Standards, Washington, I am reminded that Prof. H. N. Russell (*Ap. J.*, 66; 1927) has obtained the principal ionisation potential of vanadium from spectral series relations to be 6·76 volts. I am unaware of any laboratory determination of this quantity, but the close agreement between the spectroscopic and the present astrophysical determination is very satisfactory.

As before, I am under obligations to the Director of the Dominion Observatory, Ottawa, for the loan of the spectrograms from which my microphotometer graphs have been made.

A. VIBERT DOUGLAS.

McGill University,
Montreal, Feb. 28.

### Raman Effect and Fluorescence.

SIMPLE probability considerations reveal an interesting relation between fluorescence and the modified scattering of light. If $N_r$, $N_s$, etc., be the number of systems in the energy levels of energy values $E_r$, $E_s$, etc., the induced probability of transition $E_s \rightarrow E_r$ may be denoted by $W_{sr}$. If $E_s > E_r$, this causes the emission of a quantum $h\nu_{sr} = E_s - E_r$, which fuses into an external quantum $h\nu$, so as to form a new quantum $h(\nu + \nu_{sr})$, giving rise to negative or anti-Stokes lines. The total energy so radiated is $N_s \cdot W_{sr} \cdot h(\nu + \nu_{sr})$.

Similarly, the transition $E_r \rightarrow E_s$ gives rise to the positive lines of frequency $\nu - \nu_{sr}$, and its total energy is $N_r \cdot W_{rs} \cdot h(\nu - \nu_{sr})$. As a result, the $s^{th}$ level acquires a surplus number $(N_r - N_s)W_{rs}$ systems ($W_{rs} = W_{sr}$). We postulate that thermal agitation restores the normal distribution so that this surplus number reverts to the $r^{th}$ level, emitting total energy $(N_r - N_s)W_{rs} \cdot h\nu_{rs}$, of frequency $\nu_{rs}$. We identify this radiation with fluorescence. Of course it is in the infra-red, when the modified lines are visible. When $\nu_{rs}$ nearly equals $\nu$, it will be shown with the help of Born's formulæ, in a paper appearing elsewhere, that the factor $W_{rs}$, since it involves a term $1/(\nu^2 - \nu_{rs}^2)$, becomes very large, so that the intensity of a fluorescent line (now visible) is much greater than a modified visible line, as is actually the case.

PAUCHANON DAS.

72 Srigopal Mallick Lane,
Calcutta, India, Feb. 28.

### Indication of Hydroxyl in a Water Vapour Discharge Tube.

THE presence of OH in the gas coming from a water vapour discharge tube has been demonstrated by photographing the exit tube with a quartz spectrograph; the well-known band at 3060 A. was obtained. Addition of a small quantity of oxygen to the water vapour has the effect of increasing the intensity of the bands; a larger amount of oxygen causes the appearance of the green oxygen afterglow. This glow is continuous in the visible and is accompanied by the OH bands in the ultra-violet. The active gas appears to possess both reducing and oxidising properties. This is illustrated by the simultaneous reduction of copper sulphate to copper oxide and metallic copper and the oxidation of metallic silver. In both instances heat effects have been observed. The glow appears to be unaffected by the copper sulphate, but is removed by the silver. An extensive study of the conditions determining the production of OH, its separation from any other active constituents which may be present, and its chemical properties are now under way in this laboratory.

G. I. LAVIN.
FRANCIS B. STEWART.

Princeton, New Jersey, Mar. 15.

### The Green Flash.

HERE at 700 feet above the sea the green flash at sunset may be seen whenever the horizon is clear of clouds. At times the air is so clear that the mountains of St. Vincent, 110 miles to the west, can be clearly seen at about the time of sunset. On such evenings Venus may be followed right down to the sea horizon when, as now, it is near its maximum brightness.

A few nights ago I watched the planet setting through a pair of field binoculars. About five minutes or so before it set there was a great deal of change of colour from red to peacock green, but it was quite evident that the red colour was on the whole below and the green above, showing that the image of Venus was being drawn out into a short spectrum. When the planet was very nearly on the horizon the colour changed several times from red to green and vice versa, but just as it disappeared the image was of a distinct peacock green.

This observation shows that the explanation of the green ray is physical (refraction) as now generally admitted, and not physiological, for the light from Venus was not nearly intense enough to produce an after-image.

C. J. P. CAVE.

St. Nicholas Abbey,
Barbados, Mar. 12.

### African Pluvial Periods.

THE interesting remarks in the News and Views columns of NATURE for Mar. 16, with reference to Bushveld man and Mr. Leakey's discoveries in Kenya, direct attention once again to the 'Pluvial periods of Eastern Central Africa.' I should like to be permitted to point out that while the theory which finds reason for a genetic connexion between these 'pluviations' and glacial episodes of higher latitudes is sound enough, and although there is evidence to show that in all probability some such connexion existed, the correlation of Kenya pluvials with definite periods of the Pleistocene, as recently set forth, is purely hypothetical. There is room for discussion concerning them; and according to my showing, which may of course be wrong, the Kenya archæological expedition's third 'pluvial' is, so to say, an epi-pluvial, and is (if anything) Bühl and not Würm in date; and so *mutatis mutandis* with the others. The Expedition's ground in the Rift Valley is likely to be full of pitfalls, and in my opinion a great deal of work must be done there before one can say with confidence which of certain deposits are pluvial and which are not.

E. J. WAYLAND.

### Beryllium and Helium.

IN a letter on the "Transmutation of the Lighter Elements in Stars" (NATURE, April 13, p. 567), R. d'E. Atkinson and F. G. Houtermans remark that "the isotope $Be^8$ . . . is probably unstable (it does not occur on the earth) and will then almost certainly break up into two helium-nuclei. . . ."

I am reminded of an observation made many years ago. It was found (*Proc. Roy. Soc.*, A, vol. 80, p. 587; 1908) that specimens of the mineral beryl always contained helium without appreciable quantities of radioactive matter to explain its presence.

Can it be that this helium has originated from the isotope $Be^8$? If so, it would indicate that the isotope in question, even if it does not exist now, *has* existed within geological times, and subsequent to the formation of the mineral.

RAYLEIGH.

Terling Place, Chelmsford,
April 14.