Frequency Arrays. By H. E. Soper. Cambridge, University Press, 1922. 48 pp.

This booklet gives a very condensed treatise upon the advantages to be gained in the use of "symbols bearing an objective or logical significance" in the study of statistical and other distributions. No attempt has been made to establish any new results, but any knowledge of the mass of results treated here, and the fact that the treatment is restricted to less than fifty pages, should produce faith in anyone in the power and possible conciseness of the method of attack recommended by the author.

No one is advised to try to read this booklet who is not already familiar with most of the work and results of Pearson and his disciples, for it contents itself for the most part with the very concise reproduction of most of the most important results of Pearson and others, with practically no explanation of those results. This is no criticism, of course, because the book is designed for the use of the advanced student who is interested in research in statistics and who desires a very concise method of attack. The book then will be of little or no use in any undergraduate course in statistics, even as a reference book. For this reason it would perhaps be well for the reviewer to limit further account to a mere list of some of the most important topics included:

Moment arrays.

Binomial, Poisson, Gaussian, exponential and gamma types of frequencies; including the simple, multiple and general Gaussian distributions, the correlation surface, multiple correlation, Gaussian derivatives, Thiele derivatives, tetrachoric functions.

Sampling without replacement and partitioning a limited population.

Hypergeometric and kindred frequencies; including moments of hypergeometrical frequencies and of the double hypergeometrical series of frequencies.

Geometrical distributions; Samples of vectors; Random migration; including polar symbols in two dimensional distributions, circular distributions and vector sampling, moments of tensors of circular distributions, the symmetrical Gaussian, circular area, uneven distribution of points on a circle, single points, non-circular distributions and vector sampling, polar symbols in three dimensional distributions, spherical distributions and vector sampling, fortuities of resultant tensor when n randomly selected tensors are set in random directions in a space of s dimensions.

C. H. Forsyth

Atomes et Électrons. Institut International de Physique Solvay. Rapports et discussions du Conseil de Physique tenu à Bruxelles du 1er au 6 avril 1921. Paris, Gauthier-Villars, 1923. 8 + 273 pp.

The International Institute of Physics was founded in 1912 by Ernest Solvay for the object of encouraging physical research. One of the means of accomplishing this object was the organization of international congresses, with a limited number of participants, meeting at Brussels from time to time.

This volume is the third that has been published, containing the papers read, and the discussions regarding them, at the Congress of 1921. The two former volumes were entitled *La Théorie des Rayonnements et les Quanta*, published in 1912, and *La Structure de la Matière*, published in 1921. From the titles of these volumes it will be seen that the three congresses that have already been held have been concerned with questions that are of the greatest interest in the present state of physical science.

The volume under review begins with a paper on the *Theory of electrons*, by Lorentz, and includes a discussion of effects due to the rotation of electrons. Sir Ernest Rutherford reports on the structure of atoms with particular reference to the interpretation of his experiments on atomic disintegration as a result of collisions between atoms and rapidly moving α-particles. The experimental results, which, at present, can be interpreted only with the aid of the hypothesis of energy quanta, $h\nu$, are described by de Broglie. Kamerlingh Onnes has two reports; one on paramagnetism at low temperatures, considered from the point of view of the constitution of the elementary magnets, and a second report on the superconducting state of metals, considered with reference to the Rutherford-Bohr atomic model. Sir W. H. Bragg reports on the result of measurements of the intensity of Röntgen rays reflected from diamond. Experiments on the angular momentum accompanying magnetization, in iron and nickel, which result in observing only half the effect to be expected if the elementary magnets are electrons circulating in closed orbits, are described by de Haas. Finally, there are two papers on the quantum theory; one by Bohr on its application to atomic problems, and another by Ehrenfest on Bohr's principle of correspondence.

A valuable feature of this volume, as well as the preceding ones, is the discussions following the various reports. These discussions, sometimes raising additional difficulties, and sometimes bringing out alternative views and new results, serve to show, not only how far from finality is the solution of these fundamental problems, but also the immense progress that has been made in recent years in proposing such problems for solution.

E. P. ADAMS

Bessel Functions. By A. Gray, G. B. Mathews and T. M. MacRobert. London, Macmillan, 1922. xiv + 327 pp.

This is a second edition of the classical treatise of Gray and Mathews prepared by Andrew Gray and T. M. MacRobert. The general plan of the original treatise has been retained but many changes of detail have been made. The analytic work at the beginning of the book has been rewritten and a collection of examples has been added to each of the first seven chapters. More than half of the book is devoted to physical applications, the topics treated including vibrating membranes, hydrodynamics, steady flow of electricity and heat, propagation of electro-magnetic waves, and diffraction. At the end of the book is a collection of tables and a bibliography of the more important treatises and memoirs.

H. B. PHILLIPS