Jupiter Shines High in December Sky

Astronomy

December: Orion shining magnificently in the eastern evening sky! This is apt to be the association of ideas in the mind of the student of the stars. Last April this finest of all constellations vanished in the west, now it has returned to presage the coming of a new year.

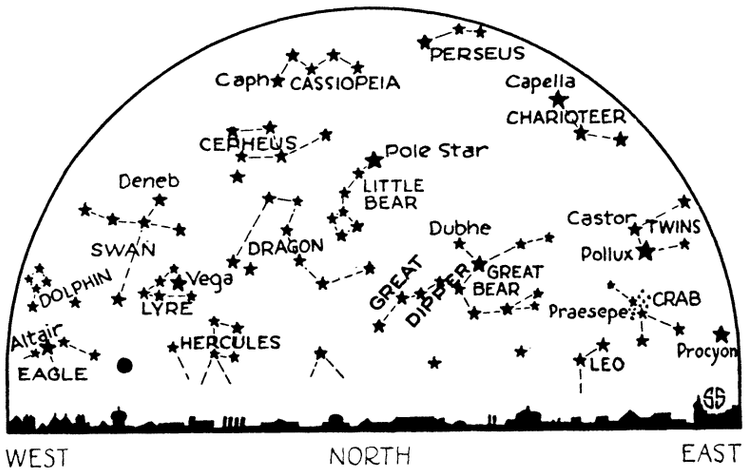
Next to the great dipper, probably no other group of stars is so familiar as Orion. The three stars in a row, now standing nearly upright, form the so-called "belt". Toward the south is Rigel, while to the north is Betelgeuse. Betelgeuse is especially interesting because it was the first star to have its diameter measured by means of the interferometer. This was an invention of Prof. A. A. Michelson, and was applied to the stars on the great 100-inch telescope at the Mt. Wilson Observatory by F. G. Pease. With its aid he found that the star is about two hundred million miles in diameter. As a matter of fact, its diameter changes. Sometimes it is as small as one hundred eighty-five million miles, while at other times it expands to two hundred fifty-six million miles. These figures represent two hundred fourteen and two hundred ninety-six times the diameter of the sun.

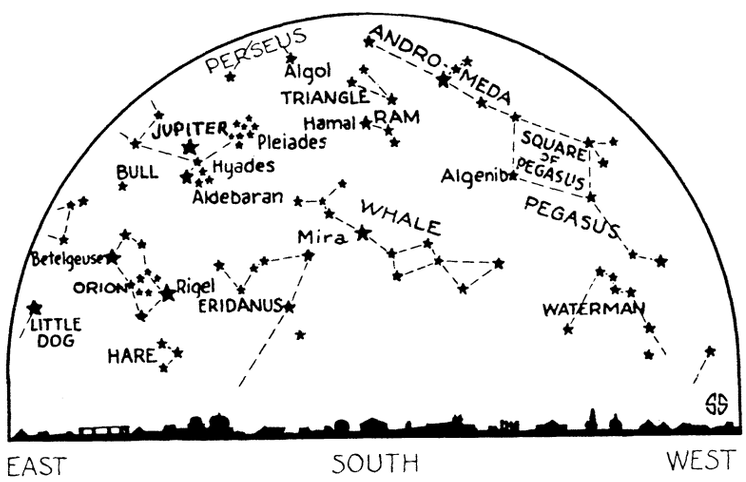
Above the belt of Orion is Bellatrix. The belt refers to the belt of the gigantic warrior with which the ancients identified this group of stars. Orion was a mighty warrior, and was represented on the old star maps as a man holding a club in one hand and a lion skin over the other arm. Betelgeuse represents one shoulder, Bellatrix the other. He is about to smite the heavenly bull, Taurus, which is represented by the constellation now above Orion. The red star of Aldebaran, in this group, represents the eye of the bull, watching Orion. The constellation of Taurus is further decorated this month by the presence of one of the planets; in fact, the largest of the planets, Jupiter. It is near Aldebaran, a little above it and to the left. As it shines with a steadier light than the stars, however, there is no doubt as to which is star and which is planet.

With the aid of even a small telescope, Jupiter becomes a very interesting object, because of its four conspicuous moons. These were the first astronomical objects ever discovered with a telescope. In the year 1610, when Galileo, in Florence, heard of the invention of a device in Holland that would make distant objects appear close, he at once recognized its astronomical possibilities. Without receiving any details of the construction of the device, and solely on his own knowledge of optics, he proceeded to construct one. This little instrument was hardly as good as a modern pair of opera glasses, yet with it he made some of the most important of all discoveries. It was in January that he completed it, and as Jupiter then, as now, happened to be conspicuous it was the first thing he looked at. To his surprise he found that the planet was not alone, but attended on either side by smaller points of light.

Like the good astronomer that he was, he soon got over his surprise, and made a drawing of what he saw. The next night he looked again and found that the additional "stars" had moved. Night after night he watched them, and every night he saw them in a different position. Occasionally one of them would disappear, only to reappear a day later.

These are the four largest of Jupiter's moons. Unlike the earth, which has only one satellite, or Venus, which has none, Jupiter has nine satellites. As they revolve around the planet, they sometimes pass in front of it and sometimes behind it, when they are not visible, even to a telescope. These four largest moons are all just a little below the limit of naked-eye visibility. In fact, claims have been made by persons of exceptionally keen sight that they have seen them with the unaided eye. It is not likely that this is the case, but it is possible that occasionally (*Turn to next page*)





HOLD THESE MAPS in front of you and face North or South. The upper or lower one will then show the stars of the December evening sky

December Sky—*Continued*

two or more of them might be so close together that they would appear as one object of a brightness equal to their sum. Then they might be seen by persons of keen sight.

For over two and one-half centuries after Galileo's discovery, no more moons were discovered. Then the great refracting telescope at the Lick Observatory in California, with its yard-wide lens, was completed. One of the most skillful astronomers to use this instrument was the late Edward E. Barnard, a former Nashville photographer, who took up astronomy in an amateur way but became one of the greatest in his field before he died a few years ago. On the night of September 9, in 1892, Prof. Barnard looked at Jupiter with this huge instrument, then the largest in the world. He saw the planet, as well as the four moons that Galileo had discovered so long before. But he saw something else. Instead of four, there were five points of light. At first, he probably thought that it was merely a star that happened to be in the same direction. Then he measured its distance from the planet and looked again a few hours later. If it were a star, the motion of the planet would have left it behind, but a satellite would go along with the rest of the system. Sure enough, it had moved with Jupiter, and so was without question a fifth satellite. Thus Barnard had joined the exclusive group of satellite discoverers which Galileo had founded.

The next few years brought no fur-their satellite discoveries, until December, 1904, when Dr. C. D. Perrine, another Lick Observatory astronomer, made a photograph of the planet with the large reflecting telescope. On this plate a sixth moon turned up. He continued his observations, and the next month,, January, 1905,.fished still a seventh Jovian satellite out of the obscurity in which it had moved for countless ages.

In January, 1908, an English astronomer, P. J. Melotte, also by photography, discovered the eighth. However, the Lick Observatory was destined to score again, because in July, 1914, a young astronomer there, Dr. Seth B. Nicholson, with the same reflecting telescope, tried to make a photograph of the eighth satellites. To his surprise, the photograph showed not only the eighth but still another one, which was number nine. No others have been found since, though it is likely that there are several more tiny bodies circulating around the planet which will be picked up as astronomical observing methods are improved. When the 200-inch reflecting telescope, now being constructed for the California Institute of Technology is completed, satellites number ten, eleven, and twelve may be found.

Our own single moon, of course, is with us this month as usual. But it does two things of interest that would repay watching. As it moves through the sky it frequently comes in front of stars. Usually these are faint, but occasionally one bright enough to be seen by the naked eye is thus occulted. Two occultations of naked-eye stars occur this month. Neither is very bright, however, and a pair of opera glasses, or field glasses, would help greatly in watching the phenomena.

On December 14, a star in Taurus, known as alpha Tauri, is hidden behind the moon at twenty minutes after six, Eastern Standard Time. About an hour later, at 7:22, it emerges on the other side. As the moon moves across the sky from west to east, the star disappears on the eastern edge and reappears on the western edge of the moon. The moon is not quite full on the 14th, however, so we cannot see the eastern limb. Consequently, the star will seem to disappear a short time before it reaches the illuminated surface.

The second occultation occurs on the 24th of the month, or the day before Christmas. This star is theta Virginis in the constellation of Virgo. This occultation occurs at a less convenient time, for it happens in the early morning hours.

Altogether, nine first magnitude stars are visible in the December evening sky. Betelgeuse, Rigel, and Aldebaran have already been mentioned. Low in the southeast, below the belt of Orion, is the most brilliant of all the stars we can see, Sirius, the dog star. This is in Canis Major, the greater dog. Over in the east is another bright star, which is Procyon in Canis Minor, the lesser dog. Higher in the east is the brilliant Capella in Auriga, the charioteer.

Between Procyon and Capella, and a little to the north, are two bright stars, one above the other. These are the twins, Gemini. The lower one is the first magnitude star, Pollux; the upper one is Castor.

Lower in the northwest, now nearly out of view, is Lyra, with the bright star Vega. Somewhat above it is Cygnus, the swan, with the bright Deneb.