

Letters to the Editor.

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Fluorescence of Mercury Vapour under Low Excitation.

IN earlier letters to NATURE (Aug. 18 and Nov. 10, 1928), I have described mercury fluorescence with exciting wave-length as long as  $\lambda$ 3125. Since then even longer waves have been used. The source was a nickel arc, with a filter of natural (ortho) salicylic acid, which cuts off completely all waves shorter than 3360. The mercury vapour was at high density. The spectrum observed consists of the two well-known broad continuous maxima, one in the visual region (green fluorescence), and the other in the ultra-violet, from about 3130 to 3650. The latter has never, so to speak, been dissected. If it has appeared at all in any spectrum it has appeared complete, and it has never shown any signs of resolution into a fine structure.

It was of interest to see what would happen in the present case when excitation is applied near the middle of this band. The result is that it still apparently resists dismemberment, even in these trying circumstances: the whole of it is excited with a striking violation of Stokes's law. The continuous fluorescent spectrum extends as much as 300 Å. beyond the limit of the exciting spectrum, as set by the sharp cut of the filter. Owing to stray light from the source, the fluorescent spectrum is only seen quite detached beyond this limit, and it is hard to say whether any discontinuity of intensity sets in at the beginning of the 'anti-Stokes' region.

RAYLEIGH.

Terling Place,  
Chelmsford, Jan. 10.

Light-scattering and the Hydrogen Spectrum.

IN an important paper in the *Proceedings of the Royal Society* for January, Raman and Krishnan give an account of their researches on the production of new radiations by light-scattering. In 1928 they announced the discovery that when a transparent medium is irradiated by monochromatic light the radiations scattered by the molecules contain spectral lines of modified frequencies. The difference between the incident and the scattered frequencies corresponds to a characteristic infra-red frequency of the molecule. Such new lines are clearly shown in the beautiful spectrograms which illustrate their paper. The authors direct attention to the usefulness of this phenomenon as a substitute for infra-red spectroscopy.

The secondary spectrum of hydrogen contains many thousands of lines, of which only a small proportion has been classified. I wish to suggest the view that many of these lines arise in the way described by Raman and Krishnan, in conformity with the theoretical work of Smekal and others. When hydrogen gas is subjected to an electric discharge, the lines of the Balmer series are emitted by atoms of hydrogen, and the neighbouring molecules of gas must be subjected to bombardment by light quanta of corresponding frequency. Hence we should expect each Balmer line to be accompanied by a system of fainter lines, corresponding to molecular frequencies in the infra-red. The accompanying table shows some of the first results of an examination of the secondary spectrum in

the neighbourhood of the five Balmer lines  $H_\alpha$  to  $H_\epsilon$ : The wave-numbers of these lines are given at the top of the table. In the lower part of the table are the wave-numbers and intensities of certain lines recorded by Gale, Monk, and Lee. The numbers in bold type are differences between such wave-numbers and the wave-number of the nearest Balmer line.

$H_\alpha$	$H_\beta$	$H_\gamma$	$H_\delta$	$H_\epsilon$
15233.22	20564.79	23032.54	24373.06	25181.34
15102.10 (1)	20436.09 (1)	22903.51 (0)	24242.95 (1)	..
<b>131.12</b>	<b>128.70</b>	<b>129.03</b>	<b>130.11</b>	..
14970.53 (2)	20302.96 (3)	22770.26 (0)	24111.46 (2)	24919.57 (0)
<b>262.69</b>	<b>261.83</b>	<b>262.28</b>	<b>261.60</b>	<b>261.74</b>
14842.77 (oa)	20174.02 (1)	22643.75 (3)	23982.31 (2)	24790.49 (0)
<b>390.45</b>	<b>390.77</b>	<b>388.79</b>	<b>390.75</b>	<b>390.85</b>
14709.75 (oo)	..	22509.10 (2)	..	24657.74 (0)
<b>523.47</b>	..	<b>523.44</b>	..	<b>523.60</b>

It will be seen that these differences are approximately constant in each horizontal row, and are not far from the series of numbers 130, 260, 390, 520. In pure rotation spectra in the far infra-red the bands consist of a series of equidistant lines at intervals of  $h/4\pi^2 Ic$ , where  $I$  is the moment of inertia of the molecule. Assuming that the lines represent a rotation spectrum, the  $B$  constant of the spectrum, which is defined by  $h/8\pi^2 Ic$ , would be roughly equal to 65  $\text{cm}^{-1}$ . My fellow worker, Ian Sandeman, who discussed the Fulcher bands of hydrogen at the Royal Society of Edinburgh on Jan. 7, finds  $B' = 33.39$  for this system, a value only one-half the above. This led me to search for intermediate lines in the rotation spectrum, resulting in the discovery of most of the remaining members. The first member, however, instead of appearing at 65  $\text{cm}^{-1}$ , is displaced and is found at 70  $\text{cm}^{-1}$ . It should be mentioned that in many cases lines are observed having a frequency exceeding the frequency of the exciting line by the appropriate infra-red frequency.

There are indications that in addition to the pure rotation spectrum described, there are lines due to vibration-rotation spectra. These are at present being investigated. The claim made by Raman and Krishnan that light-scattering serves as a powerful, convenient, and accurate method of exploring molecular spectra seems to be fully justified. It appears probable that it will be of the greatest service in disentangling the complex structure of the 'many-lined' spectrum of hydrogen. H. S. ALLEN.

The University,  
St. Andrews, Jan. 10.

Variation of Latitude with the Moon's Position.

RECENT investigations at this laboratory have suggested a possible connexion between the variation in latitude of a given place on the earth's surface and the position of the moon in the sky at the time observations for latitude are made. An analysis of the whole series of the latitude observations which were made by Ross at Gaithersburg from 1911 to 1914, has revealed a striking correlation between the moon's hour angle and the value of the latitude obtained. The data were restricted to results obtained with the photographic zenith telescope, thus eliminating all personal equation. For convenience the observations were divided into two periods, one from 1911 to 1913, the other from 1913 to 1914. According to Ross's estimates, the 1913 to 1914 observations were considerably superior to those of the earlier years, as is evidenced by the smaller probable error.

In conducting the analysis a card catalogue was made of the results of the observations of latitude for each night and each group of stars. The mean right ascensions of the group give the necessary data for ascertaining the moon's hour angle at the time of