

From the facts of optics we deduce the existence of an æthereal medium, which according to Fresnel's view is discontinuous. (A good account is given in this section of the struggle between the corpuscular and undulatory theories.) The dispersion of light as interpreted by Cauchy lends support to the discontinuity of the medium.

Unfortunately, the luminiferous æther cannot be made to explain gravitation. The author discusses some of the theories of gravitation, such as that of Lesage. Moreover, the elastic æther which transmits light cannot account for electro-magnetic actions. Prof. Hannequin also finds difficulties in the electro-magnetic theory of light; these appear to rest, however, not on any impossibility of accounting for optical phenomena on the electro-magnetic theory, but on the irreconcilable differences in the properties of the æther as originally invented to explain light and those of the electro-magnetic æther.

In this way we arrive at a multiplicity of irreconcilable æthers as well as a multiplicity of irreconcilable atoms.

The necessity and the contradictions of atomistic explanations of nature having thus been brought out, the author concludes his first book as follows:—

"Why should atomism be found everywhere in modern science to such an extent that it is, as it were, its vital principle, if its contradictions were final, and if they had not their last reason in the very substance of a reality which only appears to us under the obscure veils of space and time, but which perhaps will reveal its law to him who will seek it above extension and duration, or in a word above the appearances which science analyses?"

We are thus led to the purely metaphysical part of the work, which it would be out of place to attempt to discuss here. The final chapter, however, sums up the conclusions arrived at. Science will never attain to the indivisible towards which she seems to be incessantly marching; if she did reach it, she would be unable to explain nature by means of it. Our difficulties vanish if we render to the atom its true sense—the element, definite but always complex, with a minimum of extension in space and a minimum also of dynamical attributes. And instead of seeing in it the real individual stripped of all activity and of all quality, all that we ought to see in it is the work of the mind pursuing in space the reduction without end of phenomena which, though pure appearances, are appearances which have their basis in reality.

There can be no question of the interest and importance of a philosophical examination of the foundations of science such as M. Hannequin has attempted.

He has, we think, exaggerated the inconsistencies of the "atoms" postulated for different purposes. So long as we do not imagine that we have ever to deal with absolute indivisible structureless atoms the contradictions do not exist. Most of us would agree with M. Hannequin as to the barrenness of any system of absolute atomism.

There is no reference in the book to any of the more direct methods in which matter is proved to have a discontinuous structure, and by which an estimate is obtained of the size of the molecules; such methods as are described in Lord Kelvin's lecture on the size of atoms (Popular Lectures and Addresses). This is surely a serious omission.

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OUR BOOK SHELF.

Elements of Physics. By Henry Crew. Pp. xiv + 347. (London: Macmillan and Co., Ltd. New York: The Macmillan Company, 1899.)

THE writer of this review possesses a collection of text-books of physics written during the first half of this century, all the volumes put together occupying a length of about six feet on his book shelves. He sometimes wonders where a future collector would find the space for all the text-books written now, when professors who have not written their own text-books are beginning to be rare curiosities. The proportion of books, however, that possess any originality has not increased, and may be put down, roughly speaking, as one in ten. The rest may be good because they have been inspired by good books, but there is a dreary similarity between them.

It would be ungracious to make these remarks while reviewing one of the average class of productions, and it must therefore at once be stated that Mr. Crew's volume cannot help striking the reader at once as having been the result of a good deal of thought, both in wording and arrangement. The book is very elementary. I think it is customary in this country to enter somewhat more fully into many parts of the subject, even in a first course. On the other hand, it treats of several matters which it is customary to omit, and it is on this point that we wish specially to commend the volume.

I note with great satisfaction a general chapter on waves, before the special consideration of sound waves is entered upon, also the introduction—at an early stage—of the wave theory of light. The great amount of time which, owing to examination requirements, we are forced—often against our will—to devote to geometrical optics, would much more usefully be spent in explaining (as the writer seems to do) the elements of diffraction and interference.

It is, further, a satisfaction to see frequent allusions to the phenomena of every-day life, and this feature might have been still further extended by including, for instance, some reference to the principal meteorological phenomena. No doubt very often the most common occurrences are most difficult to explain, and it may be impossible to give to elementary students a satisfactory explanation of, e.g., the rainbow or the blue colour of the sky. But unless the attempt be made the students generally carry away the impression that what they learn in the lecture room belongs to a different part of their existence from what they can see and observe outside the college buildings. The book begins with mechanical and kinematical principles, including among other matters the consideration of harmonic oscillation and a well-considered chapter on the properties of matter.

Altogether it forms an admirable introduction to the study of physics. The only criticisms I should like to make, refer to some of the illustrations; but as the book only suffers to a slight extent from the prevailing epidemic of bad illustration caused by the spreading microbe of cheap processes of reproduction, we must be satisfied and say no more about it.

ARTHUR SCHUSTER.

A Laboratory Outline of General Chemistry. By Alexander Smith. Pp. 88. (Chicago: Kent Chemical Laboratory of the University of Chicago, 1899.)

THIS book comes with a strong claim to attention. I is an untrammeled attempt to lay down a course of practical chemistry in an educational and scientific spirit, and the author's introduction sounds a pleasing note.

Much thought, care, and experience are embodied in the work, and though no claim to originality of material is made there are a good many things included that are fresh to books on practical chemistry. The author makes some very just remarks on the difficult question of the correlation of lecture and laboratory work, and it