

and being set in motion by its own particular wave length. The smaller irregularities in magnetism may be due to these minor resonators, ■ ■ and we can see how a ■ comparatively small change in the sun may alter the intensity of one of these waves and so affect the needle.

Yours sincerely

J. R. Holt

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tism, instead of reinforcing it. Also that certainly the changes, possibly the whole of this was due to the action of external causes. Of course I naturally thought of the sun, as the most probable body external to the Earth; and the idea first struck me that as Sir W. Thomson suggests, the sun may be an immense magnet; but after consideration I dismissed this idea as improbable; for the sun to cause the entire magnetism or even the large secular changes it would want to be a very powerful magnet indeed. So I remained for some time, dissatisfied with the existing theory, but unable to suggest anything else which even appeared plausible. Things were in this state when I heard of Hertz' researches on ether waves, and then it occurred to me that besides the very short ether waves causing light and radiant heat, and the waves of medium length investigated by Hertz; the solar radiation also contained longer waves, varying from a few inches up to thousands of miles in length. Among these there was one special length for which the whole Earth acted as a resonator; and that consequently the whole mass of ether within the earth was thrown into vibration by these rays. This so far seemed to me even probable, and it occurred to me that possibly the explanation of magnetism might be found in this surging

of the ether. As to how this vibration would act on a compass needle, I could not say a priori; I determined to tackle the problem, when I was on leave and had some spare time. Then came this sunstroke and drove the whole thing out of my head until Sir W. Thomson's address caused me to remember it. Of course there may be nothing in the idea, but on the other hand there may be something. That the solar radiation is confined to the light and radiant heat waves, seems to me excessively improbable; that it comprises such very long waves as I have spoken of seems to me not unlikely; if the period of vibration of one of these waves synchronises with that of the ether in the Earth, the latter must be thrown into vibration; and it seems to me that this vibration must affect a compass needle either directly or indirectly.

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 Now of course if the Earth was a perfect sphere and immoveable, the vibrations could not be related to any axis except the line joining the centres; but (a) the rotation and (b) the ellipticity, would cause it to be related to the polar axis. I am inclined to think that a large effect is to be ascribed to the ellipticity. Of course the distribution of matter inside and on the surface of the earth, may cause the existence of a large number of smaller resonators, each having its own particular period

Dear Mr. Fitzgerald

I suppose you have forgotten my name, but you may be able to recall it by the facts that I got Sen. Mod. in Experimentals in 1880, and shortly after, went to India in the Civil Service. I did not take to the I.C.S. and found that reading of any solid character was impossible, so I steadily went back both in Experimentals and in Mathematics, until I got a sunstroke in 1889 which has left me partially paralysed probably for life, and until lately I have been unable to do any scientific reading at all. Even now the only reading which I can do is of the light popular kind, as I am unable to write. The immediate cause of my writing to you, is my seeing a report in Nature of a recent speech of Sir W. Thomsons, at a meeting of the Royal Society, in which he suggested that the Sun was a powerful magnet, and that the minor changes in terrestrial magnetism were due to solar action. For some years back I have been dissatisfied with the theory which ascribes terrestrial magnetism to masses of magnetic matter distributed through the Earth. My objections to this theory are many, but I may cite the principal. (1) I find a difficulty in conceiving how any such mass with a definite direction of magnetism could arise in the original molten mass (2) Supposing one such mass to have arisen, it

would exercise a directive force on any newly-forming mass, tending to place the latter so that the external effect of both was as nearly nil as possible (3) Granting that in some way such a distribution had arisen as to account for the observed magnetic force, and that the Earth had cooled to such an extent that the masses of magnetic matter were held firmly in their places and were not free to turn in obedience to the directive force; each mass would still be acted on by all the rest with a force tending to reverse its magnetism, and in the first instance of course to demagnetise it, and unless these magnetic masses have a power of retaining their magnetism far transcending any substances with which we are acquainted, in the lapse of ages this magnetism would have entirely disappeared (4) Granting all this; if the masses have any freedom of movement, the directive force would tell in the lapse of time (5) If the masses are held perfectly rigidly, the changes in the Earth's magnetism cannot be due to such masses. For these and other reasons I came to the conclusion that it was erroneous to attribute the Earth's magnetism to magnetic masses, and that such masses as have actually been found are consequences, not causes; and that if the direction of the magnetism in them was examined, it would be found that they opposed the Earth's magne-

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