Magnetic Field Effects on Quantum Wells

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PREFACE

This book, *Magnetic Field Effects on Quantum Wells*, is an in-depth analysis of the topic and the first of its kind.

The scope and intended focus of the book are as follows:

1. The book covers the physics of a semiconductor nanostructure.
2. The book contains a comprehensive theoretical account of the topic.
3. The book is aimed at providing academics and scientists complete information on the physics of a non-tunneling regime of a semiconductor nanostructure in a magnetic field.
4. This is the first comprehensive account of the topic.

The book deals with a semiconductor nanostructure called an isolated GaAs–AlGaAs quantum well (QW). The parametric variations of the transmission coefficient of the QW in a non-tunneling regime are calculated in the absence and presence of a magnetic field applied perpendicular to the GaAs–AlGaAs interfaces. Both analytical and numerical investigations are reported. The magnetic field dependence of the parametric variations is explained in a quantitatively exact manner. The book also contains a comprehensive theoretical account of the topic. Background information about microelectronics, nanostructure physics, and classical mechanics is also covered to enable readers to understand the book.

Unique features of this book include:

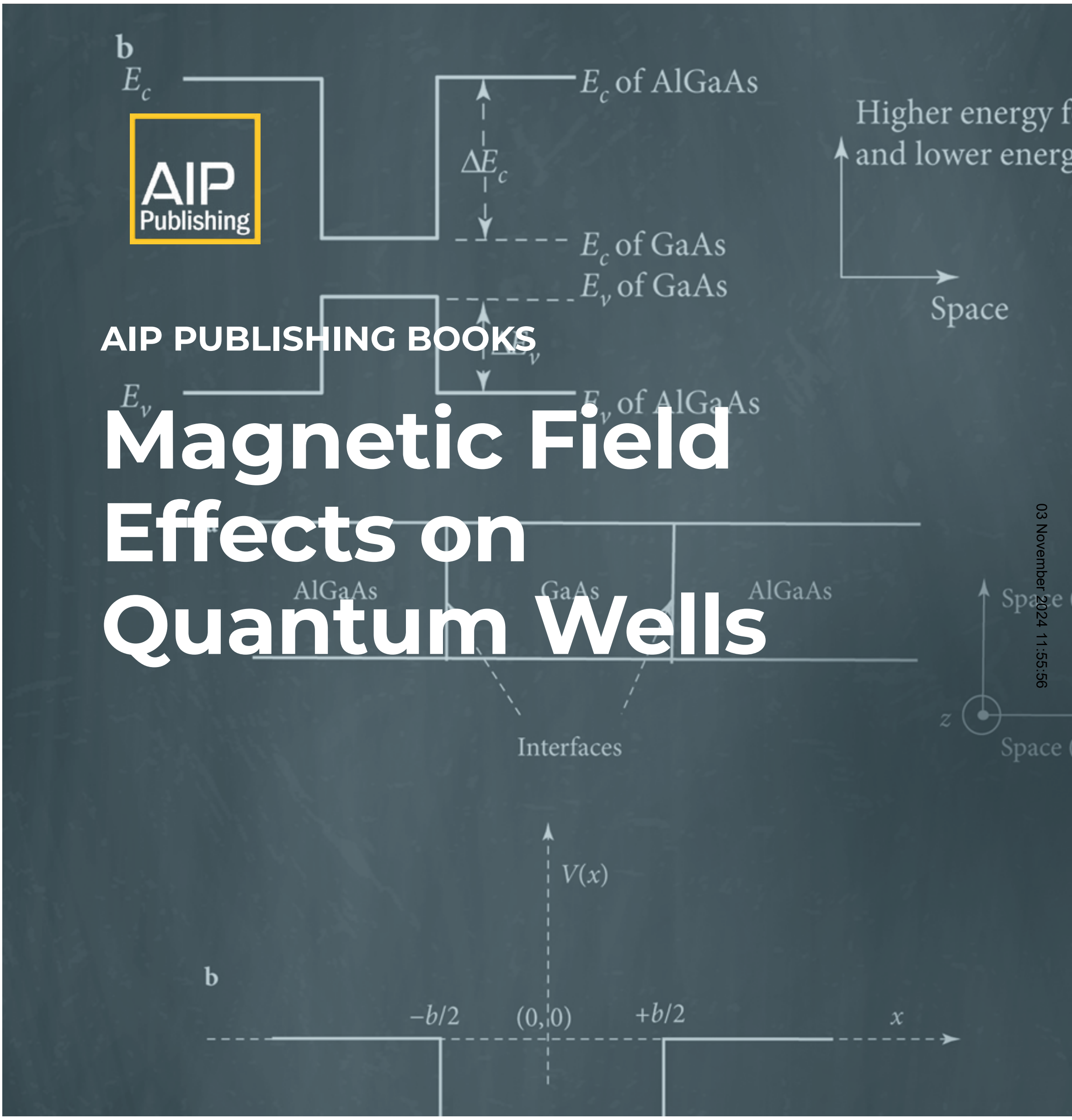
1. Complete calculations
2. Analytical and numerical accounts
3. Magnetic field effects brought out and explained in a quantitatively exact manner
4. A comprehensive theoretical account of the topic

Benefits of this book for the reader include:

1. Backgrounds on microelectronics, nanostructure physics, and classical mechanics
2. Complete acquaintance with the physics of the topic

Audiences of the book are graduate students and academics of physics and electrical and electronic engineering.

The organization of chapters is as follows. After a necessary introduction to the backgrounds of microelectronics and nanostructure physics in the first two chapters, Chap. 3 solves the 1D problem in zero magnetic field and reveals the analytical expression for the transmission coefficient. In Chap. 4, the classical Hamiltonian function of a charged particle in an electric and a magnetic field is calculated, which is used in Chap. 5 to obtain the corresponding Hamiltonian operator. In Chap. 5, the problem is resolved by reducing the 3D problem to a 1D problem. In Chap. 6, the analytical expression of the magnetic-field-dependent transmission coefficient is obtained. Chapter 7 carries out numerical investigations to reveal the effects of the magnetic field on the transmission coefficient. We find that a larger magnetic field reduces the effective depth of the quantum well.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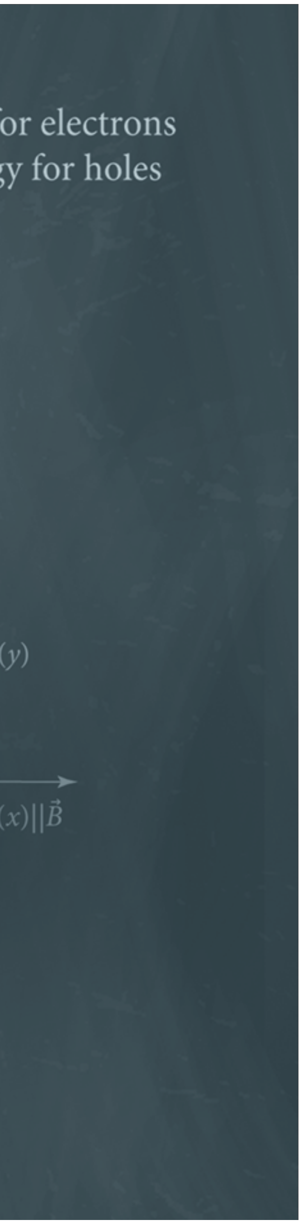

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