

The Solar System.

THE Solar System is made up of the sun and its family of eight planets with their satellites and hundreds of asteroids which revolve around it in orbits almost circular. To these must be added some of the comets which travel around the sun in elliptical orbits. Altogether there are several hundred bodies. They are moving forward in space at the rate of about eleven miles a second. The sun is the commander ; it is its influence which keeps the others in their orbits and prevents them from wandering off into space.

The sun is a star—an immense globe, fiery, self-luminous having a diameter of 866,500 miles or nearly 110 times that of the earth. Thus it is 1,300,000 times as large as the earth. Like this planet it revolves on its axis making a complete revolution in about twenty-six days. Estimates as to the temperature of the sun's surface very considerable but the best authorities say it is about seven thousand degrees Centigrade. To us it is by far the brightest and also most important of all the heavenly bodies because its attraction controls the earth's motions and its rays supply the energy which maintains all forms of terrestrial life. The sun is supposed to be a gaseous compound of different elements differing from the earth only in as much as the earth is solid. The generally accepted theory is that its heat is caused by slow contraction. If such be true there must come a time after some millions of years when the sun will be cold and so all life here must cease, unless in the meantime the end of the world should intervene.

Mercury, the planet nearest the sun is the smallest of them all. Its mean distance from the sun is about 36,000,000 miles and its diameter about 3,000 miles. It revolves around the sun in 88 days and most astronomers say that it turns on its axis in the same number of days but there is much uncertainty about the length of its day. In these latitudes Mercury is very seldom seen with the naked eye but when its position is known it is easily visible as a brilliant red star of the first magnitude.

The planet next in order of distance from the sun is Venus the brightest of stars. It has a diameter of 7,700 miles and its mean distance from the sun is 67,200,000 miles. It is the earth's nearest neighbor for sometimes it approaches to within 26,000,000 miles. It goes around the sun in 225 days and the generally agreed upon time of revolution on its axis is 23 hours nearly. This planet is surrounded by a very dense atmosphere which completely obscures its surface. Next to the sun and the moon Venus is the most brilliant object in the heavens. When at its greatest brilliancy, it is easily seen with the naked eye in the day time.

Next to Venus at a distance of 93,000,000 miles from the sun comes the earth, a planet with which we are all more or less acquainted. It resembles Venus very much in size but differs from it in being provided with a satellite—the moon. This is an immense globe, 2162 miles in diameter which revolves around the earth at a distance of 239,000 miles in about $29\frac{1}{2}$ days. As it turns on its axis in the same time, there is one side of the moon never visible from the earth. For the same reason day and night on the moon are each equal to $14\frac{3}{4}$ of our days. The moon is not self-luminous but reflects the light which it receives from the sun. There are no traces of water or atmosphere found on it, and therefore astronomers conclude that the moon is “dead,” or without life.

Next outside the earth comes Mars a dusky red planet which revolves around the sun in an orbit having a radius of about 141,000,000 miles. Its year—the time of its revolution around the sun equals 687 days. It rotates on its axis in $24\frac{1}{2}$ hours and has a diameter of 4,200 miles. This planet is accompanied by two very small moons. Mars is noted on account of its canals or markings on its surface. These have, at various times been held as certain evidence that Mars is inhabited by beings of very superior intelligence. But that question is still very unsettled for many astronomers, while admitting the reality of these wonderfully arranged canals, declare, that, on account of the low density of the Martian atmosphere and small amount of heat it receives from the sun, the temperature must

always be very low and so Mars is not habitable—at least by beings such as live on the earth.

Outside the orbit of Mars come the Asteroids, about 700 of them revolving around the sun at distances varying from 135,000,000 to 450,000,000 miles. They are all very minute bodies—the largest being not 500 miles in diameter while some of them are less than 20 miles. Two theories are put forward to account for the presence of these small bodies ; one is that a large planet was somehow spoiled in the making and did not stick together. The other theory is that these are fragments of a large planet which exploded and broke into many pieces.

The nearest outside neighbor of the Asteroids is Jupiter, which ranks next to Venus in brilliancy among the heavenly bodies. Its distance from the sun is 483,000,000 miles and it revolves around it in $11\frac{3}{4}$ years. Its diameter is 88,000 miles and thus it is 1355 times as large as the earth. It is by so much the largest of the planets, that it is larger than all the rest put together. It rotates on its axis, swifter than any other planet, in about 10 hours. Jupiter is accompanied by eight satellites. Four of these are larger and are remarkable as being the first heavenly bodies discovered with the telescope. The physical condition of this planet is not yet determined although it is evidently different from that of the earth or Mars. The general opinion is that Jupiter is very hot—some astronomers say it is boiling. As it receives much less heat from the sun than the earth does, it must have the source of its heat within itself—very probably because like the sun it is slowly condensing.

Next to Jupiter comes Saturn in many respects the most remarkable of all planets. It revolves around the sun, at a distance of 886,000,000 miles in $29\frac{1}{2}$ years. Its diameter is 7400 miles and it rotates on its axis in $10\frac{1}{4}$ hours. The planet resembles Jupiter in its physical constitution. Its most wonderful feature is its system of three flat, thin, concentric rings which surround it like circular disks. No where else in the universe is such a sight to be seen. The outside ring is about 1200 miles broad, then there is an open space of

2000 miles and inside which is the central ring 17000 miles broad. After another open space the third ring, about 10,000 miles broad, comes at a distance of 9,000 miles from the planet. The rings are all very thin—only about 100 miles across. Besides these rings Saturn is attended by ten moons. Thus the nights can hardly ever be very dark and it must often be hard for the native of Saturn to say when daylight comes.

Uranus, the planet next outside of Saturn, is, on account of its distance rather difficult to see with the naked eye but if its position be known, it may easily be distinguished on a clear night. Uranus was unknown to the ancients and was accidentally discovered by Sir William Herschel in 1781. It is 1,800,000,000 miles distant from the sun around which it revolves in 84 of our years. Compared with Jupiter and Saturn it is small being only 32,000 miles in diameter. There are no markings on it clear enough to determine the time of its rotation. It is well supplied with Satellites, having four small ones which are peculiar inasmuch as they revolve backwards compared to the satellites of the other planets.

Neptune the outermost planet is another that has been discovered in modern times. Its discovery is one of the triumphs of modern astronomy. It was noticed that Uranus was not following the path which had been computed for it so astronomers began searching for the reason of its misbehaviour. Two of them Leverrier and Adams calculated that another planet of about equal size must be somewhere near and retarding the progress of Uranus. So well had they its location calculated that Neptune was found in September 1846 less than one degree from where they said it was. This planet has a diameter of about 33,000 miles and is at a distance of 2,800,000,000 miles from the sun around which it revolves in 108 years. It cannot be seen by the naked eye on account of its distance. Neptune is accompanied by one satellite which, like those of Uranus moves backward. In its physical characteristics it resembles Uranus and so its period of rotation is not known.

By far the majority of the comets are visitors from space who just pass through the solar system and go off never to return. Their total number must be enor-

mous for there is one in sight almost all the time. Most of them are visible only in large telescopes but there are some of all grades of brightness for occasionally one comes that is bright enough to be seen in daylight. Such bright ones have always been looked upon as presages of evil and that opinion still survives though it is hard to find any good ground for it. About 85 are known to revolve around the sun in long ellipses and so their return can be foretold as is the case with Halley's comet which returns about every 76 years. At the nearest approach to the sun some comets come within 6,000,000 miles and so must become very hot. Some of these bodies are of an enormous size reaching 1,200,000 miles in diameter and having tails sometimes 100,000,000 miles long. They must be very light bodies for stars can be seen through them and they exert no perceptible attraction on the sun or the planets. What they are made up of is yet an unsettled question—the most probable hypothesis is that they are composed of small meteoric particles widely separated, each particle in an envelope of rarefied gas and vapor in which light is produced either by electrical discharges between the small bodies or by reflected sunlight.

Such are the various bodies that make up the Solar System. The great central sun speeding through space, conveys with it a very numerous family many of which have lesser attendants of their own. Each planet and satellite revolves in its orbit with unfailing accuracy. Astronomers say that once they were placed in position and given a shove and a spin, Gravitation is sufficient to keep them forever moving in their courses. But who fashioned these tremendous spheres and set them at their proper distances? Who gave them their start and that initial twist? It is in the heavens that the omnipotence of God is most manifest; there He has placed His most stupendous works. The more we study the stars the more we are convinced of the existence of a First Cause. Such study leads us more easily to understand that the stars and planets are

“Forever singing as they shine,
The hand that made us is Divine.”

F. L. M. '18