ASTRONOMY

Mars Becomes Prominent

Jonathan Swift described Mars' two moons about 150 years before they were scientifically discovered by an American astronomer, Asaph Hall, in 1877.

By JAMES STOKLEY

➤ RAPIDLY DRAWING NEAR for its approach to the earth in March, the planet Mars is now a prominent object in the southeastern evening sky. From a distance of 76.6 million miles on Feb. 1, it will approach to 63.7 million miles on Feb. 28. Its minimum distance, on March 11, will be 62.1 million miles.

Mars, now in the constellation of Virgo, the virgin, rises in the east about 8:00 p.m. and remains visible for the rest of the night. Although not as bright as Sirius, the brilliant star in the south in Canis Major, the great dog, Mars is brighter than any other star now visible. And because of its approach, it is increasing in brilliance. On Feb. 28 it will be nearly twice as bright as it was on the first.

The accompanying maps show the skies as they appear about 10:00 p.m., your own kind of standard time, at the first of the month; 9:00 p.m. on the 15th, and 8:00 p.m. on the 28th.

Sirius Brightest Star

Look toward the south for the display of brilliant stars that make winter evening skies so magnificent. Sirius is the brightest star of all. Higher and to the right is the constellation of Orion, the warrior, with the characteristic row of three stars that form a belt. Above the belt is Betelgeuse; below is Rigel. Both are stars of the first magnitude.

On the other side of Orion from Sirius is Taurus, the bull, with Aldebaran, a first magnitude star that is distinctly red. Supposedly, it marks the bull's eye. Below Taurus, and farther north, is Aries, the ram, in which Jupiter now shines. This planet is even brighter than Mars. It sets around midnight.

Capella is the bright star in Auriga, the charioteer, shown mainly on the northern sky map, which is above Taurus. Next to Auriga, toward the southeast, are Gemini, the twins, with Pollux the brightest star in this constellation. A little lower, between Gemini and Canis Major, is the little dog, Canis Minor. Here you can see another bright star named Procyon.

Saturn is another planet now in the evening sky, but it is drawing close to the sun. At the end of February Saturn sets with the sun and is invisible. But at the beginning of the month you may be able to glimpse it low in the west as darkness is falling. It is in the constellation of Aquarius, the water carrier, which is not shown on the maps.

Now that the Space Age has dawned, it is no longer a novelty to have tiny satellites dashing around in the sky. But if there were ever any inhabitants of Mars, they long ago could watch two small moons moving around in a similiar manner. Mars has two natural satellites, called Phobos and Deimos, which are as close to the planet as many of our artificial satellites are to earth. Although considerably larger than any artificial satellite that man has yet hoisted into orbit, they are far smaller than the moon.

Phobos, which is nearer to Mars, is only 3,700 miles above its surface. It revolves around the planet in 7 hours and 39 minutes—less than one-third of a Martian day. No other known natural satellite revolves around its planet in less than its day—the period of rotation on its axis. However, artificial satellites characteristically do so. And, like Phobos, many of them rise in the west and then move across the sky to set in the east.

Deimos is 12,500 miles above the surface of Mars and revolves around it in 30 hours and 18 minutes. Since the "day" of Mars is 24 hours, 37 minutes, Deimos remains visible from a particular place in the planet for nearly three days without setting. During that time it goes through a complete cycle of phases, from new to full moon, and back to new, twice.

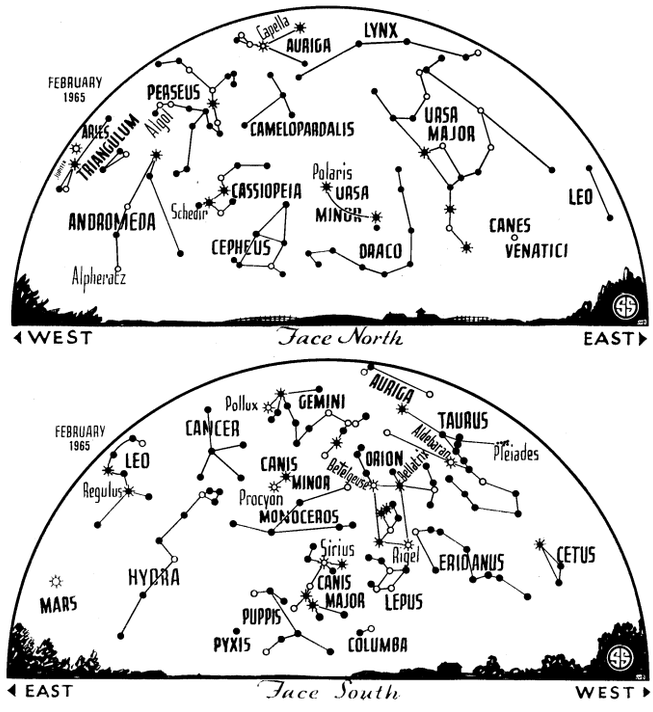
However, this rapid change of phase would hardly be visible to the naked eye. The diameters of the two satellites cannot be measured from earth, but astronomers estimate that Phobos is about ten miles in diameter and Deimos only five. As seen from Mars, Phobos has only a third the apparent diameter of our moon from earth, and when full it would only be about a twenty-fourth as bright. The apparent diameter of Deimos would be about a twenty-fourth of that of the full moon for us. It would never be more than about a fortieth as bright as Phobos. Thus, even with two natural moons, there is not nearly as much moonlight on Mars as we have on earth.

Swift's Description

Phobos and Deimos were discovered by an American astronomer, Asaph Hall, in 1877. Yet Jonathan Swift, in his "Gulliver's Travels," which was published in the 1720's, described them with fair accuracy.

According to Gulliver's account, the astronomers of Laputa (the moveable island that floated above the earth) "discovered two lesser stars, or satellites, which revolve about Mars; whereof the innermost is distant from the center of the primary planet exactly three of the diameters, and the outermost, five; the former revolves in the space of ten hours and the latter in twenty-one and a half."

Probably Swift, or some astronomer friend, arrived at these figures by analogy with the moons of Jupiter. Since earth has one moon and four of Jupiter's 12 moons were known in Swift's time, two satellites would seem reasonable for Mars, in orbit between earth and Jupiter.



☼ ✱ ○ • SYMBOLS FOR STARS IN ORDER OF BRIGHTNESS

Jupiter's diameter is 88,700 miles. The distance of Io, the inner satellite, is 262,000 miles, or 2.94 times the diameter. Europa, the second satellite is 417,000 miles away, or 4.7 diameters. Thus, it is not hard to see how he arrived at his distances, especially since the figures for Jupiter were not known with their present accuracy. Actually, Swift's estimates were too great, since Phobos is only 1.4 times the Martian diameter away from the center of the planet. The distance of Deimos is only 3.5 diameters.

Kepler's Third Law

There is an astronomical principle known as Kepler's third law, which states that the squares of the times it takes the planets to revolve around the sun—their periods—are proportional to the cubes of their mean distances from the sun.

In some way, Swift decided that ten hours was a reasonable period for the inner satellite. The square of 10 is 100 and the cube of its distance—3 diameters—is 27. The cube of the distance of the outer satellite—5 diameters—is 125. Now 100 divided by 27 is 3.7 Multiplying by 3.7 gives 462.5, the square of 21.5, which is the figure Swift gives for the period.

In his account, Gulliver goes on to point out that the periods and distances of the satellites discovered by the Laputan astronomers do follow this relationship, "which evidently shows them to be goverened by the same law of gravitation that influences the other heavenly bodies."

Celestial Timetable for February

FEB.	EST	
1	11:36 a.m.	New moon
3	5:00 a.m.	Moon passes south of Saturn
8	10:00 p.m.	Moon passes south of Jupiter
9	3:53 a.m.	Moon in first quarter
14	2:50 a.m.	Algol (variable star in Perseus) at minimum
	6:00 a.m.	Moon nearest; distance 224,200 miles
15	7:27 p.m.	Full moon
16	11:40 p.m.	Algol at minimum
17	5:00 p.m.	Moon passes north of Mars
19	8:30 p.m.	Algol at minimum
22	5:20 p.m.	Algol at minimum
23	12:40 a.m.	Moon in last quarter
	10:00 p.m.	Mercury behind sun
26	5:00 a.m.	Saturn behind sun
	5:00 a.m.	Moon farthest, distance 251,800 miles

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

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TECHNOLOGY

Windshield Darkens To Protect Eyes

➤ AN AIRCRAFT windshield that will darken 1,000 times faster than the blink of an eye is being developed to protect pilots from being blinded by a nuclear flash.

The windshield, designed for U.S. Air Force bombers taking part in a low-level attack, will be made of "photochromic" materials which darken automatically when exposed to certain wavelengths of energy.

The windshield is being built by the National Cash Register Company in Dayton, Ohio, under a quarter-million-dollar Air Force contract.

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