Mathematical Analysis' is a very encouraging sign of the growing interest in higher mathematics and these works will doubtless do much towards increasing this interest. In following the pages of Professor Pierpont's work one feels that one is being led by a master of his subject and a sympathetic teacher, and these elements combined with the nature of the subject make the present work one of the most significant publications on pure mathematics that have ever appeared in this country.

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Electrical Nature of Matter and Radioactivity. By Harry C. Jones. New York, D. Van Nostrand Company. Pp. viii + 220. Price $2.

Another semi-popular book upon a well-worn subject, but a book which on the whole justifies its existence by the treatment, found in the last seventy-five pages, of the results of investigations and discussions so recent that they have not yet found place in other books on radioactivity. Thus the discussions of recent work on the origin and distribution of radium, of the properties of the α and β rays, as lately worked out by Rutherford and Bragg, of the 'radiobes' of Burke, of the decomposition products of actinium, and of radiothorium, are all new and all thoroughly commendable.

The book as a whole lacks somewhat in unity of treatment, the different sections differing considerably in value and in method of presentation. The treatment of radioactivity, which occupies all save the first third of the book, although it is non-mathematical, is on the whole thoroughly scientific, being characterized by an admirable moderation of statement, a scholarly collection of all the available experimental data, evidently from the original sources, and a judicious balancing of arguments for and against rival hypotheses. It will be read with interest and profit by physicists and chemists. It contains a commendably small amount of the sort of material which seems to be designed chiefly as food for the popular imagination.

The chapters dealing with the electrical nature of matter seem, on the other hand, to have been written largely for popular consumption and their faults are those most common to literature of this type, namely, incompleteness in the presentation of the facts and a rather immoderate haste in arriving at positive conclusions, the author's attitude being that of the ardent convert to the electrical-nature-of-matter *hypothesis* rather than that of the judicious disseminator of the present state of scientific knowledge in this field. Thus in discussing in the first chapter the value of e/m for the corpuscle, he slurs over the differences between the values found by different observers working with cathode rays, Lenard rays, photo-electric effects, the Zeeman effect, and radium rays, and says simply that the answer to the question as to the constancy of e/m for negative corpuscles is unmistakably given by the results which have been obtained. When it is remembered that these values vary for slow-moving corpuscles from 4×10^6 to more than four times that number, namely, 18.7×10^6, the statement appears rather too strong even for a popular article. Thus far these differences are certainly not to be explained by *probable* observational errors. It is to be hoped that further experimenting will soon reveal the causes of the discrepancies. The value of e/m which the author uses throughout the book is 7.7×10^6 instead of 18.7×10^6, the value given by the most reliable experiments, especially those of Seitz (*An. d. Phy.*, Vol. 8, p. 223), who succeeded in bringing the results obtainable by the three different methods used in the study of cathode rays into close accord. The value 7.7×10^6 is, of course, inconsistent with Kaufmann's measurements upon the variation of e/m with speed according to which this quantity changed from 6×10^6 to 13.1×10^6 as the speed varied from .94 to .7 that of light.

The feature of this part of the book, however, which is least commendable is the confusion either of ideas or of terms involved in such statements as the following: "Matter is then a pure 'hypothesis'—'there is not the least evidence for its existence.' Energy is the only reality." Now, of course, every trained reader knows that in the ultimate an-

alysis of things there is nothing in the universe which is not hypothetical to any particular individual except the fact of his own consciousness. But the ordinary reader will scarcely understand that in the above statements the author is merely denying the existence of matter in the broad, metaphysical sense in which the philosopher denies the existence of any external world whatever. He will rather understand him to be using language in the sense in which it is commonly used in books on physical subjects, and to be tacitly assuming the existence of an external world and yet denying the existence of matter as a constituent of that world; and indeed this is certainly what he does do, since in the next sentence we find him asserting the reality of energy.

Such assertions seem to me to be particularly fruitful of confusion of thought in the minds of the untrained, while to the trained they are devoid of all meaning. For *matter* 'as we ordinarily understand the term' does not involve any particular hypothesis as to the inner nature of the atom. As commonly understood, matter is merely that something which possesses the properties of weight and inertia. Its existence is, therefore, just as real as the existence of these properties. As investigation goes on the more properties which we find ourselves agreed in associating with weight and inertia the more definite does our idea of matter become. Thus there is now practical unanimity in regarding matter as composed of discrete particles, and recently some evidence has appeared which makes it plausible at least to endow the discrete particles with an electrical property as well as with weight and inertia, and it has also been suggested that the inertia property may be entirely wrapped up in the electrical property. If further experimenting should justify this hypothesis the term matter would lose none of its present significance, but would rather gain additional meaning, just as the term 'light' gained rather than lost in significance when Maxwell and Hertz discovered a relation between light and electricity. The assertion that light 'is a pure hypothesis, that there is not the least evidence for its existence,' would be in every respect as warrantable as the similar assertion regarding matter. Either assertion, I take it, is completely misleading in popular writing, even though there may be some technical justification for it.

But I can see no sort of justification, technical or otherwise, in denying the existence of matter and in the same breath asserting that 'energy is the only reality'; for, since energy is *defined* only in terms of matter and motion, it is obviously absurd to consider it any more real than matter. It is merely a case of the recrudescence of the confusion of ideas which Boltzmann and Planck eliminated to so large an extent from German thinking by their masterly articles on 'Energetik' which appeared in *Wiedemann's Annalen* in the winter of 1906. Of course, no one will deny that it might, perhaps, be possible to describe natural phenomena from some other view-point than that which has been adopted by the master minds of science from Galileo and Newton down to J. J. Thomson, and to start with a fundamental something which might be called energy instead of with the something which we now call matter, but this possibility, if it be a possibility, has certainly not yet been realized, and the attempts which have thus far been made in this direction have resulted only in a confused mass of logical contradictions, so that, in point of fact, energy, as the term is now used in scientific literature, is still defined in terms of matter, space and time. In view of the gross abuse which the word energy commonly receives at the hands of the unthinking, an abuse which is well illustrated by the effort which is sometimes made by high school teachers to 'get at everything,' as they say, from the standpoint of energy, even before their pupils have been taught enough mechanics to make a concise conception of the meaning of energy possible, in view, I say, of this popular abuse of the term it is particularly desirable that men of science do not add to the confusion by using it in a loose and indefinite sense.

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January 28, 1907