

ASTRONOMY

Saturn Visible After Sunset

Winter constellations will make their debut in the eastern evening sky this month, with Orion and its two first magnitude stars one of the familiar sights.

By JAMES STOKLEY

ALTHOUGH no naked-eye planet remains visible long enough into the evening in November to be shown on the accompanying maps, Saturn is visible in the southwest for a couple of hours after sunset.

It is in the constellation of Sagittarius, the archer, just below Capricornus, the sea-goat. This group does appear on the map, in the southwest. Saturn is as bright as a typical first-magnitude star. At the first of November it sets about three hours after the sun, and two hours later at the end of the month.

In the east, some of the winter constellations make their debut in the evening sky. You can identify these from our maps, which show the appearance of the sky at about 10 p.m., your own kind of standard time, at the beginning of November; 9:00 p.m. on the 15th; and 8:00 p.m. on the 30th.

Just above the eastern horizon is Orion, perhaps the most familiar of the winter groups. In it are the two first magnitude stars, Betelgeuse and Rigel. Both of these, as always when a star or planet is seen so low in the sky, are considerably dimmed by absorption of their light in the earth's atmosphere. Between these stars is Orion's belt, a row of three fainter stars.

Bright Stars Visible

Above Orion is Taurus, the bull, with the brilliant star Aldebaran, distinctly red in color, and supposedly marking the bull's eye. And to the left of Taurus is Auriga, the charioteer, in which Capella shines.

In the west, a little toward the north, is Cygnus, the swan, which includes a smaller group called the northern cross. The cross stands nearly vertical, with the star Deneb at the top. As a swan, this star is in the tail, the crosspiece forms the wings and the bottom the bird's long neck, stretched forward in flight. Just below the right-hand part of Cygnus is Vega, in Lyra, the lyre, Altair, in Aquila, the eagle, is a little to the left. (This star is shown on the southern sky map.)

The stars mentioned by name are all of the first magnitude, which means that they are among the brightest in the sky. One other of this class appears in the south: Fomalhaut, in Piscis Austrinus, the southern fish. This is so far south in the sky that only in autumn does it appear in the evening sky, and it never rises much higher than it is now.

Although it contains none of these brightest stars, a conspicuous group called Pegasus appears high in the south. This represents

the famous winged horse of mythology. Just above and to the left you can see Andromeda, the chained lady. Three of the stars in Pegasus and one in Andromeda (Alpheratz) form the "Great Square."

Just below Andromeda, in the north, you can see Cassiopeia, the queen. A little lower and to the left is her royal spouse, Cepheus, and below is Ursa Minor, the lesser bear, which contains the pole star, Polaris. The big bear, Ursa Major, is down on the northern horizon. The big dipper is part of this group.

As for the other planets that are bright enough to be seen without a telescope, Venus now shines in the morning sky toward the southeast, in Virgo, the virgin. It is many times as bright as any other star or planet.

Around Nov. 11 Mercury remains above the horizon for a short time after sunset, but is so low that it will be difficult to see. Jupiter also is low in the western sky just after the sun goes down, but sets before the sky gets dark. Mars likewise is invisible in November, because it has just passed behind the sun.

Ever since the first hydrogen bomb was exploded, men have sought for some way of controlling it, and using its great out-

pouring of energy to create useful power. Elaborate research programs, in the United States, Britain and Russia, have revealed new knowledge about the process, but the goal is still out of reach.

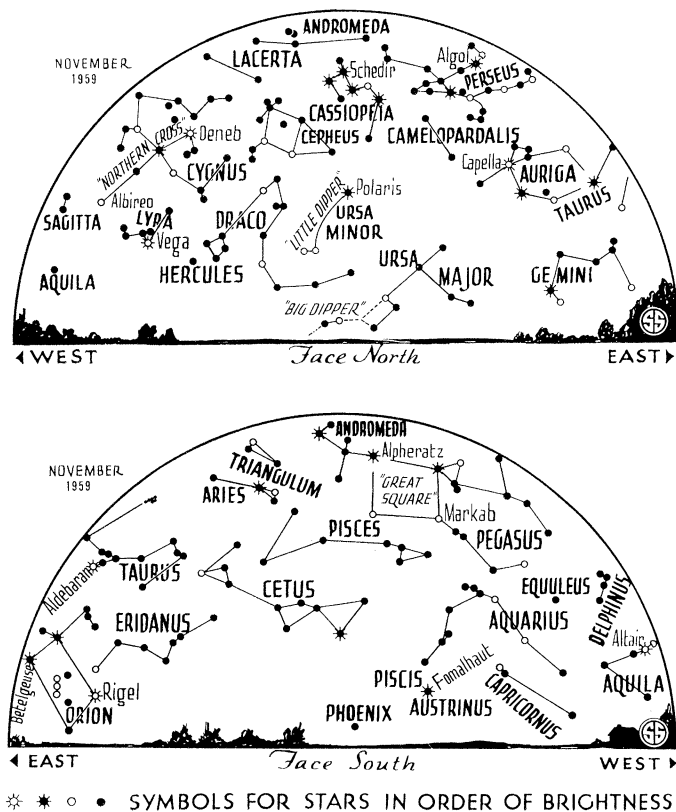
However, there are countless hydrogen power plants continuously pouring out vast quantities of energy without exploding. Virtually every star you see in the night sky is such a plant, as is the sun.

Men once believed that the sun actually burned, much like coal in a furnace, but this process would not keep it going for the billions of years that it has already been in existence. Then men believed that it was contracting, energy being released as the outermost material fell to the center, but this too is hopelessly inadequate.

Stars: Nuclear Power Plants

During the decade of the thirties scientists obtained new insight into the structure of the atom which was to lead to nuclear energy and the atomic bomb.

At the same time astronomers realized that a nuclear process probably explained the origin of solar and stellar energy. Apparently, they decided, four nuclei of hydrogen atoms could combine to form one nucleus of a helium atom. In the process a small proportion of the mass is converted to energy, which the star eventually radiates into space. This can occur in two ways.



One method is by a cycle involving carbon, which goes into the process at the start and comes out again at the end, thus acting as a catalyst. The hydrogen nuclei, also called protons, go in at various stages, and finally combine into a helium nucleus or alpha particle. Rigel, in Orion, is believed to be one star in which this process operates, as it is a very hot one—about 30,000 degrees Fahrenheit on the surface, and far hotter inside.

In cooler stars, such as Arcturus or the sun, there seems to be another way in which the four protons can combine into an alpha particle.

Nuclear Combinations

First, it is thought, a pair of protons combine in such a way as to form a deuteron, which is the nucleus of an atom of a heavy kind of hydrogen. Another proton combines with this, to form the nucleus of the atom of a light variety of helium. As this happens energy is given off, in the form of gamma radiation, which is like X-rays of enormous power. As this radiation is absorbed and reemitted on its way from the sun's heart, it gets longer and longer in wavelength. By the time it emerges from the surface, much of it is in the form of visible light.

But the end of the process occurs when two light helium nuclei, each produced in the same way, combine. They form an alpha particle, and two protons come off, perhaps eventually to join and form another deuteron as the process continues.

Some persons wonder why the sun does not explode, like a hydrogen bomb. The answer is that the first step—protons into a deuteron—takes place exceedingly slowly. In fact, with an exceedingly large number of protons, at the temperature of many millions of degrees that prevails inside the sun, it takes about five billion years before half of the pairs are joined. Very often two protons may hit and not stick together.

There are enough protons in the huge mass of the sun to keep its fires fueled and, incidentally, to supply the earth with the energy that makes life possible.

Celestial Time Table for November

Nov.	EST	
1	8:00 p.m.	Moon nearest, distance 223,100 miles.
2	12:45 p.m.	Moon passes Jupiter.
3	5:00 a.m.	Mercury farthest east of sun.
4	10:37 a.m.	Moon passes Saturn.
7	8:23 a.m.	Moon in first quarter.
9	2:45 a.m.	Algol (variable star in Perseus) at minimum brightness.
11	7:00 p.m.	Venus farthest west of sun.
	11:34 p.m.	Algol at minimum.
14	8:23 p.m.	Algol at minimum.
17	early a.m.	Shower of meteors radiating from Leo.
	2:00 a.m.	Moon farthest, distance 252,500 miles.
	5:12 p.m.	Algol at minimum.
23	8:03 a.m.	Moon in last quarter.
24	6:00 a.m.	Mercury between sun and earth.
26	9:10 p.m.	Moon passes Venus.
30	3:46 a.m.	New moon.
	7:00 a.m.	Moon nearest, distance 221,600 miles.

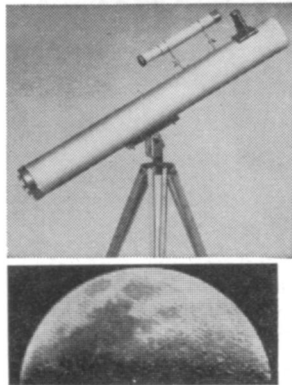
Subtract one hour for CST, two hours for MST, and three for PST.

Science News Letter, October 24, 1959

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