

INTRODUCTION

Solving problems in course work is an exercise of the mental facilities, and examination problems are usually chosen, or set similar to such problems. Working out problems is thus an essential and important aspect of the study of physics.

The series *Major American University Ph.D. Qualifying Questions and Solutions* comprises seven volumes and is the result of months of work of a number of Chinese physicists. The subjects of the volumes and the respective coordinators are as follows:

1. Mechanics (Qiang Yan-qi, Gu En-pu, Cheng Jia-fu, Li Ze-hua, Yang De-tian)
2. Electromagnetism (Zhao Shu-ping, You Jun-han, Zhu Jun-jie)
3. Optics (Bai Gui-ru, Guo Guang-can)
4. Atomic, Nuclear and Particle Physics (Jin Huai-cheng, Yang Bao-zhong, Fan Yang-mei)
5. Thermodynamics and Statistical Physics (Zheng Jiu-ren)
6. Quantum Mechanics (Zhang Yong-de, Zhu Dong-pei, Fan Hong-yi)
7. Solid State Physics and Miscellaneous Topics (Zhang Jia-lu, Zhou You-yuan, Zhang Shi-ling).

These volumes, which cover almost all aspects of university physics, contain 2550 problems, mostly solved in detail.

The problems have been carefully chosen from a total of 3100 problems, collected from the China-U.S.A. Physics Examination and Application Program, the Ph.D. Qualifying Examination on Experimental High Energy Physics sponsored by Chao-Chong Ting, and the graduate qualifying examinations of seven world-renowned American universities: Columbia University, the University of California at Berkeley, Massachusetts Institute of Technology, the University of Wisconsin, the University of Chicago, Princeton University, and the State University of New York at Buffalo.

Generally speaking, examination problems in physics in American universities do not require too much mathematics. They can be characterized to a large extent as follows. Many problems are concerned with the various frontier subjects and overlapping domains of topics, having been selected from the setters own research encounters. These problems show a “modern” flavor. Some problems involve a wide field and require a sharp mind for their analysis, while others require simple and practical methods

demanding a fine “touch of physics”. Indeed, we believe that these problems, as a whole, reflect to some extent the characteristics of American science and culture, as well as give a glimpse of the philosophy underlying American education.

That being so, we considered it worthwhile to collect and solve these problems, and introduce them to students and teachers everywhere, even though the work was both tedious and strenuous. About a hundred teachers and graduate students took part in this time-consuming task.

This volume on Atomic, Nuclear and Particle Physics which contains 483 problems is divided into four parts: Atomic and Molecular Physics (142), Nuclear Physics (120), Particle Physics (90), Experimental Methods and Miscellaneous topics (131).

In scope and depth, most of the problems conform to the usual undergraduate syllabi for atomic, nuclear and particle physics in most universities. Some of them, however, are rather profound, sophisticated, and broad-based. In particular they demonstrate the use of fundamental principles in the latest research activities. It is hoped that the problems would help the reader not only in enhancing understanding of the basic principles, but also in cultivating the ability to solve practical problems in a realistic environment.

This volume was the result of the collective efforts of forty physicists involved in working out and checking of the solutions, notably Ren Yong, Qian Jian-ming, Chen Tao, Cui Ning-zhuo, Mo Hai-ding, Gong Zhu-fang and Yang Bao-zhong.