

## INTRODUCTION

Solving problems in school work is the exercise of the mind and examination questions are usually picked from the problems in school work. Working out problems is an essential and important aspect of the study of Physics.

*Major American University Ph.D. Qualifying Questions and Solutions* is a series of books which consists of seven volumes. The subjects of each volume and the respective referees (in parentheses) 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, Relativity and Miscellaneous Topics (Zhang Jia-lu, Zhou You-yuan, Zhang Shi-ling)

This series covers almost all aspects of University Physics and contains 2550 problems, most of which are solved in detail.

The problems have been carefully chosen from 3100 problems, of which some came from the China-U.S. Physics Examination and Application Program, some were selected from the Ph.D. Qualifying Examination on Experimental High Energy Physics sponsored by Chao Chong Ting. The rest came from the graduate school entrance examination questions of seven world-renowned American universities: Columbia University, University of California at Berkeley, Massachusetts Institute of Technology, University of Wisconsin, University of Chicago, Princeton University and State University of New York, Buffalo.

In general, examination problems in physics in American universities do not involve too much mathematics; however, they are to a large extent characterized by the following three aspects: some problems involving various frontier subjects and overlapping domains of science are selected by professors directly from their own research work and show a "modern style". Some problems involve broad fields and require a quick mind to

analyse, while the methods needed for solving the other problems are simple and practical but requires a full "touch of physics". Indeed, we venture to opine that the problems, as a whole, embody to some extent the characteristics of American science and culture, as well as the philosophy underlying American education.

Therefore, we considered it worthwhile to collect and solve these problems and introduce them to students and teachers, even though the effort involved was extremely strenuous. As many as a hundred teachers and graduate students took part in this time-consuming task.

A total of 440 problems makes up this volume of five parts: electrostatics (108), magnetostatic and quasi-stationary electromagnetic fields (119), circuit analysis (90), electromagnetic waves (67), and relativity, particle-field interactions (56).

In scope and depth, most of the problems conform to the undergraduate physics syllabi for electromagnetism, circuit analysis and electrodynamics in most universities. However, many of them are rather profound, sophisticated and broad-based. In particular, problems from American universities often fuse fundamental principles with the latest research activities. Thus the problems may help the reader not only to enhance understanding in the basic principles, but also to cultivate the ability of solving practical problems in a realistic environment.

International units are used whenever possible, but in order to conform to some of the problems, Gaussian units are also used. This in fact would give the student broader training and wider experience.

This volume is the result of collective efforts of 34 physicists involved in working out and checking of the solutions, among them Zheng Dao-chen, Hu You-qiu, Ning Bo, Zhu Xue-liang, and Zhao Shu-ping.