ever, to justify a fresh effort, and within the last few days I have been able to get the effect as satisfactorily as could be wished.

The chief essential is a source giving a sharp line of great intensity at $\lambda 3303$. This was found in a sodium vapour lamp in quartz analogous to the mercury lamps in general use. Details of the construction and manipulation of these sodium lamps will be published later. The visible light from such a lamp was filtered out by means of a screen consisting of cobalt-blue uviol glass, combined with nitrosodimethylaniline. The light which came through was photographed with a quartz spectrograph, and was found to consist of $\lambda 3303$ exclusively.

This radiation was concentrated by means of a quartz lens on a quartz bulb containing some sodium. The bulb was made nearly red-hot with a bunsen burner, which was then extinguished. A patch of luminosity could be seen on the wall of the bulb when the ultra-violet beam fell upon it. As the bulb cooled and the vapour pressure of the sodium diminished, this patch of light gradually expanded, and filled the entire bulb; it then faded away, and had disappeared when the bulb was cold. This behaviour is exactly the same as is seen when D light is excited by the incidence of D light, and although in the present case the light is much fainter, the conditions of observation are in some respects more favourable, for there is no disturbance from visible light scattered or reflected by the walls of the vessel.

Critics of this experiment will naturally concentrate their attention on two questions:—

(1) Was the light observed really due to ultra-violet excitation?

(2) Was it of the same wave-length as the D line?

As regards (1), a sheet of plate-glass 1·2 cm. thick was interposed between the source and the bulb. The excited light was completely extinguished.

As regards (2) the light was rather below the intensity which would easily allow of direct spectroscopic examination, though with a little further improvement of the conditions it might be made strong enough. I have, however, proved it to be of approximately this wave-length by absorption methods. The luminosity was seen undiminished through a thick cell containing potassium bichromate solution, held before the eyes. It was absolutely invisible through a cell containing praseodymium nitrate. Thus the wavelength must lie in the region from $\lambda 5820$ to $\lambda 6020$, for this is the only region transmitted by bichromate and absorbed by praseodymium. The D line at $\lambda 5890$ lies in this narrow region, and I think, therefore, that there is no reasonable doubt that the emission does consist of D light. Discussion of the theoretical bearing of this result is deferred.

R. J. STRUTT.

Imperial College, South Kensington, May 8.

The Green Flash.

MANY descriptions of the green flash have been published in letters to NATURE and elsewhere, but I do not remember to have seen a satisfactory explanation of this curious phenomenon. Atmospheric dispersion is invoked, but this does not explain the absence of the red end of the spectrum. My observations agree in every particular with those described by Mr. Whitmell in NATURE of March 11, p. 35. At sea I have observed a violet or blue tint occasionally, and on one occasion a red flash as the lower limb of the sun emerged from a cloud into a clear space very near the horizon.

Normal atmospheric dispersion will, of course, produce a red fringe to the sun's lower limb, and a blue fringe at the upper limb, as may be seen at any time with a telescope free from secondary colour when the sun is as high as ten or fifteen degrees above the horizon. When, however, a point of sunlight only is visible, the rest of the disc being hidden beneath the horizon, atmospheric dispersion, if it could be perceived with unaided vision, should produce a complete vertical spectrum from blue to red, as in the case of stars when near the horizon. The red end of this spectrum should be most evident, since these rays are least absorbed. In the flash, however, the red is completely suppressed, and the vivid green which is obvious to the naked eye can only be seen at very low horizons. Moreover, it is not always seen, as Mr. Whitmell remarks, when the conditions seem otherwise favourable.

It seems to me very probable that the phenomenon is in some way connected with the abnormal conditions which at sea produce mirage effects. The layer of dense air in contact with the sea might produce total reflection for solar rays refracted from below the horizon, but the critical angle of reflection will depend on wave-length, and it is possible under certain conditions that the green rays may be totally reflected whilst the red are refracted.

I have one more observation to add to those described by Mr. Whitmell, and this will, I think, give the *coup de grâce* to the theory of a subjective effect due to retinal fatigue. In May, 1900, I happened to observe the setting of Venus in the sea from my eclipse camp on the Algerian coast. Observing with a 3-in. inverting telescope, I saw the planet when very near the horizon suddenly change in colour from dull red to vivid green, and as I lowered the telescope to the point where the sea horizon about bisected the field of view I was amazed to see *two* green images of Venus, one, the normal image, ascending from below, and the other sloping down from above. This was probably reflected from the sea itself. The setting took place at the moment of meeting of these two images. The whole apparition, from the moment when the colour changed from red to green, to the instantaneous disappearance of the two images, cannot have lasted more than four or five seconds. The sea about this time was found to be excessively cold, although the air was hot during the daytime, and this state of things would doubtless favour the production of a relatively dense layer of air on the surface of the sea in calm weather.

JOHN EVERSHED.

Kodaikanal, April 13.

The Larger Ions in the Air.

IN addition to the well-known small ions, which are of a type common to all gases, two classes of larger ions exist in the air under ordinary conditions. One of these consists of the large ions of Langevin which have a mobility of about 1/3000, while the other contains ions with a mobility of about 1/50. As the latter value lies between those of the mobilities of the small and large ions, the members of this latter class may be called the ions of intermediate mobility, or, shortly, the intermediate ions.

The slow movement of these larger ions in an electric field clearly indicates that they are molecular clusters of more or less complexity. Ordinarily the value of the mobility is the only guide to the nature of the ionic structure, but in the case of the large ion, at least, an important deduction is to be made from the outcome of experiments on the formation of clouds in closed vessels.

It is well known, since Aitken's notable work on the subject, that, in ordinary circumstances, the air is crowded with particles, in suspension, on which the water vapour condenses into visible drops if the air becomes slightly supersaturated. These particles,