ASTRONOMY

See Planets Early or Late

Autumn constellations now beginning to shine, even though fall does not start officially until Sept. 23, early in the morning after the night of harvest moon.

By JAMES STOKLEY

➤ IN ORDER to see planets during the month of September, one has to look either early or late.

However, the constellations of autumn are now beginning to appear, and are shown on the accompanying maps. These show the heavens as they look about ten p.m. your own kind of standard time, at the beginning of September, and an hour earlier at the middle of the month. (Add one hour if you are on daylight time.)

The stars and constellations of the evening skies are now assuming a typically autumnal appearance, even though autumn does not commence officially until the early morning of Sept. 23.

The brightest star now visible is Vega, in Lyra, the lyre, which is high in the west, nearly overhead. Almost at the zenith is Deneb, in Cygnus, the swan, and a little lower, to the south, is Altair, in Aquila, the eagle.

Three other stars of the first magnitude are indicated, but all are so near the horizon that they are somewhat dimmed. Low in the south is the constellation of Piscis Austrinus, the southern fish, in which first-magnitude Fomalhaut can be seen. Arcturus, in Bootes, the herdsman, is low in the west.

During spring and summer evenings, it was a conspicuous object, high in the sky, and this is its last appearance on our maps until next March.

Capella Now Reappearing

Near the northeastern horizon, on the other hand, is a star that is now reappearing after having been gone for recent months. This is Capella, in Auriga, the charioteer. On winter evenings it stands high in the sky, as one of the brilliant array surrounding Orion, so when we see it, we know that summer indeed is practically past.

As for the planets, Saturn may be glimpsed low in the west just after evening darkness begins to fall, especially at the beginning of September, in the constellation of Virgo, the virgin. At that time it sets nearly two hours after the sun, about the time twilight is ending. Later in September it follows even sooner after the sun, and will not easily be seen.

About midnight Jupiter appears in the east, in Taurus, the bull. Since it is far brighter than any star in the region, it will be easy to locate. It remains visible the rest of the night. Still later, about three hours before sunrise, Venus rises, even more brilliant than Jupiter, in the constellation of Cancer, the crab. Again, its great brilliance makes it easy to identify.

Then about two hours before the sun, Mars appears, in Leo, the lion. It stands close to the star called Regulus. However, it is considerably fainter, of the second magnitude, so it will not be a conspicuous object.

Autumn Official Sept. 23

The beginning of autumn, in the Northern Hemisphere at least, is usually considered to come with the autumnal equinox. This is the time at which the sun reaches the midpoint of the southward journey in the sky it began on June 21. At that time —3:07 a.m., EST on Sept. 23—it stands directly over the equator.

As the sun moves southward it gets continually lower and lower for those of us who live in northern countries, but for people south of the equator it is now getting higher. Thus, for them, the event that occurs on the 23rd is the beginning of spring rather than of autumn.

On the night of Sept. 22, during which this event occurs, the moon is full. The full moon nearest the equinox, and it could not be much nearer than it is this month, is called the harvest moon. Actually, the significance of this particular full moon is found in the fact that for several nights the time of moonrise changes very little.

On the 23rd, for example, at 40 degrees north latitude, it rises only 29 minutes later than it did on the 22nd, while moonrise on the 24th is 31 minutes later than on the 23rd. We may contrast this with the full moon of last March 30, soon after the beginning of spring. Then an hour or more elapsed between moonrise on successive nights.

The reason for this is found in the changing angle made with the horizon by the ecliptic, the path along which the moon, and the sun as well, seem to move through the sky. In March it makes a very steep angle, and as the moon moves along, it very rapidly gets lower and lower, thus causing the maximum delay in rising from one night to the next.

In September, however, the ecliptic is much more nearly parallel to the horizon. Even though the moon may move along it the same distance from day to day as it did last March, this movement does not take it so far out of sight. Since it is the distance that it moves with respect to the horizon that determines the change in rising time, we now have the least difference.

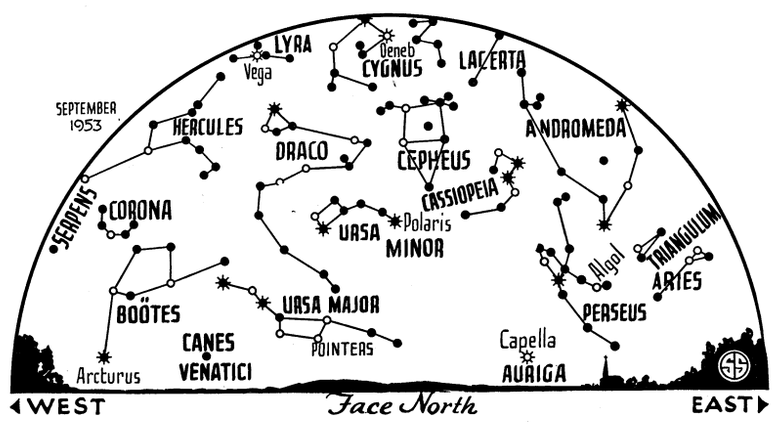
Bright, Moonlight Nights

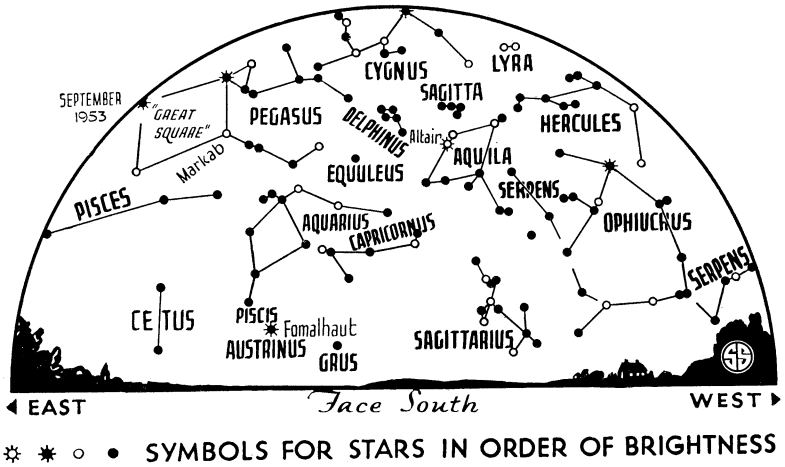
For several nights, we have lots of bright moonlight, which is supposed to help the farmer work into the night gathering his harvest. Hence it is called the harvest moon.

The moon's average distance from earth is about 239,000 miles, but each month it approaches as close as 225,000 miles, or even less, and then recedes to a distance of more than 250,000 miles. The close approach is called "perigee," and the distant position "apogee."

The latter occurs on Sept. 9, the distance being 252,600 miles. Perigee, it happens, comes at just about the time of full moon, and the distance is 221,700 miles.

All this has an important bearing on the height of the tides. As is well-known, this ebb and flow of the oceans is caused by the gravitational attraction of the sun and the moon, principally the latter. When the moon is new, it is in the same direction from earth as the sun; when it is full, it is in the opposite direction.





In either position all three bodies, earth, moon and sun, are in line, and the pull of the first two on the oceans is a maximum. At first or last quarter, the moon and sun are in directions at right angles, and the high tide from the sun coincides with the low tide from the moon, partially counteracting it. Thus, at new and full moon we have the "spring" tides, when there is the greatest difference between high and low. The "neap" tides, which occur at first and last quarter, have the least range.

Moon's Distance Important

Also, the distance of the moon has an important effect. When nearest, as on Sept. 22, it produces the greatest tidal effect, and if this happens, as it does then, to coincide with full moon, we have the highest tides of all. This is demonstrated by reference to tide tables for New York, as a typical example. Shortly after this coincidence of full moon and perigee, on Sept. 24, high tide at The Battery, at 8:45 a.m., will be 6.7 feet higher than the low tides before and after.

Back in February, when apogee came on the same day as full moon, the 28th, the subsequent spring tides showed a range of less than five feet between high and low. This is not much above the average tidal range at New York for all tides, which is slightly less than 4.5 feet.

Some of the smallest range of the year came about May 22, with a high only 2.6 feet above the preceding low. Then the moon was farthest the day after it was in the first quarter phase.

Celestial Time Table for September

Sept.	EST	
1	10:50 a.m.	Moon passes Jupiter.
4	10:23 p.m.	Moon passes Venus.
6	11:51 a.m.	Moon passes Mars.
8	2:47 a.m.	New moon.
9	11:00 a.m.	Moon farthest, distance 252,600 miles.
11	5:25 p.m.	Moon passes Saturn.
16	4:49 a.m.	Moon in first quarter.
22	11:00 p.m.	Moon nearest, distance 221,700 miles.
	11:15 p.m.	Full moon ("harvest moon").
23	3:07 a.m.	Sun over equator — autumnal equinox (autumn commences in northern hemisphere).
28	9:56 p.m.	Moon passes Jupiter.
29	4:51 p.m.	Moon in last quarter.

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GEOPHYSICS

Earth's Iron Heart Both Molten and Solid

➤ A SOLID inner core of iron is at the earth's center surrounded by the same metal in a molten state.

This is shown by new studies by Dr. J. A. Jacobs of the University of Toronto, Canada, reported in *Nature* (Aug. 15).

In the beginning the earth was completely molten. Now there is a layer of liquid metal that lies between the crust and a solid center. A mantle of rocky material extends to the surface. Below it, there is a region still so hot and under such pressure that it is liquid. At the center there is solid iron.

Solidification of the earth did not begin at the boundary of the iron core and the outside crust of rocky silicates. Instead, Dr. Jacobs' analysis shows that the iron began to become solid at the very center of the earth. This solid inner core continued to grow until the temperature at which loss and gain of heat was equaled—the adiabatic temperature—was the same as the melting point of the iron.

As the earth cooled still further, the rocky layers on the outside solidified, not from the top or surface of the earth, but at the bottom junction between the mantle and the iron core.

Thus, a liquid layer of iron was trapped essentially at its original temperature, insulated above by a rapidly thickening shell of silicates, and below by an already solid iron inner core.

Earthquake waves had indicated previously that at least part of the core of the earth is liquid because no transverse waves pass through the center of the earth. The inner solid iron core begins at a depth of approximately 5,000 kilometers (3,100 miles).

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