BOOK REVIEWS

HUNGARIAN MATHEMATICS

Introduction to Real Functions and Orthogonal Expansions

By Béla Sz.-Nagy. (University Texts in the Mathematical Sciences.) Pp. xi+447. (London and New York: Oxford University Press, 1965.) 68*s*. net.

HUNGARY has a greater concentration of mathematicians of international repute than most countries. Among the scholars best known to English readers is Béla Sz.-Nagy, professor at the University of Szeged. He was the joint author with F. Riesz of a famous book on functional analysis, first published in English in 1955 by Frederick Ungar as a translation from the second French edition. That book was a guide and an inspiration to the growing numbers of young mathematicians who were drawn to functional analysis as a field of investigation.

In research, the rock as it is quarried by the first worker to break through the hard face may fall to him in jagged and ungainly slabs. He, or more often others, will shape them into the most satisfying forms that they can be made to take. This roughness of pioneer work led Besicovitch to the provocative assertion that a mathematician's reputation rests on the number of bad proofs that he has given. Among possible counter examples to Besicovitch's statement, no one stands out more clearly than F. Riesz. In the course of his life (1880–1956) he, more than anyone else, carried topological ideas into analysis, creating the discipline of functional analysis. Everything he wrote is a model of elegance and deceptive simplicity. His reputation rests on a multitude of beautiful theorems, without a single "bad proof".

The clarity and style which Riesz brought to his papers graced the book written in 1955 by himself and Nagy. Plainly the younger writer also had the gift of exposition. We now have a book by Nagy alone, which is a translation of a text-book published in 1954 for Hungarian students. We expect a lucid account of the topics which he chooses to treat, and our hopes are realized.

The scope of the book is accurately indicated in the title. It is suitable for a third year undergraduate or a first year graduate. It is not, as the Riesz–Nagy volume was, a springboard for new advances. Nearly 300 pages are devoted to differentiation and integration. This part of the book is a more leisurely treatment of the corresponding 150 pages of Riesz and Nagy. Integrals in abstract spaces, linear functionals and Hilbert space are introduced, but not carried far. Finally, there is a clear exposition of the classical theory of Fourier series.

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THE FATHER OF NUCLEAR POWER

Collected Papers (Note e Memorie)

By Enrico Fermi. Vol. 2: United States 1939–1954. Pp. xvi+1083. (Chicago: The University of Chicago Press; Roma: Accademia Nazionale dei Lincei, 1965.) 160*s*.

THE first volume of Fermi's papers was published in 1962 (*Nature*, **200**, 961; 1963); it brought Fermi's work up to his Nobel Prize address of December 1938, after which he sailed for America to settle there and lead the scientific world to the first nuclear chain reaction. Volume 2 covers this most exciting period in greater detail than will be found almost anywhere else and reveals again Fermi's beautifully simple approach to complicated problems. It will be a keystone for the historian of this epoch of science. Unlike Volume 1, almost all the papers are in English and many are reproductions of reports from the Manhattan District Corps of Engineers not generally released until recently.

As in Volume 1, most of the papers, singly or grouped together, are preceded by a short account by one of the editors—Fermi's companions and colleagues—on the circumstances in which the work was done, the background knowledge of the time and many personal anecdotes about the working of Fermi's mind and the massive part he played in influencing his colleagues and students. These accounts give life to the book—indeed, they enable the older generation to live again those exciting days of fission and the atomic bomb project, and they show us more of Fermi than we know about his great contemporaries Rutherford and Einstein.

Fermi arrived in America at the end of 1938, and Hahn and Strassman's paper on the disintegration of uranium appeared in *Naturwissenschaften* in January, cleaning up the mysterious part at least of the story of the transuranic elements which Fermi's school at Rome had uncovered years before; some of the products of neutron bombardment of uranium were indeed barium and other elements in the middle of the atomic series. Bohr carried the news he had received from Miss Meitner to America and went direct to Fermi even before the German paper was published, and Fermi saw that in such a fission reaction yielding so much energy, neutrons might be released which could produce further fissions and hence possibly a chain reaction. Anderson recounts his setting up of an ionization chamber to observe the pulses created by fission fragments, and Fermi's insistence on simple quantitative measurements "to bring realism to pure speculation". The very first of Fermi's American papers —written with many student collaborators—demonstrates that the neutron absorption cross-section of uranium is dependent on the velocity of the neutron. In the second paper there is evidence that there may be two neutrons for every fission. The third paper gives the absorption cross-section for thermal neutrons, and the fourth shows that there are more fast neutrons for each fission than the number of thermal neutrons absorbed. At this time it is clear that Fermi saw how a neutron chain reaction could be maintained, but was uncertain whether the moderator could be water. Fermi tried to alert the Government to the implications of atomic energy, but it was Szilard, in fact, who prevailed on Einstein to write the famous letter to Roosevelt.

In view of Fermi's keen interest in this subject in 1939, it is a little surprising to find him absorbed in a meson problem and not returning to the experiments on fission until a year later, when the subject was already shrouded in secrecy. With Anderson he stacked graphite bricks into a neat pile, measured neutron diffusion and found it exceedingly low. In this arrangement the number of neutrons emitted and the number captured by the resonance process could be the more accurately determined, and by June 1941 he was able to write his report on the possible chain reacting pile. He sent this to the Uranium Committee, indicating that the central problem would be the removal of heat from the pile without introducing substances which had absorbed neutrons sufficiently to stop the reaction. Carbon dioxide at high pressure was suggested as a suitable substance and Fermi commented on the importance of the delayed neutrons in easing the problem of the control of the reaction. A little later he calculated the critical size of a fast neutron