enlarged to about 120 days (Fig. 1). Thus there are some remarkable similarities between the semiannual variation of thermospheric density and the flux $F_{n,\mathrm{E}}$ near the Earth. Finally, because the proton-flux $F_{n,\mathrm{E}}$ can transport energies up to 1 erg cm^{-2} s^{-1}, $F_{n,\mathrm{E}}$ can transport energies of more than 0·1 erg cm^{-2} s^{-1}. This has to be regarded as the typical amount of energy responsible for the semiannual density variation[5]. From these considerations we might conclude that the energy provided by the flux of fast neutral atoms entering the upper atmosphere could contribute to the observed semiannual variations in the thermospheric temperature and density. We must, however, keep in mind that the results of Fig. 1 were based on special assumptions about the density n_0 and the proper motion $\mathbf{v}_0$ of interstellar hydrogen surrounding the solar system. Until we know the properties of the surrounding interstellar matter more exactly, we cannot make any predictions about its real influence on the thermosphere. In any case, charge-transfer collisions between solar protons and neutral interstellar hydrogen in the vicinity of the Sun have to be regarded as a source of fast neutral particles entering the atmosphere.

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Correlation between Solar Activity and Brightness of Jupiter's Great Red Spot

THE "pronounced correlation" claimed by Graf, Smith and McDevitt[1] between Zurich sunspot numbers and the relative brightness of the Jovian red spot is not readily apparent in their Fig. 1. It is therefore worthwhile to calculate r, the actual correlation coefficient between the two functions plotted. Using values scaled from Fig. 1, the result is $r = 0{\cdot}27$. This value of r implies[2] that only 7·5 per cent of the variation of the red spot can possibly be attributed to the solar activity responsible for the Zurich sunspot number. For the fifty values of the two functions compared, however, a correlation coefficient of 0·27 is not significant at the 5 per cent confidence level usually adopted in studies of this kind. In view of these considerations the relationship between the two phenomena will remain unestablished until better correlations can be obtained.

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New Determination of the Diameter of Neptune

As part of a systematic programme for the prediction of occultations of stars by planets, attention was called in 1967 to the rare possibility of an occultation (on April 7, 1968) by Neptune (magnitude 7·7, apparent diameter 2″·4) of the star B.D. − 17° 4388 (magnitude 7·8). Photographic observations of the relative positions of Neptune and the star at the Royal Greenwich Observatory on March 14, 1968, confirmed this possibility and enabled reliable predictions to be given for this unique opportunity for determining the diameter of the planet. The two existing principal determinations are those of Barnard[1], in 1899–1900 (52,900 km = 2″·43 at the mean distance of 30·06 astronomical units), and of Camichel[2] in 1953, using a double image micrometer (45,000 km = 2″·07).

Photoelectric observations of the times of the disappearance and reappearance phases were made at several observatories in Australia (Mount Stromlo, Siding Spring), New Zealand (Mount John) and Japan (Dodaira, Okayama). Continuous recordings were made to cover these phases, and times of "1·0 light", "0·5 light" and "0·0 light" have been reported. Visual observations were also made from the same areas.

As a first stage in the analysis twelve photoelectric observations of "0·5 light" were used to determine an accurate position and diameter of the planet assuming its cross-section to be circular; the rate and direction of motion of the planet relative to the star are regarded as known. The result was extremely good, with the relative positions of the star and centre of the planet being determined to within a few thousandths of a second of arc. This was made possible by the high accuracy of the photoelectric observations coupled with the very slow angular motion of the planet (3 seconds of arc in 1 h).

There was no evidence of any oblateness, although the geometry of the occultation (Fig. 1) would make any small variation from a circular cross-section very difficult to detect.

Using the ephemeris of Neptune as determined from this analysis it was a simple matter to deduce the diameters corresponding to the first detectable diminution of light (1·0 light) and to complete extinction (0·0 light).

The values obtained for the three diameters are

1·0 light 50,500 ± 100 (*S.D.*) km = 2″·32 ± 0″·01
0·5 light 50,100 ± 200 (*S.D.*) km = 2″·30 ± 0″·01
0·0 light 49,000 km = 2″·25

The value at 0·0 light is based only on the Japanese observations and no estimate of error is given. The angular values are those at the mean distance.

The interpretation of these values will require some assumptions about the atmosphere of Neptune, for refraction of as little as 0″·01 will increase the deduced

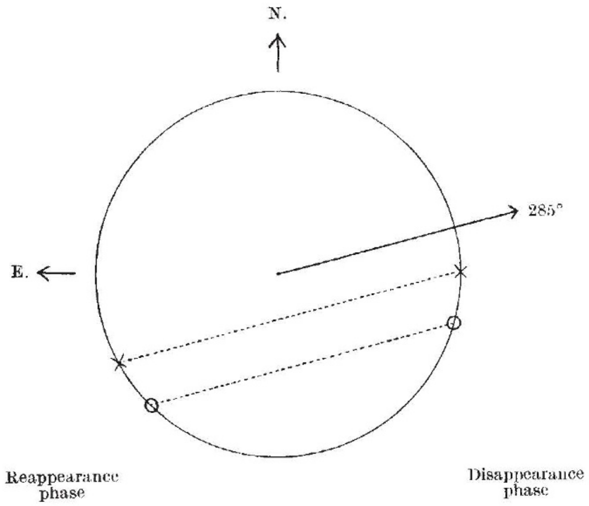

Fig. 1. The occultation of B.D. − 17° 4388 by Neptune on April 7, 1968. The circle represents the disk of Neptune and its direction of motion in position angle 285° is indicated. The crosses show the position angles as seen from Japan, the circles those from Australia and New Zealand. The duration was about 45 min from Japan and 40 min from Australia and New Zealand.