

Preface to the Second Edition

Since the first edition of this book, the field of spin physics in semiconductors (as well as in metals) has been steadily expanding, and thousands of new papers on this subject were published. The focus has somewhat shifted from spin-related optical phenomena, to spin-related electrical and magnetic properties, in particular to the spin Hall effect.

In this edition, all the chapters (except Chap. 3) have been substantially updated to include new ideas and recent results. Besides, we now have a new chapter (Chap. 11), which, strictly speaking, does not belong to semiconductor physics, but might be nevertheless interesting for the semiconductor community. It is devoted to spin torques in ferromagnetic metals, where new and interesting phenomena have been studied, which promise important applications for switching magnetic domains with a potential impact on the technology of information storage and processing.

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The purpose of this collective book is to present a non-exhaustive survey of spin-related phenomena in semiconductors with a focus on recent research. In some sense, it may be regarded as an updated version of the “Optical Orientation” book, which was entirely devoted to spin physics in bulk semiconductors.

During the 24 years that have elapsed, we have witnessed, on the one hand, an extraordinary development of the wonderful semiconductor physics in two dimensions with the accompanying revolutionary applications. On the other hand, during the last maybe 15 years there was a strong revival of interest in spin phenomena, in particular in low-dimensional semiconductor structures. While in the 70s and 80s the entire world population of researchers in the field never exceeded 20 persons, now it can be counted by hundreds and the number of publication by thousands. This explosive growth is stimulated to a large extent by the hopes that the electron and/or nuclear spins in a semiconductor will help to accomplish the dream of factorizing large numbers by quantum computing and eventually to develop a new spin-based electronics or “spintronics”. Whether any of this will happen or not still remains to be seen. Anyway, these ideas have resulted in a large body of interesting and exciting research, which is a good thing by itself.

The field of spin physics in semiconductors is extremely rich and interesting with many spectacular effects in optics and transport. We believe that a representative part of them is reviewed in this book. We have tried to make the presentation accessible to graduate students and to researchers new to the field.

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