LETTERS TO THE EDITOR.

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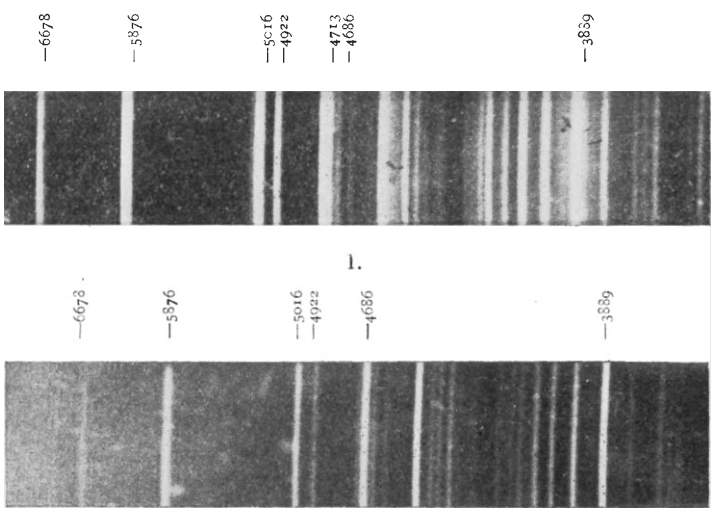
The Spectra of Helium and Hydrogen.

THE spectra of helium and hydrogen have acquired considerable importance in view of the recent experimental researches of Prof. Fowler and the theoretical investigations of Dr. Bohr. Before the appearance of Fowler's investigation the only hydrogen series known terrestrially were the diffuse series, consisting of the Hα, Hβ, &c., lines, and the infra-red series predicted by Ritz, two members of which (18751·3 and 12817·6) were observed by Paschen. However, by passing a strong condensed discharge through mixtures of helium and hydrogen, Fowler was able to photograph four members of the principal series, the strongest line of which is at 4686.

It should be noted that the 4686 line appeared on the photograph of the spectrum of a helium tube, which had been taken at the Solar Physics Observatory at South Kensington several years ago. Sir Norman Lockyer and Baxandall in their paper pointed out that the terrestrial line was very probably identical in origin with the chromospheric line of nearly the same wave-length photographed during the eclipse of January, 1898. They also noticed that the 4685·90 chromospheric line is of the same nature as the helium eclipse lines, being long and sharply defined. They concluded that the line is probably due to a gas, which is associated in some way with helium. The 4686 line has also been observed in the spectra of stars of the fifth type, and in the spectra of certain nebulæ, and had been attributed to hydrogen in accordance with Rydberg's calculations, which depend on the numerical relations existing between the different series.



In addition to the series having the 4686 line as first member, Fowler was able to photograph three members of the sharp series, which are found in the spectrum of ξ Puppis, and three members of a new ultra-violet series, which he calls the second principal series of hydrogen. According to the theory put forward by Dr. Bohr, the two principal series and the sharp series are given by helium. Also it should be possible to obtain the diffuse series from helium containing no hydrogen when the sharp series appears.

For some time I have been investigating the origin of the 4686 line, and the experiments already carried out support Bohr's theory. The chief difficulty consisted in driving out hydrogen from the poles of the helium spectrum tube, but this was accomplished so far as spectroscopic evidence goes. No hydrogen could be detected in the bulbs and capillary when heavy discharges from a coil capable of giving a 20-in. spark were passed through the tube. The 4686 line was strong in the capillary and fairly strong in the bulbs. The pressure of helium employed in these experiments varied from about 0·25 mm. to 1 mm. The capillary, in addition to the helium spectrum and the 4686 line, showed impurity lines due to oxygen.

Photographs I. and II. show the spectra obtained when a strong condensed discharge is passed through helium at pressures of 1 mm. and 0·3 mm. respectively. In the first photograph the 4686 line is of nearly the same intensity as the 4713 helium line, and the two are scarcely separated in the reproduction. The low-pressure photograph (Fig. 2) shows the 4686 line much stronger than the 4713 line. In both cases the hydrogen lines at 6563 and 4861 are not seen. The 4086 line could not be obtained from an ordinary hydrogen tube, nor from a neon tube containing a small amount of hydrogen as impurity. A tube containing a mixture of hydrogen and purified argon was also prepared, but the line was not visible when heavy condensed discharges were passed through the mixture.

E. J. EVANS.

The University, Manchester,
August 11

Coloured Organisms on Sea-Sand.

A VARIED and interesting field of investigation awaits the microscopist who will make a detailed examination of the minute fauna and flora of apparently barren sands on the seashore. To-day, on landing at the island of Oronsay at low tide, the otherwise pure white sand was seen to be coloured pink in one area, for an extent of several yards, green a little further up the beach, and golden-brown in small patches here and there. On examining samples with the microscope the brown colour was found to be due to living diatoms (*not* dinoflagellates in this case), naviculoid forms like Caloneis; the pink is formed of amorphous masses of fine granules in a jelly loosely adhering to the sand-grains, and may perhaps prove to be bacteria in a zoogloea state, while the green is caused by patches of a very simple alga (? a Coccophycid) made up of groups of rounded green cells in a single layer on the sand-grains. I have kept samples of all the organisms and will submit them to a botanist for more precise identification. No Amphidinium patches were present so far as I could see. The variety of organisms present in the one little bay, the extraordinary abundance in each patch, and the brightness of the colour produced on the white sand were very striking, and seemed worthy of note.

The colour was not in any of these cases due to the sand-grains themselves, which are mostly clear quartz with, as usual, a few black specks and some white shell fragments. Nor was there apparently any fresh-water on the beach, and certainly not any sewage or other source of impurity. It is a lonely, sandy bay,