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MAGNETIZATION BY ROTATION¹

So far as we know at present, a magnetic substance, that is a substance whose molecules are elementary magnets, can be magnetized in two ways, and only two ways: In the first place it can be magnetized by creating a magnetic field in it or putting it in a magnetic field, as has been known for very many years; and, in the second place, it can be magnetized by simply setting it into rotation in a region initially neutral magnetically, and both initially and finally neutral electrically. It is chiefly with this latter process that we are concerned at this time.

In this process, as we shall see, the magnetization is produced *directly* by a sort of molecular gyroscopic action, which distinguishes it sharply from other processes in which *magnetic fields* are produced by rotation, but in which *magnetization* may or may not result, according to circumstances. It will be conducive to clearness to consider briefly some of these processes.

Thus if we take a tube of brass, or other non-magnetic substance, electrify it, and rotate it about its axis, a magnetic field will be produced similar in a general way to the field which would be produced by winding the tube with a coil of insulated wire and passing an electric current through it, as Rowland proved over forty years ago. So far, there is no magnetization. But if a rod of iron is introduced into the tube, and either maintained at rest or rotated with it, the rod will become magnetized—not because of its rotation, but be-

¹An address delivered before the National Academy of Sciences, April 22, 1918. Most of the material presented here is taken from papers previously published in SCIENCE, the *Physical Review* and the *Proceedings of the National Academy of Sciences*. Detailed accounts of most of the work are given in the *Physical Review*, 6, 239, 1915, and 10, 7, 1917.

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