

## INTRODUCTION

Solving problems in school work is the exercise of mental faculties, and examination problems are usually the pick of the problems in school work. Working out problems is a necessary and important aspect of the learning of Physics.

The *American University Ph. D. Qualifying Questions and Solutions* is a series of seven volumes. The subjects of the volumes and their respective referees (in parentheses) are as follows:

1. Mechanics (Qiang Yuan-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 Comprehensive Topics (Zhang Jia-lü, Zhou You-yuan, Zhang Shi-ling)

These books cover almost all aspects of university physics and contain 2550 problems, most of which are solved in detail.

These problems have been carefully chosen from a collection of 3100 problems some of which came from the China-U.S.A. Physics Examination and Application Programme and Ph.D. Qualifying Examination on Experimental High Energy Physics sponsored by Chao Chong Ting, while the others from the graduate preliminary or qualifying examination questions of the following seven top American universities during the last decade: Columbia University, University of California at Berkeley, Massachusetts Institute of Technology, University of Wisconsin, University of Chicago, Princeton University, State University of New York at Buffalo.

In general, examination problems on physics in American universities do not involve too much mathematics. Rather, they can be categorized into the following three types. Many of the problems that involve the various

frontier subjects and overlapping domains of science have been selected by the professors directly from their own research and show a "modern style". Some of the problems involve a wide field and require a quick mind to analyse, while the others are often simple to solve but are practical and require a full "touch of physics." We think it reasonable to take these problems as a reflection, to some extent, of the characteristics of American science and culture, as well as the tenet of American education.

This being so, we believe it worthwhile to collect and solve these problems and then introduce them to the students and teachers, even though the effort involved is formidable. Nearly a hundred teachers and graduate students took part in this time-consuming task.

There are 160 problems in this volume, which is divided into three parts: part I consists of 41 problems in geometric optics, part II consists of 89 problems in wave optics, part III consists of 30 problems in quantum optics.

The depth of knowledge involved in solving these problems is not beyond the contents of common textbooks on optics used in colleges and universities in China, although the scope of the knowledge and techniques needed in solving some of the problems go beyond what we are usually familiar with. Furthermore, some new scientific research results (e.g. some newly developed lasers) are introduced in the problems. This will not only enhance the understanding of the established theories and knowledge, but also encourage the interaction between teaching and research which cannot but enliven academic thoughts and excite the mind.

The physicists who contributed to solving the problems in this volume are Shi De-xiu, Yao Kun, Lu Hong-jun, Chen Xiang-li, Gu Chun, Han Wen-hai and Wu Zhi-qiang. The initial translation from Chinese into English was carried out by Xuan Zhi-hua. Some revisions have been made in this English edition by the compilers, the translator and the editor.