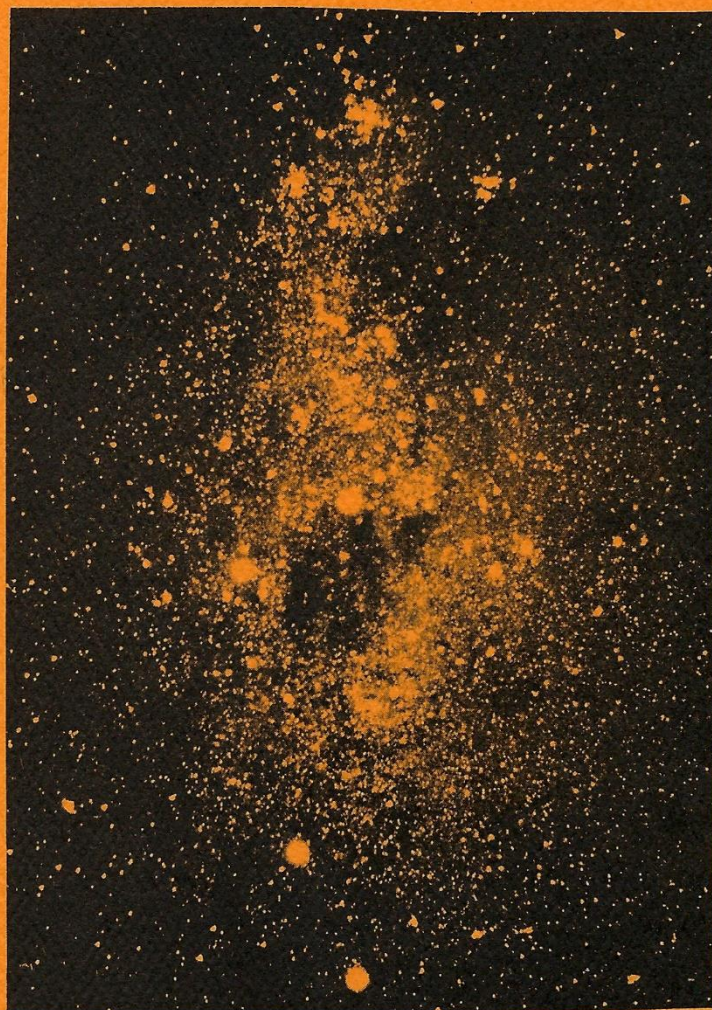


# THE WASP

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



Above, Centaurus/Cruce region.  
From bottom to top; Alpha & Beta  
Centauri, the Southern Cross, and  
Eta Carinae nebula. At left, the  
Large & Small Magellanic Clouds.  
Both pictures taken from the editor's  
backyard in southern Warren.

## JUNE 79

THE WARREN ASTRONOMICAL SOCIETY  
PUBLICATION



# This Month...

# JUNE 79

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:

1 <sup>st</sup> Thurs.	Cranbrook Institute Of Science 500 Lone Pine Road Bloomfield Hills, MI	3 <sup>rd</sup> Thurs.	Macomb County Community College – South Campus K Building 14500 Twelve Mile Road Warren, MI
------------------------	---	------------------------	---

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:

Mar 30/31.....	Pete Kwentus, 771-3283
Apr 6/7 .....	Frank McCullough, 725-4736
Apr 13/14 .....	Don Mission, 727-9083
Apr 20/21 .....	John Root, 464-7908
Apr 27/28 .....	Jeff Stanek, 751-1673

# WAS Exchange

FOR SALE. . . 3" refractor in very- good condition. Completely equipped with the following: equatorial mounting with setting circles, three eyepieces, star diag., 2x Barlow, 6 x 30 finder, erecting prism, sun screen proj., and accessory tray. Price - \$250. Contact Jeff Stanek, 751-1673.

FOR SALE. . . Cave 12½" transportable mounting with: slow motion on dec. (dec. motor needs replacement). Price - \$400.

10" f/4.9 mirror (needs final figuring) with: diag. (Coulter), tube & homemade cell. Price - \$75.

6" f/10 finished mirror. Price - \$20.

Fork for equatorial mount, laminated birch plywood, some holes.  
Price - \$15. Call Rik Hill, day 517-799-9390, nite 517-35-5548; or write 4503 E. Patrick, Midland, MI 48640.

FOR SALE. . . 3¼" f/11 refractor tube assembly, makes excellent guide scope.

Price - \$175 or best offer. Unitron Unihex, will fit above. Price - \$44 or best offer. Call Bob Shannon, 885-4283.

REACH THE RIGHT PEOPLE.

ADVERTISE IN THE WAS EXCHANGE.

THE FOLLOWING ARE THE MINUTES FOR THE WARREN ASTRONOMICAL SOCIETY MEETING WHICH WAS HELD ON THURSDAY, MARCH 15, 1979 AT MACOMB COMMUNITY COLLEGE:

The meeting was opened at 8:20 p.m. by our president, Dave Harrington. He explained that the first part of the meeting will be taken up with business while the second part of the program will feature Carl Noble who will speak on "Heavy Equatorial Mounts." After intermission, eclipse slides will be shown and will be followed by a NASA movie. Robin Bock, treasurer, announced a \$251.59 balance in our treasury.

Dennis Jozwik then took the floor to give an Observatory Report. He disclosed that the dome is now working again after the winter freeze had immobilized it. He further added that everything in the Observatory was in top working order. Regretfully he told the society of his resignation as Observatory Chairman. A successor will be named, hopefully, by the April meeting.

Lou Faix, chairman of the elections committee, asked for volunteers to fill vacancies coming up at the annual May election. Robin Bock reported on the Society's Library. She is establishing a loan procedure and asked that members return missing literature, books and equipment.

Spring Campout plans were then revealed by Doug Bock. Dates are April 13, 14 and 15. Reservations can be made immediately.

An important change of location for next month's meeting is scheduled. The Auditorium in the "S" building will be used in order to accommodate a larger audience expected for viewing members' pictures of the Eclipse 1979 in Canada. Display boards in the lobbies of the buildings will guide the audience to the proper location. Jeff Stanek, editor of the WASP, requested articles on the Eclipse for next month's issue.

Carl Noble then gave his talk on heavy equatorial mounts. He included an historical background from Galileo in 1610 to modern times. Professional and amateur mounts were displayed for further study. Intermission followed at 9:30 and refreshments were served by Connie Shannon, hostess for March.

After intermission, Doug Bock supervised the showing of special eclipse slides taken by Rick Hill, Doug Bock, Lou Faix, Jerry Persha, Frank McCullough, Dennis Jozwik, Mike Potter and Bill Whitney. This super presentation was admired by all. The last item on the program for the evening consisted of a NASA film entitled: "The Challenge of the Unanswered Question." Beautiful shots of Aurora and clever illustrations on how they take place made the show informative and readily understandable. The meeting was then adjourned at 10:40 p.m. by Mr. Harrington.

Respectfully submitted,



Loretta D. Caulley, Secretary

MINUTES OF THE APRIL 19, 1979 MEETING OF THE WARREN ASTRONOMICAL SOCIETY  
HELD AT MACOMB COMMUNITY COLLEGE:

A very special meeting of the Society was held in the large auditorium of the Macomb Community College. All of the pictorial and research effort of the Warren group who went to the Feb. 26 total eclipse in Canada had been put together. An audience of about one hundred enthusiasts heard Frank McCullough first define just exactly the nature of the eclipse phenomena. This was closely followed by Doug Bock's preview of the evening's slide presentation. Narration and preparation was done by Doug, Pete Kwentus, Frank McCullough, Larry Kalinowski and Gary Boyd.

Before actual presentation of the slide show mention was made of the Colloquium at Wayne State University of the Voyager trip to Jupiter held this last year. Thursday, April 26. room 314 are the date and place of this event. Again, at Wayne State, another lecture would take place on Thursday, May 3 at 4:00 p.m. at the DeRoy Hall. This lecture title is: "In Search of Ancient Astronomers." All members are welcome to attend.

After intermission, Robin Bock, treasurer, gave her report on the April 14th campout which was successful and enjoyable for all who participated. Doug Bock announced that the MSU Invitational in Lansing is scheduled for April 28th and would feature two speakers and also, a Messier Contest. Elections will be held in May with Lou Faix and Dr. Paul Strong heading up the nominations committee. Ray Bullock offered and sold a copy of Burnham's Celestial Handbook. Dave Harrington introduced Pete Kwentus as the new Observatory Chairman who promptly asked for volunteer lecturers for May 19th.

Tim Skonieczny led the program with a technical talk on the weather for Eclipse 1979. He used data from Ann Arbor and also U. S. Weather satellite pictures. Dr. Strong gave a detailed presentation entitled "The Shape of Solar Coronas." Included in his fascinating account of solar activity were sun spots, coronal shapes, solar cycles and the coming maximum sun spot activity which is expected to take place this November.

The third part of the evening's program took place after the second intermission. A Nasa film called "Great is the House of the Sun," wound up the evening's events. Studies from the University of Hawaii on radiation and ultra-violet light told much about solar research and its possible practical applications. The meeting was closed at 10:35 p.m. by Mr. Harrington.

Respectfully Submitted,



Loretta D. Caulley, secretary

# BINARY STARS

By Mark Bieniek

Contrary to the popular belief of beginning amateur astronomers, binary stars (or double stars) are more common than the single star system that we exist in. It has been estimated that  $\frac{1}{2}$  or more of the observable stars on a clear moonless night are binary stars.

If one should refer to a star atlas or map he would see that doubles far outnumber the other types of stars.

These double stars can be divided into 2 basic groups or classes, those of which ~ of interest to most astronomers and those that are not of much interest. Of the latter group, there is only one type-optical doubles. These are not of much interest because they are not true binary stars due to the fact that they can be hundreds of light years apart.

They appear as doubles in a pair of binoculars or a small telescope because of our point of view and their chance alignment. An example of this type is the star Mizar, the middle star in the handle of the Big Dipper.

Of primary interest to astronomers are the physical binaries. These are stars that are close enough to orbit around one another. There are 5 different types of physical binary stars. A description of a few follows.

One type-visual binaries can be detected by using binoculars or a small telescope to split the star into its component parts (this of course depends on the apertures used and the separation of the 2 stars).

Some binaries are so close that they cannot be resolved into their component parts. These double stars can be located by observing a short-term decrease in a star's brightness caused by one star eclipsing the other. This type is called an eclipsing binary.

Using spectral lines produced by the star can be a method by which double stars are also found.

If one of these spectral binary stars is receding and the other is approaching with respect to our view of it, there will be 2 spectral lines. One shifted toward the red end of the spectrum (receding) and the other toward the blue end (approaching).

One other way of finding binary stars is to measure their motions against the background stars. This method is used when Doppler shifts or eclipses fail to reveal a companion star. These are called astrometric binaries.

There are several other types of physical binary stars plus interesting points about their origin and evolution but it is not within the scope of this article to expand on these topics. Information on these and other points can be found in most well-written books on Astronomy.

URSA MINOR  
The Little Bear  
POLARIS

Most of the cultures in ancient times identified, classified, told stories about and correctly ascertained the nature and importance of Polaris, the Pole Star in the constellation called Ursa Minor or Little Bear. Navigators, explorers, pilots, surveyors, Boy Scouts, Girl Scouts, hikers, even modern shepherds know this starry lantern which points to the north. Astronomers have named this star, Alpha Ursae Minoris. It is simultaneously the Little Bear's tail and also the handle end of the Dipper. It is a triple system of suns properly classified as a Cepheid variable. A spectroscopic binary, Polaris also includes a little 9th magnitude blue companion. All are 407 light years distant from the Earth. Knowledge of the location of the famous star has aided untold numbers of our ancestors and in modern times is the genesis of other disciplines.

Naturally our great American Indians came up with a most delightful legend about Polaris. Their tale relates how a group of tired hunters were lost in the forest. Being pious Indians they immediately prayed for help. A little Indian maiden appeared identifying herself as the spirit of the Pole Star and volunteered to guide them home. Quickly, they reached the safety of their tepees and then immortalized the adventure by calling Polaris 'The Star That Never Moves.' Later, at death their spirits joined the Pole Star in the heavens. They are still guiding all who seek a way out of woods, forest and uncharted waters.

The Norse men visualized Polaris as a live action geometric figure. The sharp point of their imaginary compass became Polaris with the rest of the stars circling around it. Thus Polaris became "Verlader Naple" or the World Spike. The Mongols called this star the Golden Peg. Chinese stories link the Pole Star to Tau My, the goddess of wisdom and enlightenment who cares for all seeking guidance in realizing the great goals of this life. In India legends have a Dhava Lak who prays and prays, lost in meditation, forever waiting and watching for a reply to life's problems. The Arabs and Egyptians saw Polaris as a villain, all, alone and ostracized from his fellow stars. Greek legend has Arcas, who was protected from the wrath of the cannibalistic Kronas by being lifted and swung up into the sky by none other than the great Jupiter.

Finally, is there a South Star? Too bad and sad but the answer is negative. Presently there is a peculiar absence of stars in the corresponding point due south of the axis of the Earth. Only we northern astronomers and travelers have this fortunate navigational asset. We thank you great Polaris!

Submitted by,  
Loretta D. Caulley

# *EROS* — the semi-quarterly publication of the OSU Astronomy Club

## Spectroscopy

Brent Warner

Astronomers have always depended on the light that reaches the earth for information on celestial bodies. In early times this was pretty much limited to noting the brightness and position. In the 19th century~ however, scientists began to study the spectra of astronomical objects, and spectroscopy was born.

Although Newton, in his studies of color, used the solar spectrum during the eighteenth century, the type of study we are concerned with begins in 1802. In that year, William Wollaston passed sunlight through a narrow slit, then spread it out into its component colors, just as anyone with a prism can do. Wollaston noticed that certain regions of the spectrum were dark. "Regions" is not quite the right word though, since the regions were so thin that they showed up only as dark lines across the spectrum. The thinness of the lines mean that only a short spread of wavelengths is involved. (To put this discovery in the proper historical setting, it is interesting to note that, in that same year, Wollaston did some theoretical work supporting the - then unproven - idea that light is a kind of wave.)

The dark lines are called Fraunhofer lines, because it was Joseph von Fraunhofer who did the first extensive studies of them. Just as Fraunhofer was not the first to see the dark lines in the solar spectrum, so also the spectrum was not the first major interest of Fraunhofer. Fraunhofer was a lensmaker, at a time when lensmaking was much more difficult than today. Glassmakers had trouble casting large pieces of glass free from flaws. They also had trouble making glass to match optical qualities decided on beforehand. Fraunhofer hoped to work out ways of making glass with controlled optical qualities. In this way, he felt, lensmaking could start to depend more on calculations and less on trial and error. But to control the properties of the glass he made, Fraunhofer had to be able to measure them precisely. Since the properties of glass vary with wavelength (that is why a prism works) Fraunhofer needed a wavelength standard. He tried the yellow light produced when sodium is vaporized in a flame. This light consists of two wavelengths which are quite close to each other. In 1814 he tried the solar spectrum, and noticed the dark lines seen earlier by Wollaston. Fraunhofer assigned the more prominent lines capital letter labels, since he realized they could be useful as fixed reference points in the spectrum. Fraunhofer also believed, correctly, as we shall see, that the pair of lines he labelled "D" had the same wavelengths as the yellow sodium light he had studied.

The dark lines became a tool in Fraunhofer's study of diffraction gratings, increasing refinement of which allowed better measurements of the wavelengths of the lines. A diffraction grating is a flat object with many closely spaced parallel lines, which spreads out the colors of the spectrum. Diffraction gratings are now widely used, in introductory science laboratories and in scientific apparatus, but in Fraunhofer's time much work was left to be done, on theoretical as well as practical matters. Fraunhofer worked on both aspects of the problem. Some of Fraunhofer's diffraction gratings were made by winding fine wire back and forth between two parallel rods which had screw threads cut into them. One such grating had 340 turns

per inch. Another method was covering one side of a piece of glass with gold foil or grease and scratching parallel lines through the covering. His most successful technique was scratching lines into glass with a diamond point. (Today, some gratings are made by ruling with a diamond point, some are made using a master grating as a mold.) Another area which Fraunhofer pioneered was the astronomical use of diffraction gratings. He discovered that the spectra at the moon and planets had the same pattern of dark lines as the sun. Certain bright stars however, he found to have different spectra. Thus the cause was in the stars (and sun) and not in our terrestrial atmosphere, that the black lines appeared in the spectra.

Exactly where this cause lay began to emerge in the work of Robert Bunsen and Gustave Kirchhoff, who developed spectroscopy (the use of spectra) into a chemical tool. Bunsen was interested in the colors produced when small quantities of chemicals are placed in a flame. Fortunately, the Bunsen burner, which Bunsen invented, was well suited for this study. Bunsen had been trying to match the colors of the flames with filters made using colored solutions. Kirchhoff suggested using a diffraction grating to study the spectra of the flames, and this proved successful. Each element when injected into a flame, gives off its own spectrum, consisting of light at a certain number of wavelengths. The spectra produced showed lines which were like the Fraunhofer lines except that they were bright lines rather than dark lines. Each element has its own identifiable spectrum. Kirchhoff and Bunsen found the spectra of many known elements (thus aiding analytical chemists) as well as the spectra of some elements which were previously unknown. Cesium, for example, was discovered by them in 1860. Another important discovery they made was that elements can absorb at the same wavelength at which they emit. First it was determined that the Fraunhofer lines were, in fact, the same wavelength as the yellow light given off by sodium. To determine this, sunlight was passed through a flame into which sodium was injected. Then the combined sunlight and flame light was spread into a spectrum. When the sunlight was strong enough to overpower the light from the flame, the positions of the D lines were noted. Then, when the sunlight was weakened, it could be seen that the yellow sodium light fell at the same at the same points in the spectrum. This showed that the D lines and the sodium light were the same. It was also found, however, that when especially bright sunlight was used, passing sunlight through a sodium-burning flame darkened the D lines. This meant that the sodium atoms were absorbing at the same wavelengths that they were emitting. This related the two types of spectra (bright line and dark line) produced by gases. Consider a gas, such as sodium vaporized by a Bunsen burner flame, placed against a dark background. If its light is spread into a spectrum, the spectrum will have narrow bright sections (lines) at the characteristic wavelengths for sodium. But a gas seen against a background that's bright enough (such as the solar atmosphere seen in front of the solar interior) produces a spectrum with dark lines at the characteristic wavelengths. Thus the origin of the Fraunhofer lines was explained; gases in the solar atmosphere absorb light at their characteristic wavelengths to create the dark lines.

Naturally, astronomers began to use the discoveries of Bunsen and Kirchhoff. The Fraunhofer lines, for example, could tell what elements are present in the solar atmosphere. But there were also times when astronomers could use the bright line spectra, i.e. the light given off by the elements. For example, Pierre Janssen, observing an eclipse in India in 1868,



discovered that solar prominences have bright line spectra like those of Bunsen and Kirchhoff's burner flames. This meant that solar prominences like burner flames - consist of hot gas. J. Norman Lockyer, also using spectroscopy, discovered the gaseous nature of solar prominences at almost exactly the same time. In fact, their announcements of their discoveries arrived at the French Academy within minutes of each other, a coincidence which cemented a friendship between the two men. Lockyer, however, went on to make another discovery. He had noticed a previously unidentified line in the solar spectrum and, suspecting that it was produced by hydrogen under solar conditions, tried to produce it in the lab. Failing to find it, he decided the line must come from an unknown element, which he called helium, after Helios, the sun god. As we know today, helium was eventually isolated on earth. Helium remains the only element discovered in space; "nebulium", identified in the spectra of some nebulae turned out to be a spectral line of oxygen which normally doesn't show up strongly.

A fuller understanding of the spectra of the elements had to await deeper knowledge of the structure of the atom. Current ideas of atomic structure originated with the model put forward by Niels Bohr in the early years of this century. Bohr's model, besides dealing with problems which had been puzzling atomic physicists, also led in a fairly natural way to an explanation of atomic spectra. In Bohr's model, an atom consists of a nucleus, made up of protons and neutrons, orbited by electrons. This idea was not new with Bohr, but another feature of his model was: that the electrons could occupy only certain specific stable orbits. The amount of energy that the electron possesses varies from orbit to orbit. Thus, to move from one orbit to another, the electron must either take in or emit light. Light, as we know, is a wave, but it has particle properties as well; it exists in particle-like units called photons. The amount of energy contained by a photon is directly related to the wavelength, and thus to the color. When an electron moves between two orbits, the amount of energy it must either take in or give off is determined by the particular transition the electron makes. The energy difference doesn't depend on whether the electron moves "Up" or "down". Thus, a photon emitted as an electron falls from a high energy orbit to a lower one has the same wavelength as the photon which must be absorbed to return the electron to the higher orbit. This explains Bunsen and Kirchhoff's discovery that an element absorbs at the same set of wavelengths that it emits. The differences in the spectra of the various elements result from the different electron orbits possible with the different elements. Ideas of the atom have changed since Bohr first proposed his model; electrons are no longer thought of as point-like particles following definite orbits, but as fuzzy objects found in regions known as orbitals. However, the idea of certain stable configurations and energies, with all the same implications for spectroscopy, remains unchanged. So far, we've seen that spectroscopy can identify elements present in gases through which light is shining - such as the atmosphere of the sun or gases which shine by themselves - such as solar prominences and nebulae. But spectroscopy can do much more than this. It should be no surprise, for instance, that spectroscopy can also identify molecules, since atoms rearrange their outer electrons when joining together. (In fact, there have been molecules discovered by astronomical spectroscopy and found only later in the lab.) Another use is the measurement of Doppler shifts. The Doppler effect is a phenomenon whereby light emitted by objects moving towards or away from us is shifted towards shorter or longer

wavelengths respectfully. At first glance, this might seem to make it impossible to distinguish between the various spectral lines, since they would be shifted away from the wavelengths measured for them in the lab. However, groupings of lines, such as the sodium D lines, can still be recognized. By measuring the amount which the wavelengths are shifted, the velocity of the object emitting the light towards and away from us can be found. This can be used on objects moving bodily through space and on those which have internal motions. For instance, some stars alternately expand and contract. As their outer layers move towards and away from us, their spectral lines show Doppler shifts. The magnetic fields of astronomical bodies can also be studied spectroscopically. When an atom is placed in a magnetic field, the field interacts with the electrons, and some sets of electron orbitals which were formerly all of the same energy may now be split among a number of closely spaced energies. This splits what was previously one spectral line into a number of closely spaced ones. From the amount of splitting, the field strength can be determined. From the polarization, the direction of the magnetic field can be found. Thus, we see that the attempt to produce better glass led to a versatile, widely used astronomical technique.

Publications Available

Mitchell Luman

# SKY CALENDAR JUNE 1979

Information for helping teachers and students observe the sky

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
<p><b>EVENING PLANETS:</b> JUPITER, brightest evening "star", is 30° up in mid-twilight on June 1, going to only 10° up on June 30 (compare diagrams for June 3 and 28). SATURN is about 30° to upper left of Jupiter. Don't confuse Saturn with Regulus, a little fainter and 8°-10° to Saturn's lower right. MERCURY can be seen by June 7th; ½ hr after sunset it is only 3° above horizon. 30° N of W, and 40° lower right of Jupiter.</p> <p><b>Sunday evening, June 3:</b> With binoculars, look for Beehive cluster 1½° upper left of Jupiter. For comparison, Pollux and Castor are 4½° apart.</p> <p>Watch Jupiter and stars shown on this diagram get lower each night. On what dates will you last see each?</p> <p>Procyon</p> <p>W</p>	<p><b>Morning:</b> Pleiades 5° N of Venus and 11° from Mars. On what date will you first see Pleiades with naked eye?</p> <p>Pleiades</p> <p>Venus</p> <p>10° apart</p> <p>Mars</p> <p>11°</p> <p>Can you still see Procyon?</p> <p>W</p>	<p><b>Morning:</b> Pleiades cluster, 7° from Venus, may be lost in twilight. Try with binoculars. Venus and Mars 8° apart.</p> <p>Pleiades</p> <p>Mars</p> <p>Venus</p> <p>8°</p> <p>W</p>	<p><b>Morning:</b> Pleiades cluster, 7° from Venus, may be lost in twilight. Try with binoculars. Venus and Mars 8° apart.</p> <p>Pleiades</p> <p>Mars</p> <p>Venus</p> <p>8°</p> <p>W</p>	<p><b>Morning:</b> Pleiades cluster, 7° from Venus, may be lost in twilight. Try with binoculars. Venus and Mars 8° apart.</p> <p>Pleiades</p> <p>Mars</p> <p>Venus</p> <p>8°</p> <p>W</p>	<p><b>Morning:</b> Pleiades cluster, 7° from Venus, may be lost in twilight. Try with binoculars. Venus and Mars 8° apart.</p> <p>Pleiades</p> <p>Mars</p> <p>Venus</p> <p>8°</p> <p>W</p>	<p><b>Morning:</b> Pleiades cluster, 7° from Venus, may be lost in twilight. Try with binoculars. Venus and Mars 8° apart.</p> <p>Pleiades</p> <p>Mars</p> <p>Venus</p> <p>8°</p> <p>W</p>
<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>
<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>	<p><b>Evening:</b> Saturn 8° apart</p> <p>Regulus</p> <p>Moon</p> <p>W</p>

**Magnitudes of the Planets:** Venus -3.3; Jupiter -1.5 to -1.4; Saturn +1.0 to +1.1; Mercury: June 9 -1.0; June 14 -0.5; June 20 0.0; June 30 +0.6. **Motions during June:** Jupiter goes 5.6° eastward in Cancer, and passes 1° S of Beehive June 10. Saturn goes 1.8° eastward in Leo. On June 1 it is 8° east of Regulus and 2.3° NE of 4th-magnitude Rho; on the 30th it is 10° from Regulus and 3.7° from Rho. Each day Venus goes 1.2° and Mars goes 0.7° eastward, both planets crossing from Aries into Taurus; watch them separate by 0.5° per day because of the difference of their motions. Mars passes 4° south of the Pleiades June 25. 6th-magnitude Uranus retrogrades 0.9°, going from 3.3° to 2.4° ESE of 3rd-magnitude Alpha Librae.