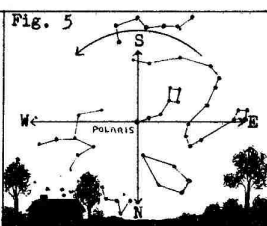
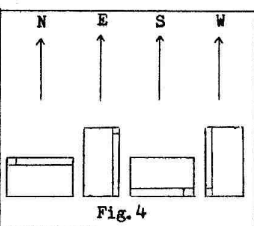
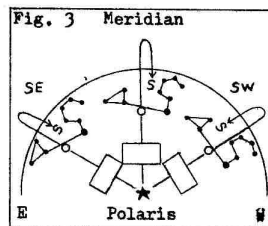
You may find it helpful to draw lines on the chart that indicate an imaginary route between the "guide star" and the object. (See fig. 2) Also, outline stars that form patterns, such as triangles, parallelograms, etc.



If you are unfamiliar with the constellations, use the cards along with a star atlas that shows the outlines of the constellations.

The constellation containing the deep-sky object and the "guide star" is illustrated as it looks at culmination, therefore, if it is east or west of the meridian, angle the card in that particular direction. (See fig. 3)

The right chart must be used upside down so that it matches the inverted image of an astronomical telescope. Facing south, the card is held upside down and level, but when observing objects toward the east or west, the card is turned progressively, until it is held lengthways due east or west. (See fig. 4) Facing north, the card is held rightside up, as long as the object is above Polaris, as this is actually south of it. (See fig. 5)



Hubble classification of galaxies

E Elliptical galaxies	SB Galaxies with barred spirals
EO Globular structure	SBO Transitional stage between the elliptical galaxies and the true barred spirals. Similar to SO forms.
E1 Very slightly elliptical form	SBA Well-developed bar with poorly defined fuzzy spiral arms.
E2-7 Ellipticity increasing	SBB Well-defined bar with spiral arms starting either tangent to an internal ring, or from the ends of the bar.
S Galaxies with spiral structure	Intermediate class as in SB
SO Intense nucleus with characteristic faint envelope. No sign of spirals.	SBC High degree of resolution of the small bar and of the spiral arms.
Sa Large amorphous center and diffuse tightly wound arms.	Irr Irregular galaxies
Sb Intermediate class between the early Sa and the late Sc types.	Irr I Highly resolved structure as continuation of Sc forms.
Sc Highly branched well-differentiated arms, resolved into stars and HII regions. Small nuclear regions.	Irr II Irregular structure without rotational symmetry.
Approximate star magnitude scale	Globular star clusters
L. Chart	Concentration: I largest, XII smallest
R. Chart	

Types

Galactic or open star clusters (Shapley's classifications)	Planetary Nebula
c = very loose and irregular	I stellar
d = loose and poor	IIa oval, homogeneously bright concentrated
e = intermediate rich	IIb oval, homogeneously bright without concentration
f = fairly rich	IIIa oval, nonuniformly bright
g = considerably rich and concentrated	IIIb oval, nonuniformly bright with brighter edges
	IV annular
	V irregular, intermediate to diffuse nebulosity
	VI anomalous

Abbreviations and chart symbols

M = Number in Messier's Catalog	Jan = Month that the constellation and deep-sky object reach culmination
NGC = Number in Dreyer's New General Catalog	Tau = (Taurus) this and other three letter abbreviations is the constellation where the deep-sky object is located
H = Number in Herschel's Catalog	* = Star or stars
RA = Right Ascension for epoch 1950	
Dec = Declination for epoch 1950	
⊙ = (Gal Cl) Galactic or open star cluster	
⊕ = (Glob Cl) Globular star cluster	
☾ = (Pl Neb) Planetary nebula	
☼ = (Dif Neb) Diffuse nebula	
☼ = Galaxy	
⊙ = (Size) Apparent diameter	
⊙ = (Size) minutes of arc (")	
⊙ = (Mag) Magnitude-photographic magnitude is given for all objects except that visual magnitude is given for diffuse nebula.	
Jan = Month that the constellation and deep-sky object reach culmination	
Tau = (Taurus) this and other three letter abbreviations is the constellation where the deep-sky object is located	
* = Star or stars	

LEFT CHART shows what may be seen with the naked eye. Stars are shown to 4.5 magnitude, and some 5th magnitude stars are shown near the deep-sky object. If you can not see all of the stars shown in the left chart with the naked eye, the atmospheric transparency is poor, or there is too much light pollution at your observation site. Remember, that the moon, particularly when it is full, interferes with both naked eye and telescopic observation.

RIGHT CHART shows stars that are visible in the viewfinder during good seeing conditions.

The average viewfinder (6x30 to 8x50) has a field of view of two to three degrees. You will soon learn how much sky area of each different chart is visible in the finder by noting the one degree tick-marks indicated at the top of each chart. Each chart has a scale that allows it to fit a 3x5 index card. Size and convenience is the main consideration of ASTRO CARDS.

SKY CALENDAR AUGUST 1977

Information for helping teachers and students observe the sky

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
<p>Evening Planet: Mercury can be found with binoculars in evening twilight during early August. Begin searching for it very low in W 30 to 40 min after sunset. Mercury sets just north of due west one hour after sunset.</p> <p>One hour before sunrise:</p> <p>Pleiades Moon Aldebaran Mars</p> <p>14 New Moon, not visible. Within a week, moonlight will begin to seriously interfere with Milky Way viewing. While evening skies are still dark, look for objects under August 2, 3, 6, 14, 15, 20.</p> <p>One hour after sunset:</p> <p>Moon 1st Qtr moon tonight (evening half moon) Antares</p> <p>28 Tonight's full moon is above horizon all night, from sunset to sunrise. Moon, halfway around zodiac from sun, appears in Aquarius, making it difficult for us to see that constellation's faint stars.</p>	<p>One hour before sunrise:</p> <p>Mars Aldebaran Jupiter Venus</p> <p>8 One hour before sunrise:</p> <p>Pleiades Moon Aldebaran Mars</p> <p>15 If sky is very clear low in south, look for 2 hazy patches in Milky Way (positions marked Nb and OCl on map). OCl is M7 in Scorpius, a star cluster 750 light-years away. Binoculars resolve it into stars.</p> <p>Eastern sky, one hour before sunrise, Aug 22:</p> <p>Mars Jupiter Castor Venus Procyon</p>	<p>Tonight moon rises as evening twilight ends. Moon rises later each night, allowing dark skies. When sky darkens, follow the Milky Way's course through Cassiopeia, the Summer Triangle, Sagittarius, and Scorpius.</p> <p>One hour before sunrise, Aug 9:</p> <p>Mars Moon Aldebaran Jupiter Venus</p> <p>16 With binoculars, try to find very thin crescent moon as early as you can. At sunset it is 8° up, 24° left of sun. From East coast Mercury is covered by moon just after sunset. Observers between Appalachians and Miss. R. can see it reappear.</p> <p>From about Aug 10 to Sept 16 each year, the sun passes in front of Leo the Lion. On Aug 22 or 23 the sun passes very near Regulus. Within 3 weeks Regulus will be easy to find low in eastern morning sky. See Sept Calendar.</p> <p>Moon rises about an hour after sunset.</p> <p>September morning sky will feature two close planetary pairings: Mars-Jupiter, and Venus-Saturn. A fifth planet, Mercury, will also be visible. See Sept Sky Calendar.</p>	<p>Locate the Teapot, formed by 8 stars in the constellation Sagittarius, the Archer. Note how the Milky Way looks like clouds of steam rising from the spout of the Teapot.</p> <p>One hour before sunrise, Aug 10:</p> <p>Mars Aldebaran Jupiter Moon Venus</p> <p>Eastern sky, one hour before sunrise, Aug 17:</p> <p>Mars Jupiter Castor Venus Pollux Procyon</p> <p>One hour before sunrise:</p> <p>Venus Saturn</p>	<p>One hour before sunrise:</p> <p>Mars Aldebaran Jupiter Venus</p> <p>One hour before sunrise, Aug 11:</p> <p>Mars Aldebaran Jupiter Venus Moon</p> <p>One hour after sunset:</p> <p>Spica Moon</p> <p>MORNING PLANETS FOR AUGUST: See below, and diagrams for Aug 1, 4, 7-13, 17, 22, 27, and 31. In August 1977, dark evening sky has been quite barren of planets. Future Augusts will improve: In Aug '78 we'll have Venus and Mars; in '79 Saturn; in 1980 Mars, Jupiter, and Saturn; in 1981 Venus, Mars, Jupiter, and Saturn. Hang in there, summer skywatchers!</p> <p>3 Planets are prominent in eastern morning sky all month as follows: Venus is the brilliant morning "star" rising 3 hours before sun. Jupiter, next in brightness, is 2.4° above Venus on Aug 1. Because of Venus' rapid motion, by Aug 31 Jupiter appears 32° upper right of Venus. Reddish Mars appears as extra first magnitude star in Taurus. On Aug 1 Mars is 16° upper right of Jupiter and 5° upper left of Aldebaran. By Aug 31 Mars is 2° from Jupiter. Saturn becomes visible at month's end. See 8/31.</p>	<p>The year's best display of "shooting stars", the Perseid meteor shower, occurs next week, Thursday night, Aug 11-12, is the best night. Expect up to 50 meteors per hour on Friday Aug 12, 2-4 hrs before sunrise.</p> <p>One hour before sunrise:</p> <p>Castor Venus Pollux Moon Procyon</p> <p>One hour after sunset:</p> <p>Moon Spica</p> <p>Eastern sky, one hour before sunrise, Aug 27:</p> <p>Mars Jupiter Castor Pollux Venus Procyon</p>	<p>Last Quarter (morning half moon). On clear dark summer evenings, look for the Great Rift, the dark lane of dust clouds dividing the Milky Way into two branches from Cygnus southward.</p> <p>One hour before sunrise:</p> <p>Castor Venus Pollux Moon Procyon</p> <p>In the northeast, note Andromeda, a slightly curved line of 3 bright 2nd-magnitude stars. Aim binoculars 6° above the middle one, and look for hazy patch (Glx on map). It is another galaxy, 2 million light years away!</p> <p>Eastern sky, one hour before sunrise, Aug 27:</p> <p>Mars Jupiter Castor Pollux Venus Procyon</p>

Magnitudes of the Planets: Venus -3.6 to -3.5; Jupiter -1.6 to -1.7; Saturn +0.7; Mars +1.2 to +1.0; Mercury (Aug 1-8) +0.4 to +0.6. Motions during August: Venus -36°, Mars 20°, Jupiter 5 1/2° (all eastward). Venus on Aug 1 is in "pan-handle" of Orion, 14° N of Betelgeuse and 2.4° from Jupiter. Venus enters Gemini on Aug 2, passes 3/4° S of 3rd mag Mu Gem Aug 7, 7° S of Pollux Aug 22, and enters Cancer Aug 26. Mars on Aug 1 is 5° N of Aldebaran; on Aug 22 it passes between Beta and Zeta Tauri, the tips of the Bull's horns; on Aug 31 it is 2° from Jupiter. Jupiter crosses from Taurus into Gemini Aug 19, and is 1/4° S of 4th mag 1 Geminae Aug 24.

Sunrise/Sunset East Lansing: Aug 1 6:29 a.m./8:59 p.m.; Aug 16 6:45 a.m./8:39 p.m.; Aug 31 7:01 a.m./8:14 p.m. (EDT)