A Debate on Relativity, with an introduction by William Lowe Bryan, President of Indiana University. *Favoring the theory*: R. D. Carmichael, H. T. Davis. *Opposing the theory*: W. D. MacMillan, M. E. Hufford. Chicago and London, Open Court Co., 1927. viii+154 pp.

This book is an account of a debate on the theory of relativity held at the University of Indiana on May 21 and 22, 1926. Professors Carmichael and MacMillan discussed the theoretical aspect of the theory, the two other debaters the experimental aspect. In this way the reader gets an opportunity to review the different ways of reasoning and finds at the same time a place where he can get some information about recent experiments relating to Einstein's theory. We find a discussion of Miller's experiments (1921-'25), those of Michelson and Gale (1925), of St. John (1923), of Tomaschek (1925). The repetition of Michelson's experiment in a rotating balloon by Picard and Stahel (1926) was too recent for mention.

The main argument of Professor Hufford against the conclusiveness of the experimental evidence is that the theory of relativity is not the only way to explain the different experimenta crucis. Against Michelson's experiment he sets Miller's results. He uses Poor's criticism of the way in which Campbell has interpreted the results on the bending of light rays during the sun eclipse of 1922. Such explanations are, however, always explanations ad hoc, as Professor Davis points out.

Professor Carmichael gives an interesting exposition of the outstanding elements of Einstein's theoretical work. He emphasises the simplicity of the theory, that is not in the least affected by the rather complicated mathematics required for its mastery. We might add here that the same criticism was heard by Newton against his exposition. Calculus was to many of Newton's contemporaries just as esoteric as tensor calculus is to many modern scientists. Even Huygens confessed that he could not master it sufficiently.

It is a pity that the theoretical aspect of the theory has so unsatisfactory an opponent as Professor MacMillan. Professor MacMillan has had the unhappy idea to base his opposition against the theory of relativity on so-called "normal intuitions." For him the euclidean character of physical space and the newtonian character of physical time are "normal intuitions." What these things are may be illustrated by another example given by Professor MacMillan.

"The physical universe is continuous in time. This postulate asserts that the universe had no beginning and will have no end. It is at this point that we part company with many of the theologians."

And with all mathematicians, I believe. Continuity is not defined by "having no beginning and no end." Among the other examples there are some that seem equally insufficient. "Normal intuitions" are not so normal after all.

If our conceptions about space and time are so vague, it is really time to criticise them severely. But Professor MacMillan even tells us that Newtonian mechanics, being based on these same normal intuitions, is beyond any doubt whatever. With these fixed ideas he cannot believe in Einstein's interpretations and he advises us to wait till we find a better way to account for the difficulties in the explanation of natural phenomena.

It is always interesting, when we face this kind of criticism of Einstein's theory to recall how bitterly Newton's mechanics was attacked around 1700. It did not at all agree with the "normal intuitions" of the people of those days. Men like Swift, Berkeley, Leibniz protested against those freaks of absolute space and universal attraction. And it is exactly because of the fact that Newton's mechanics does violate some of the "normal intuitions" of the human mind in the last centuries—compare the criticism of Euler, Carl Neumann, Mach, of Newton's conception of rotation—that Einstein's theory was born.

D. J. STRUIK

Encyclopädie der Mathematischen Wissenschaften mit Einschluss ihrer Anwendungen. Volume 2 in three parts. *Analysis*, edited by H. Burkhardt (1896–1914), W. Wirtinger (1905–1912), R. Fricke and E. Hilb. Third part, second half. Leipzig, Teubner, 1923–1927. xiii+675–1648 pp.

Mathematicians who eagerly expected the publication of this volume certainly will not be disappointed; it is a result of careful and thorough work on the part of a number of leading specialists in their respective fields. The volume contains an enormous amount of bibliographical material which is presented in readily accessible form. It is difficult to imagine a mathematician engaged in research or even in teaching the subjects discussed, who will fail to benefit by repeated consultation of this volume.

The volume under review consists of four parts which were published separately at different dates.

Heft 6 (July 14, 1923) contains the articles by Nörlund, *Neuere Untersuchungen über Differenzengleichungen*; Bohr and Cramér, *Die neuere Entwickelungen der analytischen Zahlentheorie.*

Heft 7 (April 1, 1924), Borel and Rosenthal, *Neuere Untersuchungen über Funktionen reeler Veränderlichen*, contains three parts: Zoretti and Rosenthal, *Die Punktmengen*; Montel and Rosenthal, *Integration und Differentiation*; Fréchet and Rosenthal, *Funktionenfolgen.*

Heft 8 (September 10, 1924) contains the article by Hilb and M. Riesz, *Neuere Untersuchungen über trigonometrische Reihen*; Hilb and Szász, *Allgemeine Reihenentwickelungen*; Lichtenstein, *Neuere Entwickelung der Theorie partieller Differentialgleichungen zweiter Ordnung vom elliptischen Typus.*

Heft 9 (December 15, 1927), Hellinger and Toeplitz, *Integralgleichungen und Gleichungen mit unendlichvielen Unbekannten.*

A detailed analysis being entirely out of place here (we give a separate review of the last article by Hellinger and Toeplitz, which was published also as a separate book) let us point out only the desirability (*i*) of mentioning boundary problems and the notion of Green's function in the theory of difference equations, for example, M. Bôcher, *Boundary problems and Green's functions for linear differential and difference equations* (Annals of Mathematics, vol. 13(1911–12) p. 71–88). (ii) of giving a place to the theory of q-difference equations as a field closely related to that of difference equations. (iii) of having an author index at the end of the volume. The absence of such an index is unfortunately a general defect of the Encyklopädie.

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