

classical theory of light and the theory in which light is regarded as made up of single quanta of energy emitted discontinuously from luminous atoms. Fig. 1 (reproduced from the paper) illustrates the proposed experiment. K is a stream of canal rays, L_1 is a focussing lens, S is a screen containing a slit which serves to isolate a definite pencil of light, and the lens L_2 renders the emergent beam parallel. The emergent pencil is observed through a telescope focussed for infinity, so that the image of the slit in the screen S would be seen sharply focussed in the field of view. Since the atoms in the canal rays emitting light are in motion, the Doppler effect comes into evidence, and the rays proceeding at any instant from individual luminous atoms in different directions should, according to the wave-theory of light, be of different frequencies. Einstein suggests that the rays passing through the slit S and incident on the upper and lower parts of the lens L_3 should consequently be of different frequencies. If, therefore, a layer of a dispersing medium such as carbon disulphide be placed between the lens L_2 and the observing telescope, the different rays would travel through it with different velocities. Hence the wave-front should suffer an aberration and the image of the slit seen in the focal plane should shift through an extent proportionate to the thickness of the dispersing layer introduced. Einstein conceives that according to the quantum theory of light, on the other hand, such displacement should not occur, and he believes that the proposed arrangement furnishes an *experimentum crucis* to decide between the rival theories.

I wish here to direct attention to a fallacy which is present in Einstein's reasoning and invalidates it. It is clear that in the proposed experiment what would be observed are not the moving luminous atoms but the fixed edges of the illuminated slit in S, and it is easily shown that even according to the principles of the wave-theory no aberration of the image of the latter could be expected. To make this evident we may conceive the slit to be extremely narrow, or in the alternative, if it be wide, regard it as divided up into a large number of very narrow elements each of which, according to Huyghens's principle, would operate as a secondary source of light. The light from any small portion of the lens L_1 arriving at the slit would spread out by diffraction in all directions in the form of cylindrical waves, so that the waves reaching L_2 would consist everywhere of *superposed* wave-fronts of all the frequencies reaching the slit; and not, as Einstein supposes, of different frequencies at different points of L_2 . The waves diverging from S would thus pass through L_2 and the dispersing medium behind it according to the ordinary laws of geometrical optics, and no shift or aberration of the image of the slit would occur. The error in Einstein's reasoning lies in his having ignored the vitally important part which diffraction plays, according to the wave-theory of light, in the theory of the formation of images of illuminated apertures by optical instruments.

C. V. RAMAN.

210 Bowbazaar Street, Calcutta, March 16, 1922.

The Weathering of Mortar.

MR. RICHARDSON'S letter (March 9, p. 310) anent the above calls, I think, for some further remarks. My observations never led me to conclude that the growth of moss was in any way responsible for the development of the ridge-and-ring markings upon

the surfaces of old and exposed mortar. I have seldom seen moss growing thereon, but lichen is very often present, covering the whole surface, and not limited to the linear concavities. There is a row of fishermen's cottages at St. Ives, Cornwall, fully exposed to the sea, and the old mortar in the walls shows the markings in unusual perfection, but there is no evidence that moss ever grew upon it.

In 1896 I suggested that the phenomenon was a physical effect due to the expansion and contraction—or perhaps the former only—set up by alternations of temperature in a substance like mortar. Strains and stresses along lines of least resistance would tend to destroy compaction along such lines, rendering them more liable to be deepened by atmospheric erosion. Possibly the expansion and contraction in the stones themselves may also affect the stability of the mortar.



FIG. 1.

The accompanying photograph (Fig. 1), taken many years ago, shows some ridge-and-ringed mortar at the base of an old wall near Corfe. The wall faced south, and was built of Purbeck limestone. During its construction some thin pieces were placed vertically between the two masses of mortar. The penny fixes the dimensions of the mural components. The structure here was very conspicuous, but, with lapse of time, the photograph has faded somewhat.

C. CARUS-WILSON.

March 17, 1922.

Metchnikoff (Mechnikov) and Russian Science in 1883.

I HAVE read with the greatest interest the review of the "Life of Elie Metchnikoff" published in NATURE of February 9. In NATURE of November 17, 1921, I gave an account of the present state of science in Russia and its "proletarianisation," and I beg to be permitted to say a few words on the state of science under Russian absolutism.

According to the above review, the book referred to says that the government of the university of Odessa became more and more reactionary; but it was not for political reasons that Metchnikoff left the university—the reasons were "scientific."

Following an invitation, I took part in the Congress