Transit of Mercury of November 14, 1907

Reprinted from St. Michaels Almanac 1907, Shermerville, Ills.

On November 14, 1907 there will be a transit of the planet Mercury across the face of the sun. As this is a rare astronomical event, the reader will wish to know something of its meaning and of its importance.

Astronomy tells us that the sun is attended by a family of eight large and many hundred small planets that circulate about it in the same direction but at different distances. Our earth is one of the large planets and is the third in the order of distance from the sun, its mean distance being about 93 millions of miles. All the planets except two are farther from the sun than we are, these two being Mercury and Venus.

In Fig. 1 we have a diagram, drawn correctly to scale, of the orbits of the three inner planets. The outer and largest circle is the path of the earth about the sun, and gives its position for almost every five days throughout the year. The next circle is the orbit of Venus, which does not interest us at present. The inner and smaller circle is the orbit of Mercury, and gives the position of the planet for every five days during the months of October, November and December of the present year 1907. It will be seen at once that as it takes the earth 365¼ days, or one year, to move about the sun, it takes Mercury only 88 days, or less than 3 of our months to do so. This is owing not only to the smaller size of his orbit, but also to his greater speed. This last can also be well seen on the diagram by comparing the five-day intervals of Mercury with those of the earth. Indeed, if the reader examines Fig. 1 closely, he will discover another fact, the considerable variation in Mercury's speed when in different parts of his orbit, as for instance when near the points P and A. When he is at the point P he is said to be in perihelion, or nearest the sun, about 28½ millions of miles away, and moves about 36 miles a second, and when he is at the point A he is in aphelion, or farthest from the sun, 43½ millions of miles away, and moves about 23 miles a second.

The reason of this variation in his speed is owing to the fact that according to Kepler's laws a planet must move in an ellipse with the sun, S, in one of its foci, and its radius vector must sweep over equal areas in equal times. Mercury's orbital ellipse, on the scale of the diagram, is practically a circle with its centre at the point O and its radius equal to the planet's mean or average distance from the sun, of about 36 millions of miles. The radius vector of a planet is the line joining it with the sun at any time. Now, if the reader will imagine two radii vectores drawn from the sun to Mercury's positions on two successive five-day intervals anywhere on his orbit, he will see at once that as these radii vectores become longer the distance run by the planet becomes shorter, and the reverse, so that the area of these elliptical sectors is always the same for the same intervals of time. And this is what is meant by saying that the radius vector sweeps over equal areas in equal times.

As the sun is 7½ million miles out of the centre of Mercury's orbit the planet's distance from the sun is subject to a variation of 15 out of an average of 36 millions of miles. The consequence is that the amount of light and heat he receives at perihelion, P, and at, aphelion, A, varies as 9 to 4 that is, he receives more than twice as much light and heat when at perihelion than when at aphelion, and this after an interval of one half of his year or only 44 of our days. We may therefore imagine that while his average supply of light and heat is nearly 7 times our allotment, with this enormous variation in addition, life upon Mercury according to our notions would be unbearable, in fact impossible, since his average temperature must be 210 degrees Centigrade, only 25 degrees below the melting point of tin. And to this we must add the view of Schiaparelli, that the planet turns on its axis only once in going round the sun, and that consequently one side must have perpetual day and the other perpetual night.

The earth also, as does every planet, moves in an ellipse, but this ellipse could not be distinguished from a circle except that the sun would be about 1½ out of 93 millions of miles out of centre. The earth is in perihelion, B, on January 2, and is then about 3 millions of miles nearer the sun than when in aphelion R, on July 3. Lest this variation of distance should cause us any anxiety, Providence brings us nearest the sun in winter and farthest away in summer, just as we would wish it. And lest we should rejoin that the opposite would be true for the southern hemisphere and the extremes of summer and winter there more pronounced, this again has been provided for by placing very little land and very much water in the southern hemisphere.

As Mercury's orbit lies entirely within that of the earth and is much smaller, a study of Fig. 1 will show us that he must always appear to be near the sun and visible therefore only in the twilight after sunset or before sunrise. If the reader will take any point on the earth's orbit and run from it two lines, one to the sun and the other to any point whatever on Mercury's orbit he will see that as he moves these points about, the angle between the lines can never exceed 28°. Thus on October 23, the earth is at H and Mercury at I. He is then at his greatest distance or elongation from the sun, (which then happens to be only 24°) because the line I H is tangent to his orbit. He is then approaching