Letters to the Editor.

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Frequency Change in Scattered Light.

WORK has been carried out in this laboratory on the frequency change in scattered light (Raman effect), using a plane polarised beam. The preliminary results seem sufficiently interesting to be worth publishing even in an incomplete form. With carbon tetrachloride and an unpolarised beam, it is found that the modified lines of wave-lengths 4400 A., 4419 A., and 4447 A., produced by subtracting the quanta corresponding to the infra-red wave-lengths 46μ, 32μ, and 22μ from the violet mercury line 4358 A., are all about equally strong. If the exciting light is plane polarised, the line 4447 A. is missing when the scattered light is examined in the plane of polarisation of the incident light, but appears with about twice the intensity of the other two when observed in a direction at right angles to it.

The only explanation of this phenomenon which suggests itself, couched in terms of the classical theory, would seem to be that the oscillation giving rise to the modified line at 4447 A. is linear, whereas the other two are not. If one assumes that a polarised quantum can only interact with a linear oscillator if the plane of polarisation is perpendicular to the line in which oscillation occurs and that it is re-radiated polarised parallel to this line, it is clear that the above result would be observed.

This explanation is of course only tentative. The exact intensity ratios are being determined, and work on other liquids with unsymmetrical molecules as well as on crystals is proceeding which will, it is hoped, throw further light on this interesting phenomenon.

F. A. LINDEMANN.
T. C. KEELEY.
N. R. HALL.

Clarendon Laboratory, Oxford,
Nov. 28.

The Ultra-Violet Light of the Sun as the Origin of Auroræ and Magnetic Storms.

THE novel theory of auroræ and magnetic storms described by H. B. Maris and E. O. Hulburt (NATURE, Nov. 24) cannot be examined in detail until their promised paper appears, but some of its principal features induce me to believe that the true explanation of these phenomena must be sought along different lines.

The theory supposes that occasional sudden blasts of ultra-violet light are responsible for auroræ and magnetic storms. The terrestrial effects would be almost immediately felt, and would depend relatively little upon the position of the emitting area on the sun's disc; unless, indeed, the area were in a hollow on the sun, it would be not less than about half as effective if 60° from the centre of the disc as at the centre.

These consequences appear incompatible with the marked tendency for abnormal terrestrial magnetic conditions to recur after about 27 days, which is the rotation period of the sunspot zone relative to the earth. The arguments based on this recurrence-tendency by E. W. Maunder in 1905 remain valid in demonstrating that magnetic storms are caused by something that travels outwards from particular disturbed areas on the sun in laterally limited beams; it must therefore almost certainly be corpuscular. It affects the earth only when the stream comes near the earth, and though the stream may be intermittent, its emission must be in progress for a much larger fraction of the time than that during which it is effective in producing magnetic disturbance. Evidence is accumulating to indicate that the material of the stream occupies a time of the order of a day in passing from the sun to the earth. It therefore seems that in proposing ultra-violet radiation, in merely contemporaneous excess, as the cause of magnetic storms, the theory starts from a false major premise.

Apart from this fundamental objection, the proposed explanations of the two phases of a magnetic storm seem doubtful. The eastward 'drift-current' (to use the term introduced in my letter to NATURE of Oct. 13, 1928), to which the authors attribute the initial increase of horizontal magnetic force, would affect the sunlit and dark hemispheres very unequally, contrary to usual observation in a magnetic storm; in my opinion, variations in the intensity of ultra-violet radiation are associated with changes in the solar diurnal magnetic variation of quiet-day type, instead of with magnetic disturbance.

In the second, and principal, phase of a magnetic storm, the horizontal magnetic force is decreased, and the authors ascribe this to diamagnetism in the auroral zones, due to the spiral motion of ions then present there in unusual number. When R. Gunn's recent interesting diamagnetic theory of the solar diurnal magnetic variation appeared (*Physical Review*, July 1928), I examined the nature of the field of a strongly diamagnetic auroral zone, and concluded that it would differ in important respects from the magnetic disturbance field. But should the authors' radically different conclusion be correct, and the diamagnetic field be qualitatively in accord with observation, it would still seem that the diamagnetism of the spiralling charges in the auroral zone would be of minor importance compared with the effect of the drift currents in this zone.

I hope shortly to publish a new discussion of the theory of magnetic disturbance, assuming the cause to be a neutral ionised stream (as suggested by F. A. Lindemann, *Phil. Mag.*, **38**, 669; 1919). In this connexion Mr. V. C. A. Ferraro and I have extended, and partly corrected, my investigation (*Camb. Phil. Soc.*, **21**, 577; 1923) of the motion of such a stream in the earth's magnetic field. In view of the past history of terrestrial magnetic theory, it would be too much to anticipate that this new discussion will avoid cause for criticism, but, in this difficult field, criticism and speculation are both necessary. I regret, however, that my criticism of the theory proposed by Mr. Maris and Mr. Hulburt must be of so root-and-branch a character.

S. CHAPMAN.

Imperial College of Science and Technology,
South Kensington, S.W.7, Nov. 28.

Phosphate Content and Hydrogen Ion Concentration of the Surface Water of the English Channel and Southern North Sea, June 18–22, 1928.

ATKINS, who has carried out numerous analyses of the phosphate content of the English Channel, has found that water containing 30 to 40 milligrams of P_2O_5 per cubic metre in the winter is almost completely devoid of phosphate in the early summer owing to its utilisation by algæ. The depletion occurs first in the upper layers in the spring, when