

action of the seething mass within. If this hypothesis be correct, then Jupiter must be in a state of semi-incandescence, glowing like a nearly extinguished sun, and thus causing these rapid and tremendous disturbances in his atmosphere. And not only is this opinion suggested by the inadequacy of the solar heat to cause these phenomena, but also by the fact that the light given off by Jupiter seems to exceed the amount received. Zollner, the eminent German photometrician, thought that Jupiter sends to us more light than he receives, otherwise his reflecting power must, according to his estimate, be as great as 0.62, while that of white paper is 0.78. Draper's experiments in photography also lead us to believe that more light comes to us from the planet than could be reflected from its surface, and Bond, by actual calculation, has proven this to be the case. Jupiter, then, is a sort of sun, and, indeed, he bears considerable resemblance to the sun in various ways. In the first place their density is exactly the same; then, there have been observed on Jupiter spots very similar to the phenomena known as sun-spots; moreover, the planet like the sun is brightest at the centre, and perceptibly darkens towards the limb, a fact best noticed during the transit of one of his satellites, and finally the equatorial regions of the planet seem, like those of the sun, to make more revolutions than the polar ones, as is found by observing the times of rotation of spots situated in different latitudes.

Very little bearing on this question has been ascertained concerning the atmosphere of Jupiter, the light from it—which probably never reaches the planet, but is reflected to us from the upper surface of the clouds which envelop it—giving under the spectroscope a regular spectrum, with no appreciable effect upon it of the action of the planet's atmosphere.

There is no reason, however, to believe otherwise than that all the bodies of the solar system are of the same constitution, though perhaps in different conditions, or different stages of formation. Thus the sun is nearly liquid, but still shows the same constituent elements as the earth, Mars is shown to be the same in constitution and very similar in condition to the earth; why, then should we not regard Jupiter as the same, being of the same

density as the sun, only that it is further advanced in the process of contracting and cooling.

This theory, then, which is now received by all scientists, gives to Jupiter the dignity of a sun, though on a smaller scale, not giving out nearly so much heat or light as our sun, for, indeed, his surface appears for the most part dark, a fact caused, perhaps, by the amount of clouds present in his atmosphere which cannot transmit the light. In any case the light he emits is very feeble, as is shown by the fact that the satellites, when eclipsed in his shadow, are quite obscured, and also, when in transit, cast black shadows upon the disk of the planet, whereas, if they were illuminated by his light, they should be visible even when deprived of that of the sun, and also the surface of the planet should be so bright from inherent light as not to be affected by the withdrawal of the sun's rays; but, perhaps, these shadows may be nothing more than the effect of contrast.

A subject to which our most celebrated mathematicians have devoted many hours of study, is the phenomena presented by Jupiter's satellites. These are four in number, and are remarkable as being the first heavenly bodies discovered after the invention of the telescope by Galileo, who first observed them in 1610, and in a surprisingly short time had ascertained their character and determined their motions. He called them, in honor of the Medicis, the Medician stars. They are generally known as the first, second, third and fourth satellites in the order of their distance from the planet, but they also have special names, being called respectively Io, Europa, Ganymede and Callisto. As to the size, the first has a diameter of about 2,700 miles, the second 2,200, or about the same as our moon, the third 3,600, and the fourth 3,000. Their distances from the planet range between 262,000 and 1,169,000 miles, and their sidereal periods between 1^d , $18\frac{1}{2}^h$ and 16^d , $16\frac{1}{2}^h$. In a large telescope they all show sensible disks, and, under favourable circumstances, peculiar markings have been seen upon them. The first sometimes appears gibbous, the fourth appears to have its circular edge abruptly cut off by right lines, and the third, or largest has decided markings on its disk. These, however, can be seen so rarely that we