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Radiation: An Elementary Treatise on Electromagnetic Radiation and on Röntgen and Cathode Rays.

By H. H. Francis Hyndman. London: Swan Sonneschein & Co.; New York: Macmillan Co. 1898. 8vo, pp. 307.

CSP, identification: Haskell, *Index to* The Nation. See also: Burks, *Bibliography*; Fisch and Haskell, *Additions to Cohen's Bibliography.*

Somewhat more than half this book is devoted to the properties of electromagnetic radiation—that is, of light, of the discharges of Leyden jars and oscillators, and of various other kinds. This part of the book answers its purpose; but we shall say no more of it, because the chief interest of the work lies in its collecting all that is essential in our knowledge of the newly discovered kinds of radiation.

The discussion necessarily begins, just as the history of discovery does, with the so-called *negative* rays of Crookes. These rays can exist only under pretty high exhaustions. The negative rays can pass through glass; but if they are focussed on a part of the tube where thin aluminium, and not glass, is the material of the wall, a faint glow will be perceived outside. In fact, there are there, not negative rays, but another kind of rays, called cathode rays. These rays are susceptible of reflection and refraction; their interference is a disputed question; their polarization has never been effected. They do not affect the eye. Their velocity of propagation is less than that of light, suggesting that they reside in a substance similar to, but distinct from, the luminiferous ether. When the current, instead of being steady, is rapidly intermittent, then, without any piece of aluminium, but with some focussing, X or Röntgen rays are emitted. These rays can be reflected, especially from zinc; but no interference or polarization of them has ever been discovered. Differently produced X-rays differ greatly in their penetrative power.

Becquerel rays are rays having peculiar properties, which are emitted by salts of uranium and of other metals. The metals copper and platinum are readily transparent to them; silver and tin are less so; zinc and lead are opaque. Becquerel rays are readily polarized; which shows that they are only ultra-violet-light rays. And the contrast to the X-rays in this respect ought to throw a light on the nature of the latter. "Le Bon's rays" are rays by which photographs can be taken from which the light is shut off by a sheet of iron. "Discharge rays" are rays emitted by an electric spark. They are, no doubt, merely ultraviolet rays. The light of fire-flies, glowworms, etc., is known to be peculiar, but there is no reason to suppose it other than ordinary light peculiarly sifted.

We cannot say this book is skilfully written. A certain number of facts are overlooked, and it seems almost a matter of chance as one reads whether anything will get mentioned or not. It has evidently been composed by taking all the memoirs on each branch in chronological order, and making an abstract of each; but unless every single statement of every memoir is included, this procedure will result in omissions. If all statements are included, the abstract must itself be di-

gested with pains and skill to make a thoroughly good book. However, the present work is not very faulty in its omissions.

67 (22 December 1898) 469-470

DARWIN'S TIDES

The Tides and Kindred Phenomena in the Solar System.

By George Howard Darwin. Boston: Houghton, Mifflin & Co. 1898. 8vo, pp. 378.

CSP, identification: Haskell, *Index to* The Nation. See also: Burks, *Bibliography*, *List of Articles*; MSS L 159.99, L 159.101; MS 1411b (s) (draft).

George Howard Darwin (1845-1912), the son of Charles Darwin, was a mathematician and astronomer. He received his formal education at Trinity College, Cambridge, taking a B.A. degree in 1868. He served as Plumian professor of astronomy and experimental philosophy at Cambridge from 1883 until his death. Darwin was an authority on tidal theory, geodesy, and dynamical meteorology.

There are probably not a great many people who feel any burning desire to know just how the tides behave, and just why they behave as they do, and just how predictions of them are made; so that this book may not be much sought after at the mere mention of its title. Readers of it must pass around from mouth to mouth how interesting it is, and how much the author had made of a seemingly most refractory subject. He has shown us that it is possible to write a popular book upon a branch of mathematics without childishness, without sensationalism, and to give it a real value for him who is versed in the science as well as for him to whom it is all new.

The variety of topics that are found pertinent to the general theme is astonishing. No less than twenty chapters treat of nineteen different questions, each of great interest quite apart from the rest, but at the same time the whole nineteen have such a unity that we cannot say that any one of them could have been omitted without serious detriment to the general sketch of this branch of science.

All these topics are so interesting that we hardly know which ones to choose in order to give our readers an idea of the contents of the volume. Perhaps chapter ii., partly (no doubt) from its giving the first marked impression of the work, is as striking as any. It relates to "seiches" in lakes. The word "seiche" is vernacular, we believe, only on the shores of Lake Leman, where alone this phenomenon has attracted the general attention of the inhabitants. It is a rise and fall of the water on the shore of the lake of a few inches, sometimes with a period of about an hour, sometimes in a less regular way. This phenomenon has been investigated, not by a mathematician or physicist, but by a naturalist of the school of De Saussure and De Candolle (not to leave the shore of the lake for exemplars), Dr. Forel of Lausanne, a town well placed for observing the seiches. It is interesting to see the methods of observation of this naturalist in physics; they are very ingenious, and are such as a physicist would hardly have lit upon. The observations render the nature of the seiches quite evident. The commonest are just like the slopping of a tea-cup carried in the hand—that is, the whole mass