mechanism in semiconductors, and a few pages are devoted to effects in superconductors. A topic of special interest for students in engineering science is presented in the chapter on junctions between various materials. The new and interesting properties of quantum wells and superlattices are only briefly touched on, and there is no discussion of the quantum Hall effect, for example. A final chapter on magnetic materials presents some basic facts on diamagnetism and ferromagnetism, and also includes a discussion of new magnetic materials. Looking through these chapters the question again arises whether a student in the engineering disciplines will really obtain a basic understanding of the various phenomena. I therefore suggest that further references to textbooks and original literature should be included at the end of each chapter.

The appendix includes useful formulas, as well as the above mentioned discussion of problems, which I think are very helpful for students. The list of problems at the end of the book is also attractive.

The book can be recommended for undergraduates with an engineering background, as a suitable introductory text on solid state physics. However, in teaching such a course one should give the students further material for background reading in the various topics.

Helmut Büttner
Physikalisches Institut
der Universität Bayreuth (FRG)

Optical Nonlinearities and Instabilities in Semiconductors. Edited by *H. Haug*. Academic Press, San Diego 1988. xi, 440 pp., bound, $ 65.—ISBN 0-12-332915-9

The investigation of optical nonlinearities in semiconductor materials and devices has recently become a field of rapidly increasing interest, mainly due to possible applications in optical data processing. Most important for these applications are the so called "resonance enhanced" nonlinear optical processes, which occur when the photon energy of the optical field is close to an electronic resonance of the semiconductor material, e.g. the fundamental band edge. According to the editor's statement in the introduction, the present book attempts to bring together all the investigations of the resonance enhanced nonlinear optical properties of semiconductors and their manifestation in optical instabilities. In the reviewer's opinion, this attempt has been highly successful.

The book contains 16 independent review articles on different, partly related topics, written by different authors, together with an introduction by the editor which contains some historical comments and a brief summary of the definitions and concepts employed to describe the nonlinear effects. The list of authors includes many leading scientists representing some of the most active laboratories in the field.

Most of the articles are devoted to optical nonlinearities due to electronic processes in semiconductors, including free carrier effects such as band filling, band gap shrinkage and inter-band absorption, as well as excitonic nonlinearities; however, thermally induced optical nonlinearities are also discussed (e.g. the contribution by *Wherret, Walker* and *Tooley*). Special attention is also paid to nonlinear phenomena in electronic systems with reduced dimensionality, as in semiconductor quantum well structures, and to optical nonlinearities in semiconductor devices, in particular semiconductor lasers.

The combination of theoretical and experimental work is one of the special features of this book. Fortunately, experiment and theory are not treated separately; instead, a close connection is maintained throughout the book, by means of jointly written reports, and careful arrangement of the respective papers.

The theoretical contributions cover fundamental topics such as the microscopic theory of optical band edge nonlinearities (*Haug*), the theory of dense nonequilibrium exciton systems (*Schäfer*), the nonlinear optical properties of semiconductor quantum wells (*Chemla, Miller* and *Schmitt-Rink*), including electric field effects as well as more device orientated problems such as the theoretical description of optical instabilities in semiconductors (*Koch*).

The experimental data collected in the present book cover bulk phenomena in different II–VI compounds, including semiconductor doped glasses (*Klingshirn, Peyghambarian* and *Gibbs*), exciton and biexciton processes in III–V (*Ulbrich*) and II–VI semiconductors (*Levy, Hönerlage* and *Grun*), optical phase conjugation (*Claude, Chase, Hulin* and *Mysyrowicz*), electronic transport (*Mahler, Kuhn, Forschel* and *Hillmer*), and some of the most recent results on optical nonlinearities in quantum well structures (*Chemla* et al.; *Miller* et al.; *Peyghambarian* et al.).

Device applications are described in several reports; in particular, self-electro-optic effect devices (SEED) based on electric field induced nonlinearities in quantum wells (*Miller* et al.), as well as bulk semiconductors (*Jäger* and *Forsmann*) are discussed. Finally, semiconductor lasers—which are essentially nonlinear optical devices—are considered in detail, including optical bistability in laser amplifiers (*Adams, Westlake* and *O'Mahony*), semiconductor lasers (*Harder* and *Yariv*), and higher order instabilities in semiconductor lasers, including chaotic emission (*Shore* and *Rozzi*).

The book provides a comprehensive overview of the basic physics and device applications of resonance enhanced nonlinear optical phenomena in semiconductors at a high scientific level. It is mainly addressed to research students and active research workers in this area, and for them this book will be indispensable.

Ernst O. Göbel
Fachbereich Physik
der Universität Marburg (FRG)