PROGRESS IN NUCLEAR ENERGY*

AT the Geneva Conference on the Peaceful Uses of Atomic Energy, a wealth of information was presented some of which prior to the Conference was classified. All papers that were presented there together with the proceedings have now been published by the U.N.O. in sixteen volumes. As is bound to happen, the information here is all scattered and is often repeated. Need for a coherent account of the results made available at the Conference was therefore greatly felt and the Editors of "Progress in Nuclear Energy" have done a very useful job in bringing out this series. Series 1 deals with Physics and Mathematics, and Volume 1 of this series has recently come out with forewords by Sir John Cockcroft and V. F. Weisskopf. Most of the chapters in this volume are survey articles by different authors, based upon numerous papers presented by various countries. A few papers which were complete in themselves have been directly reproduced.

The first chapter deals with the thermal neutron cross-section data for U^{233}, U^{235} and Pu^{239}. Drawing upon the experimental results of various laboratories, particularly in France, U.K., U.S.A. and U.S.S.R., the authors have given curves for fission and absorption cross-sections as functions of neutron energy. Measurements on the values of η (number of neutrons produced per thermal neutron absorbed) and ν (number of neutrons produced per fission) have also been included in the chapter. The second chapter summarizes the present state of knowledge on the neutron resonance levels of fissile nuclei, U^{233}, U^{235} and Pu^{239} in the energy range 0-50 ev. All observed resonances have been carefully analysed and the resonance parameters tabulated. The data presented in these two chapters is mainly drawn from the Geneva papers and unpublished reports, and should be of great use to both theoretical and experimental physicists. In the third chapter Bethe analyses theoretically the neutron resonances in non-fissile and and fissile materials under various assumptions and compares these with experiment.

Other good survey articles are on the techniques for measuring elastic and inelastic scattering cross-sections, neutron capture cross-section in Xe^{135}, resonance capture integral and delayed neutrons from the fission of U^{233}, U^{235}, U^{238}, Th^{232} and Pu^{239}. Needless to say, apart from their intrinsic interest, a knowledge of the quantities discussed here is of great importance in reactor calculations.

The last four articles discuss the theory and try to compare the results of calculations with experiment for various types of reactors. The first of this series is on homogeneous reactors. Because of the possibility of breeding in such reactors, they have acquired special importance and the various theoretical and experimental results discussed here should be of interest to reactor physicists. Fast reactors are discussed in the next chapter and probably this is the only comprehensive account on such reactors available in print. In chapter 10 Feinberg discusses a method for calculating the critical mass for a small heterogeneous reactor This method should be particularly useful for reactors using enriched fuel and when all fuel rods are not of the same dimensions or may in fact be of different materials. Highly enriched assemblies in which fission is caused mainly by neutrons of intermediate energy rather than by those of thermal energy, are discussed in the last chapter. Here also not much published literature is available on this subject outside this report.

Some important topics, like exponential experiments, measurements of diffusion length and slowing down age; neutron cross-sections for fissile materials in the high energy range have not found a place here and it is hoped that they will be fully discussed in subsequent volumes of series I. The book on the whole presents very important data and methods for making calculations on various types of reactor assemblies. It would prove extremely valuable to reactor physicists.

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