THE ECLIPSE OF THE SUN AND LUNAR APPULSE IN DECEMBER, 1908.

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The movements of the celestial bodies which characterize each year, are those which mark that period with special interest for the student of astronomy. The year 1907 was distinguished by the brilliant opportunity it afforded for observing our neighbor planet at opposition; and also for the rare recurrence of the November transit of Mercury which will be seen only nine times during the present century. The year 1908 has shown nothing of this particular nature; but it is distinguished for the three eclipse seasons which it includes. The occurrence of three eclipse seasons in one year is possible only when we have an eclipse very near the beginning of the year; and this is only possible at intervals of every nine years. The year 1899 included three eclipse seasons.

The plot, Fig. 1, illustrates the gradual advance of the dates of eclipses in 1908. The position of the earth is shown for the dates of the solar eclipses of January 3, June 28, and December 23; also for the lunar appulse of December 7.

Fig. 2 is a plot of the moon's orbit for December. That part which is represented by the full line is above, and the part shown by the dotted line is below the plane of the ecliptic. The point *N* is the ascending node where the moon passes from the space below to that above the plane of the ecliptic; *N'*, the descending node, is the point where she passes from the space above to that below; and *NN'*, the line of nodes, is the intersection of the plane of the moon's orbit with that of the ecliptic. The position of the moon is shown for each day from the 1st to the 28th at Greenwich noon; and also at the time of the appulse, when the moon will be below the plane of the ecliptic, and will graze the earth's shadow. The moon's position at the time of the eclipse practically coincides with that given in the plot for the 23d, since the eclipse will occur between ten and eleven minutes before Greenwich noon. The direction in which the sun is seen from the earth is shown for the 1st and the 28th at Greenwich noon; also for the 7th and the 23d at the time of the appulse and of the eclipse. The sun and moon appear to move in the direction of the arrows, and are represented by their longitudes. At the date of full moon, when the longitude of the sun and moon differ by 180 deg., the sun's rays in the direction of the arrow *a* illuminate the hemisphere which is visible from the earth. The time of full moon is 7d. 9h. 44m.; and that of the nearest approach of the moon to the earth's shadow is 7d. 9h. 55m.

Fig. 3 is a projection of the earth on a plane which is parallel to its axis and perpendicular to the plane of the ecliptic. In this projection the equator, tropics, polar circles, parallel of Greenwich, and that of an observer to whom the central eclipse will be visible at noon, are represented by straight lines. The figure represents the illuminated area and that which is in shade at the time of the appulse.

Fig. 4, drawn to scale, represents the earth, the moon, and their shadows, projected on a plane which is perpendicular to the plane of the ecliptic, and parallel to the earth's orbit radius on December 7 (Fig. 1). The length of the shadows of the earth and of the moon vary during the year. They are longest when the earth is at aphelion, and shortest when it is at perihelion. It is impossible to include them within the limits of this page. The length of the moon's shadow does not differ very much from the length of the moon's orbit radius, i. e., the distance between the earth and moon in Fig. 4; and the length of the earth's shadow is about three and two-thirds that measurement. That the moon's shadow on the average is about the same length as the radius of the moon's orbit is shown in a solar eclipse. In the case of an annular eclipse, the shadow does not reach the earth. When the eclipse is total the shadow is longer, and its vertex may fall some distance beyond the earth's surface.

On December 23, the date of the central eclipse of the sun, when the moon will be below the plane of the ecliptic (Fig. 2), the position of the observer (also below the plane of the ecliptic) to whom a central eclipse will be visible at noon is shown at *O* in latitude 53 deg. ¾ sec. (Fig. 3). Since the longitude of the observer is only 2½ deg. east of Greenwich, and the date is near that of the winter solstice, the meridians of Greenwich and of the observer are, in the drawing, indistinguishable from the great circle which represents the earth.

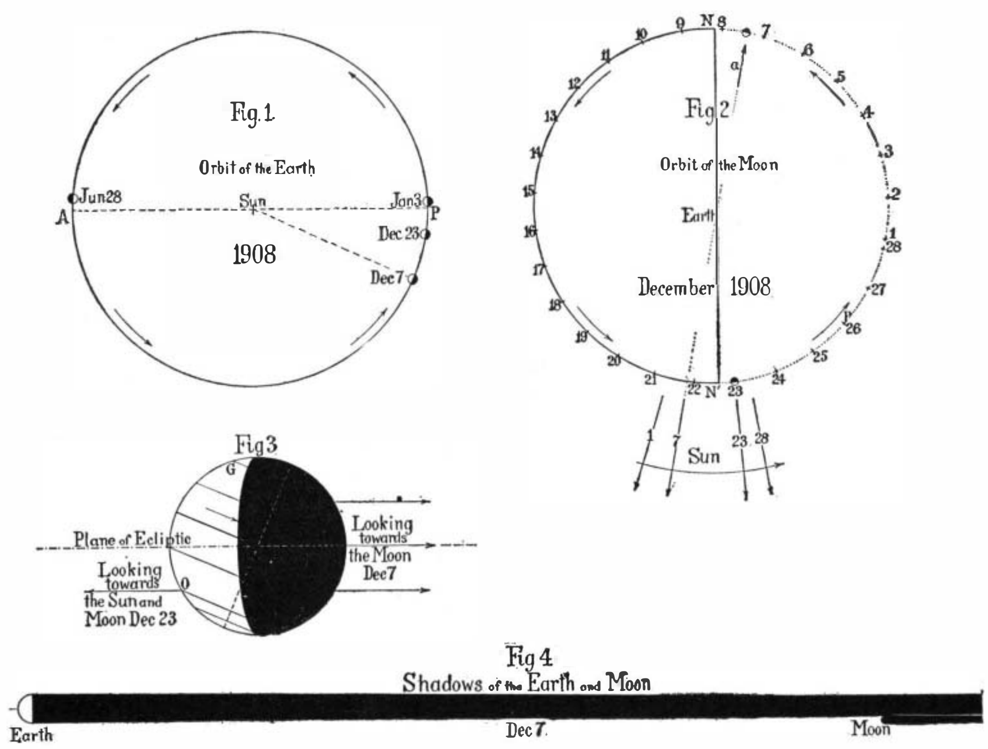

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Fig. 3 represents the earth on December 7. On the 23d the illuminated area will extend over a little more than one-half of the visible hemisphere. At the solstices the visible illuminated and unilluminated surfaces are equal, because the projection is on a plane which is parallel to the earth's orbit radius. At the date of the eclipse the moon will not be far from perigee (*P*) which she will reach on the 26th (Fig. 2). Her apparent diameter will not differ very much from its maximum. The earth will be near perihelion, and the apparent diameter of the sun will be nearly equal to its maximum. The result will be a total eclipse within a limited area, i. e., between longitudes 28 deg. W. and 38¼ deg. E.; and beyond these limits the central eclipse will be annular. The path of totality will be limited to the South Atlantic Ocean, for which reason the eclipse will have purely an academic interest for inhabitants of the United States.

Displacement: 20,000 tons. **Speed,** 21 knots. **Guns,** ten 12-inch, fourteen 5-inch.
Note the lofty forecastle deck and flaring bow.

LAUNCH OF THE "NORTH DAKOTA."

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In the Scientific American of November 14 we published a sketch of the "North Dakota," showing the completed ship as she will appear when viewed from abeam, and we supplement that illustration with views showing the great ship a few minutes after she had taken the water. The photograph gives an excellent impression of the huge bulk of the vessel and of the high freeboard which she will carry forward, where it will be serviceable in keeping her batteries dry when she is steaming head to sea. We draw attention to the considerable flare which she has at the bow above water. This is a feature which is being generally adopted among the latest ships, and particularly in those of the Japanese navy.

The ship's flaring bow will serve to throw off broken water that otherwise might come aboard, making things uncomfortable for the gun sighters by dimming the telescopic sights. Although the "North Dakota" is a turbine-driven ship, she has but two propellers instead of the four propellers which we are accustomed to associate with turbine marine engines. The possession of only two propellers is due to the fact that this ship is furnished with turbines of the Curtis type, one of the advantages of which is that the speed of revolution is comparatively low, a fact which renders it possible to develop the power on two shafts, and use propellers of larger diameter and more efficient design. The "North Dakota" is of 20,000 tons displacement and 21 knots speed, and she will mount ten 12-inch guns in five turrets and fourteen 5-inch guns in casemates.

Device for Pre-cooling Green Fruit.

The Southern Pacific Company has just announced that a pre-cooling device for preventing decay of fruit and vegetables on which more than $100,000 has been expended during the past year has proved very successful and has been adopted. This means much in the movement of green fruit from California to the East. Pre-cooling plants will be established at Roseville and Colton, Cal., where the experiment work has been carried on—one for the northern route and one for the southern, in connection with the expenditure of more than $100,000 for ice-producing plants.

Forty carloads at a time can be thoroughly chilled within four hours at the Colton plant and twenty carloads at the Roseville plant, where to get the same degree of chill it would take four days in the ordinary ice plant. The experiments of the Department of Agriculture, which has been working with the fruit shippers and the Southern Pacific, demonstrate that the greatest value lies in the rapid reduction in temperature which suspends absolutely the decaying process of nature.

Air blasts passing over ice are forced into the cars by vacuum exhaust which in itself removes the immediate chemical cause of decay.

Green deciduous fruit shipments this year are 3,000 carloads in excess of any previous year and it is believed that with the adoption of this system the shipments can easily be increased to 20,000 per year.

A machine has been designed to show the actual working time of any or all machines in a shop, so as to give an accurate record of the cost of production. It is to show whether the machine has been working its full quota of hours, and, if so, to see if the output is in accordance with the rate set. After the time for handling the work in and out of the machine has been determined, it is easy to see whether it has been left running or not during the day. The records can be arranged to suit the conditions, and certain forms have the lower part perforated, so that the total for the day can be torn off for the works manager to see at a glance how many hours the machines have been working during the day.