compilation which represents much hard work and which will serve to stimulate interest in that division of the county, inasmuch as it indicates a somewhat unexpected wealth and variety of plant forms. Mr. J. J. Marshall has furnished a list of the mosses of the Riding.

A Revolution in the Science of Cosmology. By George Campbell. Pp. 210. (London: Sampson Low, Marston and Co., Ltd., 1902.)

IN spite of the author's description of himself as "a professor and teacher of the natural sciences for many years," this attempt to revise the generally accepted theory of planetary evolution shows a very imperfect acquaintance with scientific principles. The leading idea is that the earth was never in a molten condition, but is now undergoing the process of fusion in consequence of the pressure of the external strata on the interior mass. The sun also is declared to have once been an opaque body, and to represent more or less what the earth and other planets will become. In this connection it is only necessary to point out that while a gaseous mass contracting under the influence of its own gravity will rise in temperature, there is no ground for extending this principle to masses which are liquid or solid.

Among the other unacceptable ideas met with is that which accounts for a prehistoric change in the polar climate by supposing that the North Pole of the earth was "suddenly" turned from the sun and remained in that position for ages, having ceased for the time being to rotate on its axis (pp. 35 and 140). Again, on p. 64, speaking of the Whirlpool nebula, it is stated that "the violent agitation of the mass must result in a very low temperature," whereas a high temperature would be expected.

The author appears to have a vague idea that electricity plays an important part in the development of worlds, and that "atoms of interstellar space" represent the primary state of all matter, but he makes no contribution of value to the subject.

The Reliquary and Illustrated Archaeologist. Edited by J. Romilly Allen. Vol. viii. Pp. 287. (London: Bemrose and Sons, Ltd., 1902.) Price 12*s.* net.

STUDENTS of any branch of archæology will find something to interest them in this volume. The periodical, of which the numbers issued during the present year are included in the volume, is "a quarterly journal and review devoted to the study of the early pagan and Christian antiquities of Great Britain; mediæval architecture and ecclesiology; the development of the arts and industries of man in the past ages; and the survivals of ancient usages and appliances in the present." Notes on interesting and important papers contributed to some of the separate numbers of the *Reliquary* have already appeared in these columns, so that it is only necessary to say here that the eighth volume, with its numerous, well-produced illustrations, would make a handsome addition to the library of the student of antiquities.

Earth and Sky. A Second and Third Grade Nature Reader and Text-Book. By. J. H. Stickney. Pp. viii + 118. (Boston, U.S.A., and London: Ginn and Co., 1902.) Price 1*s.* 6*d.*

THIS is a reading book for young children. Its object is, the author says in his preface, "to bring before children's minds their own relation to the natural world in such a way as to appeal to imagination and reflection." The lessons will probably prove interesting to those for whom they are intended, but they do not sufficiently encourage the child's own activity. It is not enough to tell young pupils about natural objects; they should be encouraged to observe for themselves, instead of being content with the descriptions of others.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Waste of Energy from a Moving Electron.

THE subject of the dynamics of a moving charge being of considerable interest now, I have thought the following may be useful. I have shown that a charge Q on a sphere of radius A, when suddenly jerked into motion at speed u, generates a spherical electromagnetic shell of depth 2A, in which the magnetic force H tends to the value given by

$$2AH = \frac{Q}{4\pi R}\,\frac{u\sin\theta}{1-\frac{u}{v}\cos\theta}, \qquad (1)$$

when R, the distance from the initial centre of Q, is great. Along with this H, we have perpendicular electric force in the shell, according to $E=\mu vH$, or vectorially, $\mathbf{E}=V\mathbf{vB}$, if $\mathbf{v}$ is the vector velocity of the shell. The angle θ is that between $\mathbf{u}$ and $\mathbf{R}$. The energy wasted by this shell equals the energy left behind, that is, $U-U_0+T$, if U_0 is the initial, U the final electric energy in the field, and T the final magnetic field energy. On its first formation, $\mathbf{H}$ and $\mathbf{E}$ in the shell are different; they then include in accumulated form all the $\mathbf{H}$ and $\mathbf{E}$ which are left behind by the shell as it expands. The applied force impulse follows from my formula for the force on the ether, viz. $\mathbf{F}=(d/dt)V\mathbf{DB}$ per unit volume. Denoting the time integral by $\mathbf{M}$, then $\mathbf{M}=\mathbf{M}_1+\mathbf{M}_2$, where $\mathbf{M}_2$ belongs to the shell ultimately, and is lost, whilst $\mathbf{M}_1$ is left behind in the field. We have $T=\frac{1}{2}M_1u$ and $U-U_0=\frac{1}{2}M_2u$; so that altogether

$$\tfrac{1}{2}Mu = U-U_0+T. \qquad (2)$$

Both $\mathbf{M}_1$ and $\mathbf{M}_2$ are parallel to $\mathbf{u}$.

If, now, a second impulse acts, changing the velocity from $\mathbf{u}_1$ to $\mathbf{u}_2$ say, another spherical shell is generated. Disregarding the part left behind, (1) above shows that the magnetic force in it is

$$2AH = \frac{Q}{4\pi R}\left(\frac{u_2\sin\theta}{1-\frac{u_2}{v}\cos\theta}-\frac{u_1\sin\theta}{1-\frac{u_1}{v}\cos\theta}\right), \qquad (3)$$

when the direction does not change. More generally, substitute the vector change in the quantity on the right side of (1) properly vectorised. Then the change in θ will be allowed for as well.

The energy lost in this second shell may be calculated by (3). It amounts to

$$\left\{\frac{u_2P_2-u_1P_1}{u_2-u_1}\left(1-\frac{u_1u_2}{v^2}\right)-P_0\right\}Q, \qquad (4)$$

where P is the potential function

$$P=\frac{Q}{4\pi Ac}\left(1+\frac{1}{3}\frac{u^2}{v^2}+\frac{1}{5}\frac{u^4}{v^4}+\ldots\right) \qquad (5)$$

investigated by Searle and Morton. Take $u=0$, u_1 and u_2 to obtain P_0, P_1, P_2. It may be shown that the substitution of two impulsive changes in the same direction for a single one reduces the waste; that is, the one impulse u_2 wastes more energy than the two successive impulses u_1 and u_2-u_1. In fact, the saving is great, and ten equal partial impulses in succession waste not much more than one-tenth part of that wasted by a single impulse of size equal to their sum. There is a residuum, however, and that is what appears as continuous waste when u varies continuously.

When Δu is small

$$2AH=\frac{Q}{4\pi R}\,\frac{\sin\theta\,\Delta u}{\left(1-\frac{u}{v}\cos\theta\right)^2}, \qquad (6)$$

and now the waste of energy in the shell wave corresponding to Δu is

$$\frac{\mu Q^2}{12\pi A}\,\frac{(\Delta u)^2}{\left(1-\frac{u^2}{v^2}\right)^2}. \qquad (7)$$

The magnetic force in the above shells is uniform in the depth of the shell, when the impulse acts strictly at the front of a shell.