The W.A.S.P. is the official publication of the Warren Astronomical Society and is available free to all club members. Requests by other clubs to receive the W.A.S.P. and all other correspondences should be made with the editor at the above address. Articles should be submitted at least one week prior to the general meeting.

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W.A.S.  Warren Astronomical Society  President: Frank McCullough 725-4736
        P.O. Box 474  1st V.P. : Doug Bock 533-0898
        East Detroit, MI 48021  2nd V.P. : Dave Dobrzelewski 979-3273

The Warren Astronomical Society 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 Thursday  3rd Thursday
Cranbrook Institute  Macomb County Community
of Science  College-K Building
8:00 p.m.  8:00 p.m.
500 Lone Pine Road  14500 Twelve Mile Road
Bloomfield Hills, MI  Warren, MI

Membership is open to those interested, in astronomy and its related fields. Dues are as follows and include a year's Subscription to Sky and Telescope.

Student  $12.00  College  $15.00  Senior Citizen  $16.00
Individual  $20.00  Family  $25.00

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Observatory Chairman: Dave Dobrzelewski 979-3273

Lectures are given at Stargate Observatory each weekend. The lecture will be either Friday or Saturday night, depending on the weather and the lecturer's personal schedule. If you cannot lecture on your scheduled weekend, please call the Chairman as early as possible or contact an alternative lecturer. Those wishing to use Stargate must call by 9:00 p.m. on the evening of the observing session. The lecturers for the coming months are:

August 22/23  Dave Dobrzelewski (979-3273)  Emergency back-up lecturers:
August 29/30  Marty Kunz  Doug Bock (533-0898)
September 5/6  Ray Bullock (679-9458)  Dennis Jozwik (7$4-2037)
September 12/13  John Root (464-7908)  Don Misson (727-9083)
September 19/20  Lou Faix (781-3338)
September 26/27  Dave Harrington (879-6765)

The W.A.S. is soliciting requests for items useful in Stargate Observatory. Any donated items, such as star charts, a time or weather radio, reading lamps, eyepieces, photometers, high dispersion spectrographs, measuring engines, microdensitometers, etc., will be appreciated. Contact the Observatory Chairman.
MINUTES OF THE JULY 17, 1980 MEETING OF THE WARREN ASTRONOMICAL SOCIETY

The meeting was called to order at 8:30 p.m., by President Frank McCullough.

Old Business

Nancy Tomczyk reported the WAS treasury now stands at $302.56. Doug Bock gave a brief report on the regional and national meetings. Dave Dobrzelewski gave a report on observing sessions.

New Business

Those members interested in the Perseid Meteor showers to meet Monday, August 11 at Stargate.

The summer camp-out will be held at Camp Rotary September 5 and 6. Volunteers are needed.

Members have shown an interest in having a "flea Market" at both the Cranbrook and general meeting. More on this at future meetings.

Dave Dobrzelewski gave an update on Stargate.

Dave Harrington was the first sneaker of the evening. His talk, with illustrated slides, covered the "Mathematics of Mirror Making."

Pete Kwentus spoke about the Civic Camera shop.

Doug and Robin Bock showed slides and discussed their trip to Dallas, Texas and Tucson, Arizona.

Louie Faix was the last speaker and he gave an "Astrophotography Update" along with some very interesting slides.

The meeting was adjourned at 11 p.m.

Respectfully submitted,

Connie Shannon
Secretary
On the Phenomena Attending the Disappearance of the Rings of Saturn

By G. P. Bond
Assistant at the Cambridge Observatory

From the Astronomical Journal, Vol. 1, No.3, January 7, 1850

In the course of each revolution of the planet Saturn, occupying a period of about 30 years, the plane of its ring twice intersects the sun; so that alternately, for fourteen or fifteen years in succession, the north and south surfaces are illuminated by the solar rays, while the opposite side is immersed in darkness and winter of equal duration. The passage of the sun through the plane of the ring, the spring-time and autumn of the system, occurs in quarters of the heavens not far from our own vernal and autumnal equinoxes. At the time of these changes, the edge of the ring alone, for a short interval, receives the full light of the sun; and at near these times the earth, by reason of its annual motion, passes once or twice through the plane before the comparatively slow motion of Saturn carries the line of the nodes across our orbit. At either of these phases, or whenever the earth and sun are on opposite sides of the ring, it becomes completely invisible, except with the most powerful telescopes; owing to the feebleness of the light reflected from the extremely narrow illuminated edge then presented to the eye. For some months before and after these disappearances, while the earth and sun are elevated only at a very small angle above the ring, opportunities are afforded of observing some peculiarities relating to their disposition and structure, under the most favorable advantages of position.

These opportunities, it is much to be regretted, have never yet been fully improved. Either from the small number of instruments which have yet been constructed fitted for researches of so delicate a nature, or from a want of system and concert among observers, many interesting questions remain unsettled;—such too, as are clearly not beyond the reach of investigation with a proper use of such means of information as we can command.

The recent disappearance of the rings of Saturn in 1848-49 was made a subject of particular attention at the Cambridge Observatory during most of the interval which elapsed between June 1848, when the planet reached a favorable situation, and the final reappearance of these observations, it is proposed to refer to their results in connection with a brief statement of some of the questions and conjectures which have arisen relating to certain phenomena noticed at these periods.

By comparing the phases deduced from Bessel's elements of the ring with those recently observed, the correctness of the elements receives a strong confirmation, the discrepancies scarcely exceeding the limits or errors of observation. This is all the more conclusive from 'the epoch being one of unusual occurrence. The first reappearance of the ring in September, 1848, lasted only 9 days. A similar instance has not taken place since 1656, or too early for valuable determinations. That this would be the case was pointed out by Desejour as long ago as the middle of the last century.

The first disappearance in April 1848, took place too soon after the conjunction of Saturn to be seen. The time of reappearance, caused by the passage of the plane of the rings through the sun, according to the phases
given in the Nautical Almanac, which are derived from Bessel's elements, was about noon of the third of September, 1848, while the planet was below the horizon at Cambridge. The illumination of the southern surface was first noticed at two o'clock of the morning of the 4th.

The second disappearance happened at some time between two o'clock in the morning and ten in the evening of the 13th, of September; the calculated time preceded the former limit by four or five hours. The final reappearance occurred at about six o'clock in the morning of the 19th of January, 1849, or between the same hour in the evenings of the 18th and 19th, and the calculated time is included within the same limits.

These arrangements are quite remarkable, when we consider the very delicate nature of the phenomena under discussion. In neither of the above instances can we infer an error of three hundredths of a second of arc in the calculated minor axis or the ring.

At the distance of the earth from Saturn, the edge of the ring subtends an angle much too small to be subjected to any of the ordinary direct measurements. We can, however, form an estimate of its thickness, which cannot very widely differ from the truth. This is done by comparing the amount of light reflected from the surface of the ring, seen under a very small angle of elevation, assuming that the sides and edges of the ring have equal reflective power.

The illuminated area of the south side of the ring presented to the earth between the 4th and the 13th of September, never exceeded in breadth one quarter of a second of arc; yet, even when reduced to less than a tenth of a second, it was an object almost too bright for comparison with the slender filament of light which marked the edge of the ring. It would seem, therefore, that we can hardly assign a larger value than one hundredth of a second of arc to the angle then subtended by the edge or the ring, giving a thickness of about forty miles. Compared with the diameter, this bears the proportion which the thickness of a common sheet of writing-paper does to its breadth.

It has been suggested that some inconsistencies noticed in the times of disappearance and reappearance of opposite sides of the ring might be attributed to a considerable mutual inclination of the planes of the north and south surfaces. With the thickness above assigned to the ring, an inclination of the two surfaces so great as one minute of arc is not possible; and even a much smaller value would seem at variance with the laws by which we conceive the stability of the ring to be maintained. But discrepancies have been referred to this source, amounting in one instance to nearly a quarter of a degree. Another argument against such a supposition is, that, if it were true that any great irregularity of this kind existed, it would be apparent, as the ring revolved around the planet, in an alternate increase and diminution of its brightness, in periods corresponding to that of the rotation of the ring. For since both surfaces could not at the same time coincide with the plane of rotation, when this was near the sun or the earth, one or the other of the surfaces would be successively presented to and turned from these bodies, and consequently be visible and invisible at regular intervals; this, if it takes place, has entirely escaped notice.
On similar grounds, we may question the existence of any bending or twist in the ring large enough to be sensible. This would cause the east and west ansae to be alternately brighter and fainter in like periods. The appearance of inequalities on the ring, when the eye is near its plane, has been the subject of remark with almost all observers who have followed the planet through these phases with telescopes of superior power. Many of these, it is true, are to be referred to some one or other of the satellites, which are continually threading the ring as they cross and re-cross the disk of the planet. But there is still a general agreement as to the fact that the view of the ring, at near its disappearance, does not give the impression of an even and uniformly illuminated surface.

The first proposed way of accounting for these appearances is the one which naturally suggests itself, namely, that they arise from actual inequalities and protuberances of masses of matter sufficiently large to cast heavy shadows upon the planes above them, and when seen in relief, to break up the continuity of the edge, so as to make their presence sensible to our vision.

This view of the matter at one time seemed to be well established by the observations of Sir William Herschel, who determined, or at least supposed he had determined, by means of their prominences, a time of rotation of the exterior ring, which is that now usually received. From theoretical considerations alone, Laplace inferred the necessity of these inequalities for sustaining the equilibrium of the ring, and shown that the time of rotation must be nearly that given by Herschel. This agreement has long been regarded as an admirable mutual confirmation of observation and theory.

The careful and laborious investigations of Schroeter at Lilienthal have, however, brought to our knowledge a state of things which at first sight tends greatly to weaken confidence in the above results, obtained by the Great English astronomer, and unless we can substitute some other for the most obvious explanation of them, must be held to throw a doubt upon the rotation of the ring altogether.

The observations in question were made at the Observatory at Lilienthal, in 1789-90 and 1802-3, with instruments of the first class, and prosecuted with a zeal and industry which lay a claim at once upon our confidence in what was seen by Schroeter and his coadjutors; however we may differ from the conclusions he has drawn from the appearances described. There were points of light on the edge of the ring, resembling in brilliancy small planets, but with this extraordinary peculiarity, that during the whole period of observation they retained a position always unaltered with reference to the globe of the planet. It is on this feature of absolute fixedness and immobility that he insists, and, I think, no one can duly weigh the evidence which he brings forward in all its details, without admitting that the fact is indisputable. At the very commencement of our observations at Cambridge, the same condition was noticed, and was kept up throughout the series, establishing beyond a shadow of a doubt, that these irregularities, by whatever cause produced, are stationary, and have no movement of rotation about the globe of Saturn.

The impression conveyed to the mind on seeing these inequalities is, that they are masses of matter belonging to the structure of the ring, and
adhering to it, so as of necessity to participate in all its motions. This, up to the present time, has been the opinion of all who have themselves witnessed the phenomenon. Convinced that they were motionless, Schroeter boldly announced that this property proved with mathematical certainty, that the ring does not rotate, but always preserves one fixed, immovable position over Saturn's equator.

To meet this difficulty, different explanations have been proposed by LaPlace and by Dr. Olbers. The former considered the appearance of inequalities to be due to a small mutual inclination, and a slight difference in the nodes of the two rings. The latter, that it is a merely optical effect, which he shows to be produced in certain positions of the plane with reference to the line of vision. As this can only take place on the illuminated side, it fails in accounting for their being seen when the earth is above the un-illuminated surface. Neither does LaPlace's solution cover that difficulty, that the irregularities are strongly exhibited when the eye is directed towards the un-illuminated surface, as is established incontestably by the Cambridge observations.

In this connection, we must not allow to pass unnoticed, that the authority of Herschel asserting the motion of these is brought forward by LaPlace, as confirming his theory of the rotation of the ring, while that of Schroeter, diametrically opposed to Herschel's testimony, is used to confirm the theory of the nodes of inclinations. However, that small differences to which he alludes, as possibly existing in the nodes and inclinations of the rings, as well as, time of rotation, may, nevertheless, have place without interfering with the following explanation.

In treating of the theory of rings, the same great master has assumed that they are portions of extremely flattened ellipsoids. In this case, their outer edge would be brought to an extremely narrow apex, while the inner would be comparatively broad, and may be supposed to be perpendicular to the plane of the ring. The light reflected from these interior edges will exceed that from the outer, and will abruptly cut off at different distances from the ball on each side, at the time of the disappearance of the ring. First, by the un-illuminated surface of the outer ring, at a distance from the centre of Saturn equal to the interior radius of the inner ring. Again, by the un-illuminated surface of the outer ring, at the distance of the inner radius of the outer ring; and between the two, and very close to the latter will be visible the illuminated outer edge of the ring. Finally, on both sides of the ball will extend, uninterruptedly, the outer edge of the outer ring. Similar phenomena will also attend the reappearance.

Here, then, we have a succession of breaks and interruptions in the light of the ring when seen from near its plane, sufficient to give the impression of considerable inequalities. These result, not from any hypothesis framed purposely to account for the phenomena before us, but must exist, whatever we may suppose to be the figure of the ring, and must, too, become visible, when we can direct upon them a telescope of sufficient power. The condition of primary importance, that of retaining a fixed position, is satisfied without interfering with the rotation of the ring. The inequalities thus produced will also have place on both the bright and dark sides, shining
with a light intrinsically brighter than the rest of the surface, because receiving the rays of the sun perpendicularly.

He may thus satisfy some, at least, of the singular phenomena attending the disappearance of Saturn's ring, so, as to reconcile many of the anomalous appearances which have hitherto perplexed astronomers, without requiring any other suppositions than those afforded by established facts, at the same time not precluding the possibility of other remaining sources of further irregularity.
Part 3 of 5.
a. The Georgian Planet

On the evening of 13 March 1781, William Herschel, the distinguished amateur astronomer and once-musician from Hanover, observed in the constellation of Gemini in one of his routine sky searches for new objects such as comets, nebulae, and variable stars. At one point, a curious object entered the field of his seven-foot retractor, which he recorded to be visibly larger than the spurious discs of the background stars. He then found it to increase in apparent size with increasing magnification, as the other stars remained small. In his Journal, Herschel noted it as a "curious either nebulous star, or perhaps a comet ..."

On March 17th, he observed the object again, and presently called it a comet, because it changed position since he had last observed it. The discovery was reported to Maskelyne, his friend and the Astronomer Royal at Greenwich. Maskelyne observed it, trying earnestly to distinguish the characteristic nucleus and tail in this small greenish object. He reported to Herschel that it was "equally likely that he had found another planet"--and in due course, it was calculated to have a nearly circular orbit, outside that of Saturn! Herschel suggested the planet be called 'Georgium Sidus', in honor of the King George III. The Georgian Planet, however, eventually received the name Uranus.

Herschel devised what he called a lucid-disc micrometer, which utilized a light source through a circular aperture cut out of paste board and covered with paper, and thereby simulate the planet's size, brightness and color. By selecting the correct aperture from a graduated series, and the right combination of white and blue paper as the light shield, Herschel was able to closely match the appearance of Uranus in his telescope.

Herschel soon attempted to find satellites around Uranus, as were in evidence around Jupiter and Saturn. However, it wasn't until 1787 that he had success in finding two such moons, as Uranus spent several post-discovery years in the faint-star-rich fields of Gemini, making identification of equally faint satellites difficult. Finally with his front-view scope design, he scrutinized two, faint star like objects close to Uranus' disc. He observed them for over a year, and was able to fix upon their periods, orbital planes, and greatest distances from the planet. In time, he claimed to discover four additional satellites, although these were never confirmed. He probably caught confused glimpses of two other of Uranus' moons, but these remained for Lassell to positively Identify, in 1851; and yet a fifth by Kuiper in 1948. Herschel, at that same time, claimed that Uranus and its satellites were orbitally inclined nearly 90 degrees to the ecliptic, and that the satellites moved in a retrograde
(reverse) direction about the planet. If we consider, however, that Uranus may be tilted through over 90 degrees, then the satellites actually do revolve in direct motion, in conformance with all other objects then known in the solar system. The angular tilt of the Uranian system has since been identified as being 98 degrees, and thus the system actually does rotate in correct fashion--only almost "upside-down"!

To this writing, we have considered William Herschel's endeavors in planetary astronomy, his dabbling in solar physics, his lucrative telescope business, and a little about his beginnings in astronomy, and have been introduced to some of the people in his life; including his sister, Caroline, his son, John, the astronomer, Maskelyne, and King George III, as well as the Royal Society, which was the 'clearing house' for many of his research papers. Next, we turn to Herschel's pioneering work with variable and double stars, magnitudes and parallaxes, in "William Herschel: Stellar Astronomy".

W.A.S. Exchange

For sale or trade: "Telescope World" 8" f/15 classical cassegrain with equatorial mount and motor drive, slow motion declination control, four foot pier, star diagonal. R.J. Shannon, 194 Moran, Grosse Pte. Farms, MI 48236. Phone (313) 885-4283.

For sale: 1011 Star Liner f/5.8 telescope with mounting (same type as Rotary), clock drive, 50mm finder, 24 and 8mm Brandon eyepieces and Barlow lens. Good condition. $550.00 Dave Mariotti, 714 North Wilson, Royal Oak, MI 48067. Phone (313) 545-6299.

Editor's Note

For this and the past two issues of the W.A.S.P., I have been unable to print and distribute the copies because of commitments to the Wyandotte Planetarium. During this time, the following people have graciously donated their time in taking up these duties: Lou Faix, Dave Harrington, Frank McCullough and Lydia Skonieczny. I extend my sincere appreciation to them. Perhaps we should keep them in mind if I ever have to vacate my position as editor.

There has been some confusion regarding articles. As always, articles should be submitted at least one week prior to the general meeting. My address appears at the top of the first page of every issue. If an article has already been printed, it can be submitted two days prior to the general meeting.

Sincerely,

Tim Skonieczny
Another one of nature’s spectacular shows has come and gone. The Perseid meteor shower is over for another year. For awhile it looked like we might not see them this time, but the gods yielded to our pleas and by 11PM the clouds were swept clean from the skies over Stargate Observatory. The clubs organized watch effort failed completely as no one else showed up. Pat Krause and I returned to our private facility at Mount Washington Observatory. The show was terrific even though the popcorn ran out.

With two observers we could only watch about two thirds of the sky. Our favorite late night radio station, WWV, kept a faithful note of the time as we counted the fall rate for each fifteen minute interval and estimated the magnitude of the starry bullets. Weary eyes and gathering haze overtook us at 5:15 Universal time. Nevertheless, two hours of data were acquired.

The fall rate (meteors per hour) seemed to decline steadily throughout the night. This was to be expected as earlier reports indicated the Earth would pass through the densest portion of the meteor swarm at about 8PM on the preceding evening. Adjusting our count to an hourly rate and compensating for the unwatched sky areas, we estimated that the maximum fall rate was in excess of one hundred per hour. Our estimates of brilliance were only noted to the nearest magnitude and hence are subject to some degree of error. The average brilliance was 3.2 magnitudes which is a bit fainter than most previous reports.

Bring on the Orionids (October 21st)!

![Graph showing the fall rate of meteors over time.](chart.png)
MORE FROM THE CAL - COMP USERS GROUP

by

Larry F. Kalinowski

Since the last time I reported about The Calculator-Computer Users Group, we've managed to pick up a few more interested parties from the ranks of the local astronomical societies.

A tip of the welcome hat is made to Richard Thomas (D.A.S.), Jon Root (L.A.S.), Pat Krause, John Dombrezal, Carl Rommelt and Lou Faix, all of the W.A.S. Please excuse me if I've managed to spell some of your names wrong.

I'm sorry to say that because of crowded conditions at the college this month, we won't be able to use the schools facilities for the August 28th Cal-Comp meeting. Registration and the beginning of the school year will take all of the rooms available. Instead, Ken Kelly has advised us that his home will be available for this month's meeting. Mr. Kelly lives at 19209 Mapleview in the Seven Mile-Schoenherr area. (One block North of Seven Mile and one block East of Schoenherr) Ken is proudly going to demonstrate his Radio Shack TRS-80 system. Incidentally, I'd like to mention that Ken has been in the hospital for about a week involved in a search and destroy mission. Just how successful that mission was will have to be revealed by Ken himself. Anyway, we're glad to have him back.

John Baditoi took over the July meeting and marvelously continued in Ken's absence. Programming in the BASIC language is still being covered and will continue to be the main topic for the meetings to come. If you've wanted to join our group, now's the time to make your entrance. You won't be missing much if you're a novice in this game of computing.

This month's program is for those of us with programmable calculators . . . specifically the TI-57,58 or 59, but with a little adaptation, it can be revised for all programmables. This program calculates the proper size diagonal for the Newtonian telescope. Most of us know that photographic and visual Newtonians require different sized secondaries. Is yours the correct size? You can easily find out with this short program. To be specific, this program calculates the size of the minor axis for the elliptical diagonal. When the answer is displayed, a touch of the run button will give you the size of the major axis, if you desire it. The following information is required: 1) Your objective diameter 2) Objective focal length 3) Diameter of Lunar image at prime focus (visual) or length of film frame diagonal (photographic) and 4) The diagonal to focal plane distance. Those values are stored in labels A thru D respectively. Label E runs the program. Call me at 776-9720 if you have any difficulty running this one.

By the way, Ken Kelly's telephone number is 839-7250. See you at the next Cal-Comp meeting.
NEWTONIAN DIAGONAL SIZE PROGRAM

(TI-57, 58 & 59)

2nd
LBL
A
STO
stores objective diameter in
01
register #1
R/S
stop
2nd
LBL
B
STO
stores objective focal length in
02
register #2
R/S
stop
2nd
LBL
C
STO
stores image diameter of Moon (visual) or film frame
03
diagonal (photographic) in register #3
R/S
stop
2nd
LBL
D
STO
stores diagonal to focal plane distance in
04
register #4
R/S
stop
2nd
LBL
E
Label E starts the program
(Left parenthesis
RCL
Recall objective diameter from
01
register #1
-
Subtract
RCL
Recall visual or photographic dimension from
03
register #3
)
Right parenthesis
X
Multiply
RCL
Recall diagonal to focal plane distance from
04
'register #4
+
Plus
RCL
Recall objective focal length from
02
Register #2
+
Plus
RCL
Recall visual or photographic dimension from
03
register #3
=
Equals
R/S
Stop
X
Multiply
√x
Square root
=
Equals
R/S
Stop
Chaffee Planetarium
Grand Rapids Public Museum
54 Jefferson Ave.
Grand Rapids, MI 49503

Sept. 11 through Nov. 30: "Voyage to the Giants"
New and exciting discoveries are explored with
special emphasis on the Voyager's journey to
Jupiter, Saturn and Uranus. A simulated approach
of this space ship to Saturn will be included--
this event will actually occur in November.

Thursday ************************** 8:00 p.m.
Friday ************************** 8:00 p.m.
Saturday 2:00, 3:45 & 8:00 p.m.
Sunday ************************** 2:00 & 3:34 p.m.
Adults ************************** $1.00
Children ************************** $.75

Wyandotte Planetarium
540 Eureka Ave.
Wyandotte, MI 48192
284-3100

The Wyandotte Planetarium is closed to the
general public during the months of September and
October. Group showings during the day are given
by special arrangement. Public showings resume
November 5.

September 13-28: "Autumn Skies and the Harvest
Moon" A look at the constellations visible this
month with an explanation of why the full moon in
September is so special.

Saturday 2:00, 3:00, 4:00 & 7:30 p.m.
Sunday 2:00, 3:00 & 4:00 p.m.
Adults ************************** $2.50
Children and senior citizens ************************** $1.50

McMath Planetarium
Cranbrook Institute of Science
500 Lone Pine Road
Bloomfield Hills, MI 48192
284-3100

One of the nation's finest museums of rocketry is
located just two hours from Detroit at Jackson Comm.
College. Featuring the Apollo 9 capsule, Mercury and
Gemini capsule trainers, various displays tracing
the history of rocketry, a full-size Mercury
Redstone rocket, continuous N.A.S.A. movies and a
solar system model.

Monday 8:00-5:00 p.m.,
Tuesday through Friday 8:00 a.m.-5:00 p.m.
Saturday and Sunday 11:00 a.m.-5:00 p.m.

There is a nominal charge for admission. Take I-94
to exit 142 and head south to McDivitt Street along
M-127. Turn left on Hague Road and follow to campus.
### SKY CALENDAR SEPTEMBER 1980

#### ABRAMS PLANETARIUM

**Information for helping teachers and students observe the sky**

<table>
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<th>Monday</th>
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<th>Sunday</th>
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<tr>
<td>Moon passes 1° south of Beta Librae on Sept. 14, and will be only 0.3° from Regulus on Oct 4.</td>
<td>Morning: Sun rises 24° north of east.</td>
<td>Morning: Apollo’s shadow crosses over B 164 C.</td>
<td>Morning: Sun rises 24° north of east.</td>
<td>Morning: Apollo’s shadow crosses over B 164 C.</td>
<td>Morning: Moon’s phase is 1⁄4 in the evening.</td>
<td>Morning: Moon’s phase is 1⁄4 in the evening.</td>
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**Magellanic Clouds**
- Morning: Moon’s phase is 1⁄4 in the evening.

**Nightsides of the Planets**
- Venus: -1.9 on Oct 1, crossing from Gemini through Cancer into Leo by Oct 31. Venus was 4° south of Regulus on Oct 4.
- Jupiter: -2.8 on Sept 18, crossing from Gemini into Cancer on Oct 5.
- Mars: -1.0 on Sept 18, crossing from Gemini into Cancer on Oct 5.

**Meteors**
- The Draconids are active from Sept 14 to 21, with the peak on Sept 17. The Geminids are active from Oct 17 to 22, with the peak on Oct 17.

**Diagrams included**
- Diagrams labeled showing approximate positions of VENUS, MARS, JUPITER, and SATURN for the dates and times noted above, from 1980. 
- Diagrams labeled showing approximate positions of MARS, JUPITER, and SATURN for the dates and times noted above, from 1980.

**Observations in eastern U.S.**

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**Notes:**
- Venus moves 32° eastward in 30 days (Sept 1 to Oct 1), razing from Gemini through Cancer into Leo by Oct 31. Venus was 4° south of Regulus on Oct 4.
- Mars moves 20° eastward, crossing from Virgo into Libra Sept 9. Mars is 9° east of Spica Sept 3, and 1° from 3rd-mag Alpha Librae Sept 19 and 20.
This chart is drawn for Latitude 40° north, but should be useful to stargazers throughout the continental United States. It represents the sky at the following local daylight times:
- Late August: 11 p.m.
- Early September: 10 p.m.
- Late September: 9 p.m.
This map is applicable one hour either side of the above times. A more detailed chart by George Lovi appears monthly in the publication Sky and Telescope.

The planets are not plotted on this map. Check the Sky Calendar for planet visibility. At chart time 7 objects of first magnitude or brighter are visible. In order of brightness they are: Arcturus, Vega, Capella, Altair, Antares, Fomalhaut, and Deneb. In addition to stars, other objects that should be visible to the unaided eye are labeled on the map. The double star (DB1) at the bend of the handle of the Big Dipper is easily detected. Much more difficult is the double star near Vega in Lyra. An open or galactic star cluster (OCl) located below Sagittarius, low in the south-southwest, will challenge the unaided eye. Nearby, marked Nb above the "spout" of the "Teapot", is the Lagoon Nebula, a cloud of gas and dust out of which stars are forming. The position of an external star system, called the Andromeda Galaxy after the constellation in which it appears, is also indicated (GLx). Try to observe these objects with unaided eye and binoculars.

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September Evening Skies

Abrams Planetarium
Michigan State University
East Lansing, Michigan