

Preface

This book originates from an undergraduate physics course at the University of Alberta, whose aim was to illustrate various principles of electricity and magnetism, optics, and modern physics and to show that these topics have practical application in engineering and scientific research. Finding a textbook for the course was always a challenge; most electron microscopy texts overwhelm the non-specialist student, or they concentrate on practical skills rather than fundamental principles. In any event, *Physical Principles of Electron Microscopy* seems to have found a niche in the Springer microscopy collection; it has sold quite well around the world and was translated into Russian in 2010. Special features of this book include a discussion (in Chap. 1) of the development of electron microscopy and its relationship with other kinds of imaging, and an introduction (in Chap. 2) to the fundamentals of electron optics.

In 2015, the book was used as the basis of a new undergraduate course at Zhejiang University (Hangzhou, China), and I have used that event as an opportunity to update the text and introduce several new topics of current interest. Chapter 7 now includes sections on environmental TEM, radiation damage, electron tomography, and time-resolved microscopy. I have expanded the historical and scientific references, in the form of Additional Reading sections at the end of each chapter.

Although this book contains numerous equations, the mathematics is restricted to simple algebra, trigonometry, and calculus. SI units are employed throughout. I have used *italics* for emphasis and **bold** characters to mark technical terms when they first appear. Since it provides a more intuitive description at an elementary level, I use classical physics (treating the electron as a particle) whenever possible, even in connection with phase-contrast images. Supplementary material relating to this book, including sample examination questions (some with answers), can be found under educational materials at the website www.tem-eels.ca/.

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