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## Preface

This book originated out of a desire to provide students with an instrument which might lead them from knowledge of elementary classical and quantum physics to modern theoretical techniques for the analysis of electron transport in semiconductors. The book is basically a textbook for students of physics, material science, and electronics. Rather than a monograph on detailed advanced research in a specific area, it intends to introduce the reader to the fascinating field of electron dynamics in semiconductors, a field that, through its applications to electronics, greatly contributed to the transformation of all our lives in the second half of the twentieth century, and continues to provide surprises and new challenges.

The field is so extensive that it has been necessary to leave aside many subjects, while others could be dealt with only in terms of their basic principles.

The book is divided into five major parts. Part I moves from a survey of the fundamentals of classical and quantum physics to a brief review of basic semiconductor physics. Its purpose is to establish a common platform of language and symbols, and to make the entire treatment, as far as possible, self-contained. Parts II and III, respectively, develop transport theory in bulk semiconductors in semiclassical and quantum frames. Part IV is devoted to semiconductor structures, including devices and mesoscopic coherent systems. Finally, Part V develops the basic theoretical tools of transport theory within the modern nonequilibrium Green-function formulation, starting from an introduction to second-quantization formalism.

Preparing this text has been a very long and at times painful task, especially when it became obvious that it simply could not cope with the overly large ambitions of the original project. I am deeply grateful to my family for understanding and accepting with love my absorption in writing it over a period of several years. In this endeavor, I have been helped by many colleagues. In particular, I thank Antonio Abramo, Andrea Bertoni, Paolo Bordone, Rossella Brunetti, Fabrizio Buscemi, Mauro Ferrario, Fabio Giovanardi, Chihiro Hamaguchi, Paolo Lugli, Giampiero Ottaviani, Enrico

Piccinini, Maria Prudenziati, Lino Reggiani, Susanna Reggiani, Fausto Rossi, Massimo Rudan, Alice Ruini, who have read various parts of the manuscript and/or suggested many improvements, both topical and stylistic.

The main contribution to this text, however, has come from my many students, undergraduate, graduate, and postdocs alike, who since many decades have accompanied my research and teaching activity with intelligence, curiosity, and affection. Without them not only would this book not have been conceived, but my activity itself as represented in it simply would not exist. I cannot name all these people: they have been so numerous that to mention some would inevitably mean being unfair to the others. Some are now well-known scientists around the world, some have taken a way that took them far off, out of sight but certainly not out of mind, and others remained close and continue to share with me our daily work.

This book is dedicated to every one of them.

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