record, not only the above-mentioned 43-minute oscillations, but also a series of much more rapid oscillations having a period of about 35 seconds (the latter figure being obtained by a stop-watch). The width of the basin is, at the point of observation, 2030 feet, and its mean depth about 100 feet (the tidal range is less than 2 feet). Calculation by the above formula gives, for first partial vibrations, a period of 35·8 seconds, which is very close to the 35 seconds observed; but it is to be noted that for a basin whose depth is *not* small compared with its width, the above formula is somewhat in error, and a more correct formula (involving a hyperbolical cotangent) gives 37·5 seconds. In any case the agreement is striking, and the two instances given are almost conclusive as to the explanation advanced. Simultaneous observations on opposite sides of such a basin would be quite conclusive, but these I have not yet had an opportunity to make.

(4) The following notes on the other cases referred to in (1) may be of interest in connection with observations referred to by Capt. Thomson. Quaco is only about twenty miles further up the Bay of Fundy than St. John, and yet, while expecting to find there a period similar to that at St. John, I found a period of 12½ minutes (from four separate records). This was at first puzzling, but, later, an examination of the chart showed the existence of a dangerous ledge (the Quaco Ledges) coming nearly to the surface, at a distance of eight or ten miles off shore, and forming, with a headland above Quaco and another below, an irregular basin, the dimensions of which no doubt determine the period of oscillation. A quite similar explanation applies to the oscillations at Halifax, for there a succession of banks (the Emerald, Sable Island, Le Have and Roseway) form, with the Nova Scotia coast, a large-sized bay of irregular shape.

(5) As to the external impulse that starts the oscillations, there is much uncertainty. Marked oscillations at St. John are frequently accompanied by barometric disturbances, but not always. My own observations make me believe that the oscillations and heavy ground-swell usually coexist. A notable case (for which I have to thank Mr. S. W. Kain, of St. John) occurred on September 18, 1898, when the heaviest ground-swell in several months was accompanied by marked periodic oscillations recorded on the Kelvin gauge. On the whole, I believe that the disturbance of equilibrium is due either to abrupt local variations of atmospheric pressure, or to the transmitted effect of a distant hurricane.

Those who are interested in this subject will find fuller details of the cases here discussed numerically (and also a short bibliography of the subject) in a paper by myself in the *American Journal of Science* (vol. iii., 1897). The nature of the oscillations in the Gulf of St. Lawrence are shown on curves that illustrate a tidal report, by Mr. W. Bell Dawson, in the last volume of *Transactions* of the Royal Society of Canada (see NATURE, vol. lviii. p. 260).

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GENERAL LAW OF THE PHENOMENA OF MAGNETIC PERTURBATIONS OF SPECTRAL LINES.

IN the *Philosophical Magazine* for April 1898, I pointed out that the resolution into triplets, &c., which the spectral lines suffer in a strong magnetic field, did not appear to follow any obvious general law, but appeared to be some complex function of the wave-length. To this was added the following remark:—"It is possible, however, that the lines of any one substance may be thrown into groups for each of which $\delta\lambda$ varies as λ^2, and each of these groups might be produced by the motion of a single ion. The number of such groups in a given spectrum would then determine the number of different kinds of ions in the atom or molecule.

"Homologous relations may also exist between the groups in different spectra, but all this still remains for complete investigation."

Although this investigation is still far from complete, yet the measurements so far made uniformly go to show that the foregoing expectation is about to prove true, and that e/m or $\delta\lambda/\lambda^2$ is the same for the corresponding lines of the natural groups in the same spectrum, and, further, that this quantity remains the same for corresponding lines or groups in the homologous spectra of different substances.

Not only is the magnitude of the magnetic effect governed by the foregoing law, but the *character* also of the effect is the same for the corresponding lines; and this is very interesting, as it shows that the corresponding lines probably arise from the same origin. The theory is consequently verified by the facts when the spectral lines are considered in groups corresponding to the molecular events which produce them.

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COAST-TELEGRAPHS AND SPACE-TELEGRAPHY.

THE year 1898 was an important period in the history of space-telegraphy, it was the period in which the possibility of being able to signal across wide stretches of open sea, with certainty in all weathers and at high speeds, became first generally recognised as practicable. Within the year the final report of the Royal Commission on the question of Coast-Telegraphs, published late in 1897, came into our hands; and the last few months of the year witnessed a truce to the war of "wireless-telegraphy." A wave of good feeling has now united the opponents into something like coherence, and the honours have been divided with universal approval. The result is that for the future Italy takes prominence, England eminence, while Russia, Germany and France share the luxury of many grievances.

The close of the year is very appropriately characterised by three papers, respectively communicated by Dr. Lodge,[1] Mr. W. H. Preece,[2] and Mr. S. Evershed,[3] to the Institution of Electrical Engineers, all emphasising the merits of one and the same system of space-telegraphy. The authors themselves were more or less unanimous as to the course further experiment should take, but the discusssion that followed the reading of these papers showed a certain lack of directness; many of the speakers were carried away by side issues, and a great deal of time was occupied with ill-considered suggestions and old matter. While fully recognising the value of open discussion, and of hints thrown out at random on subsidiary matters, the present writer thinks it may be useful here to indicate the limits to which the problem may be narrowed down, and to point out the very serious work that is now calling for the aid of space-telegraphy.

It is very generally admitted that space-telegraphy will replace metallic-circuit systems only under conditions where metallic circuits are impracticable. The fact that metallic circuits have been laid over the Andes, may be taken as proof that there are remarkably few land-areas that cannot be spanned by wires. For communication between *fixed* points on rough coasts, a wire suitably protected is still the right and the best thing, as is evidenced by the cable[4] laid in 1890 between Pollagill Bay on the north-west coast of Ireland, and Portdown Bay, Tory Island, and thence by duplicate underground cables to the lighthouse on the north side of the island. The great advantage of a metallic-circuit system is the consequent privacy of the messages, the simplicity of the apparatus, the speed of transmission, and the possibility the system offers for working by telephone, and in other ways avoiding the expense of skilled operators. Space-telegraphy is at present limited to comparatively short distances, and its usefulness is confined to spanning estuaries, skirting sea-boards, and for such purposes as

1 "Improvements in Magnetic Space-Telegraphy."
2 "Ætheric Telegraphy."
3 "Telegraphy by Magnetic Induction."
4 See an important paper by Mr. H. Benest, "Coast-Telegraph Communication," read before the Balloon Society, March 18, 1892).