PREFACE

The publication of this volume of selected scientific papers by Professor Sir Rudolf Peierls was planned during 1994 and 1995. He had always hoped that it would some day be possible for him to "dot the i's and cross the t's" for many of his papers, qualifying the conclusions he had reached, correcting numerical errors, or tracing out subsequent work which they had led to. He made the selection of papers to be included and he wrote the "REP Comments" which appear at the end of most of them. Fortunately all of this was completed several months before his death in September 1995.

Peierls's range of research was unusually broad. He was ready to put his mind to settling almost any quantitative question in physics, generally starting from first principles. He also wrote extensively about matters of public concern, especially to do with nuclear weapons and later the SDI proposals. A guide to his writings on these matters is given in the Complete Bibliography of his published papers, appended in this volume.

His contributions to condensed matter physics were largely on fundamental questions, establishing the principles of this subject. Most of this work was done during the years 1928–37, but much of it could not be tested until the experimental techniques needed for this had become sufficiently developed. These early papers were mostly written in German and published in German journals. Here they are given in English translations which will make them more readily accessible to physicists and better known today. Almost 50% of the papers selected for this volume are about topics in condensed matter physics.

Rudolf Peierls's work in nuclear physics began in 1933, when James Chadwick challenged him and Hans Bethe to explain his first measurements of the cross-section for photo-disintegration of the deuteron. Peierls's experience in this field developed rapidly within the next few years, on both practical questions and academic research, to the point where he and Otto Frisch could confidently conclude that the construction of an atomic bomb would be quite possible using ^{235}U, which could be obtained from natural uranium by a feasible separation process, and they pointed this out in the famous Frisch-Peierls Memorandum of 1940 which they sent to the British Government. This led on to the Atomic Bomb Project, at first in Britain under the name "Tube Alloys Project" and later in USA as the "Manhattan District Project", which many of the UK scientists, including both Peierls and Frisch, were sent to join at the end of 1943.

After the War, Peierls's research work was mostly in nuclear physics, although some of his students worked on fundamental questions in condensed matter physics posed by him. His Department of Mathematical Physics at Birmingham University grew rapidly in both size and reputation. During its first post-war decade almost all of the students were supervised directly by Peierls, whichever field of physics they were concerned with.

A large fraction of the resulting research papers were published under the student's name alone; naturally, none of the latter are included in this volume, nor in its Complete Bibliography. Peierls also did substantial work using quantum field theories, generally alone or with a research fellow, not with students. In the second decade, the department had a number of senior researchers on the staff, and even a second professor from 1960, and many of the students were then supervised by them, although Peierls was usually in close contact with what was being done. After his move to Oxford, he had a much larger department, with four main areas of research but with good contact between them, in accord with Peierls's broad view of theoretical physics, while he in his turn had an increased load of administrative duties in the University, greater contacts with outside bodies and an increasing concern for public issues of the day.

The preparation of this volume was a pleasure for Rudi Peierls and myself, and for Prof. G. Field, who made translations wherever these were needed and who typed afresh those papers whose original format was not suitable for this book. In conclusion, we thank Dr. K. K. Phua for his original proposal that a volume of this kind should be prepared and for his very considerable support for this project.

R. H. Dalitz

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