Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 252.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Magnetic Effects associated with Bright Solar Eruptions and Radio Fade-Outs

THE association of certain disturbances of the earth's magnetic field with bright hydrogen eruptions in the neighbourhood of sunspots, first indicated by Prof. Young, led to the conclusion that the solar effect was propagated to the earth with the velocity of light. Fresh impetus has been given these investigations by the observation of extensive radio fade-outs reported by Dellinger[1], at whose request special spectroheliograms were made at the Mount Wilson Observatory, Carnegie Institution of Washington, to investigate possible correlations[2]. A notable fade-out, a marked magnetic and earth-current disturbance, and an unusually bright hydrogen eruption on the sun, all occurring simultaneously, were observed from $16^h\ 45^m$ to $17^h\ 03^m$, G.M.T., on April 8, 1936, at the Huancayo (Peru) Magnetic Observatory of the Department of Terrestrial Magnetism, Carnegie Institution of Washington[3] and elsewhere. Since then, two other pronounced similar occurrences, one on August 25 and another on November 6, have been reported from the Observatory[4,5], and many instances of a less conspicuous nature have occurred[6].

The characteristic features of these phenomena as revealed so far are a marked increase in intensity of the $H\alpha$ line in the region of a sunspot, cessation of radio reflections from the ionosphere, in particular for the higher frequencies, and in equatorial regions an increase in the horizontal component of the earth's magnetic field, and increases in the electric currents flowing in the earth's crust such as would be induced by the magnetic changes. All the effects, as above noted, begin quite sharply at apparently the same time and end coincidently after a time-interval of the order of 45 minutes. Conditions after the disturbances appear to be normal. The terrestrial effects apparently are confined to the daylight portions of the earth.

The disturbances of the earth's magnetism which accompany these solar outbursts are distinct from the perturbations associated with magnetic storms—the latter are evident at all parts of the earth, while the strong magnetic effects recorded at Huancayo during the outburst of April 8 could not be discerned at the Carnegie Institution's Watheroo Magnetic Observatory, Western Australia, 169° west of Huancayo. Furthermore, both immediately before and immediately after the three notable outbursts mentioned, the earth's field was comparatively free of perturbations, while the perturbations of magnetic storms usually persist for several days; it is not to be implied, however, that the phenomena cannot or do not occur while a magnetic storm is in progress.

The nature of the mechanism which produces the magnetic effects may be surmised from the meagre data already in hand. The disturbance of August 25, for example, may be attributed to a sheet of current in the ionosphere flowing eastward over Huancayo and northward over Cheltenham (U.S.A.) with densities of 60 and 30 amp. per km. width of the current-sheet at the two places, accompanied by corresponding oppositely directed currents inside the earth[4]. In direction and magnitude this current approximates that assumed to produce the ordinary diurnal variations of terrestrial magnetism. Thus the magnetic effects may be ascribed to an increase of ionization, produced by radiation of shorter wave-length than visible light, accompanying the increase of $H\alpha$ intensity, causing an increase in the currents then flowing in the region of the ionosphere affected. The diurnal-variation currents are believed to flow in the lower, short free-path region of the ionosphere.

This hypothesis is consistent with the obvious explanation of the radio fade-outs—that they are due to increased ionization in the short free-path region where frequent collision causes large absorption of the radiated energy. Further, the rapid return to normal conditions, practically coincident with the cessation of the visible solar radiation, also indicates that the effect occurs in the short free-path region where recombination is very high.

An intensive investigation of these phenomena, designed to test this hypothesis and incidentally to clarify concepts of the diurnal variation of terrestrial magnetism and processes of ionization and recombination in the ionosphere, is under way at the Department of Terrestrial Magnetism.

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[1] *Phys. Rev.*, **48**, 705 (1935).
[2] Richardson, R. S., *Pub. Astr. Soc. Pacific*, **47**, 325 (1935); **48**, 122 (1936); *Terr. Mag.*, **41**, 197 (1936).
[3] Torreson, O. W., Scott, W. E., and Stanton, H. E., *Terr. Mag.*, **41**, 199 (1936);
[4] Fleming, J. A., *Terr. Mag.*, **41**, 404 (1936).
[5] Torreson, O. W., Scott, W. E., Davies, F. T., and Stanton, H. E., *Terr. Mag.*, **41**, 407 (1936).
[6] Dellinger, *J. H.*, *Phys. Rev.*, **50**, 1189 (1936).

Rainfall and Moon Phases in the Tropics

ON the low-lying east bank of the Demerara River, about eight miles from its mouth, is situate Diamond Plantation, the largest sugar factory in British Guiana, located approximately at 6° 42′ N. and 58° 10′ W. Preserved at Diamond is a valuable record of the daily rainfall for the past forty-six years. Through the courtesy of the Plantation authorities, I have been able to secure a copy of the register.