

In the middle of many of these there is a mountain in sharp relief, and some few are filled with a dark substance similar to that of the large spots that are seen with the naked eye; these are the largest ones, and there are a very great number of smaller ones, almost all of them circular."

It is interesting to note that, at almost the same time, speculations regarding life on the moon resulted in what was perhaps the first science fiction book, "The Man in the Moon", by Dominguez Gonzales, published in London in 1638. The novel describes the adventures of an explorer who is flown to the moon in a vehicle lifted by a flight of swans. He finds the moon peopled by a race of supermen. He describes many wonders in the lunar world, but pines for the imperfect earth and returns after a few weeks.

EARTH-BASED OBSERVATIONS

What is the moon really like? Within the past few decades observations of the moon have been made by radio waves of broad range frequencies, and by light waves in both the visible and infra-red portions of the spectrum. There has emerged a picture of a desolate world. The moon has no air, no water. The surface temperature ranges from 140° C. at noon to -150° at midnight. The surface features vary from the relatively smooth maria to the exceedingly rugged highland regions. Craters of sizes ranging from about 100 miles diameter down to the limit of telescopic resolution abound on the surface, although the maria are relatively free of craters.

The moon has a diameter of about one-quarter that of the earth. Its mass is only $1/80$ th that of the earth, so that its density is only 3.3 grams per cc as compared with 5.5 grams per cc for the earth. Consequently, the acceleration due to gravity on the surface of the moon is only about $1/6$ of its value on the earth. The area of the visible hemisphere of the moon is about twice that of the United States. Since the moon rotates on its own axis at the same rate at which it moves around the earth, only one hemisphere is visible from the earth.

The moon's orbit relative to the earth is an ellipse of eccentricity 0.055 and mean distance 239,000 miles from the earth. The sidereal period is 27.3 days. The orbit is inclined at $5^{\circ} 9'$ to the plane of the ecliptic, and precesses with a period of 18.6 years.

With these basic facts, what detailed information can be learned about the moon's history, surface features, and surface environment from recent earth-based observations? If man is going to explore the moon, he needs all the information possible before he embarks on his journey. In fact, he needs this information before he can even design the craft to carry him to the lunar surface.

Figure 1. Visual observations of the moon from the earth's surface reveal that the predominant geographic feature, or perhaps I should say "selenographic" feature, is the vast number of craters. Almost all scientists today are convinced that these are formed by meteoric impacts except for a very few, which appear to be volcanic in nature. The typical lunar crater is formed by an explosion, and the energy is almost certainly brought in by a meteoric impact. These impacts occurred over a long period of time. But without wind and water, erosion has not significantly changed the resulting surface. Many examples can be found of overlapping craters, and of craters within craters, clearly attesting to their varying ages and insignificant erosion. The most recent craters show a light coloured "halo" and a pattern of radiating streaks. These are believed to consist of material splashed out of the crater. With time, the surface is apparently darkened by the action of the sun's radiation.