

## Preface to the Fourth Edition

The Nobel Prize awarded to Albert Fert and our colleague Peter Grünberg has drawn the attention to the remarkable progress that has been achieved in the field of magnetism concerning both its understanding and its applications. Adding a section on the giant magneto resistance (GMR) effect was therefore necessary. As the GMR-effect is observed in magnetic thin-film systems, it was natural to combine the treatise on the GMR- effect with a brief summary of the specific magnetic properties of thin films; and we did so with a new panel. The wealth of phenomena encountered in thin-film magnetism is intimately related to the interplay of various sources of magnetic anisotropy. We therefore had to pay attention to the most common source of magnetic anisotropy, the crystalline anisotropy and to the phenomena that go along with it, such as magnetic hysteresis and domain walls.

The GMR-effect is only one of the many new effects that one encounters when the dimensions of solids shrink into the nanometer range. For example, the semi-classical approach to electron transport fails in small dimensions, and normal electric current flow is replaced by ballistic or diffusive transport giving rise to quantum effects such as Aharonov-Bohm oscillations, Altshuler-Aronov-Spivak-oscillations, weak localization, and universal conductance fluctuations. A new section on quantum transport is devoted to these phenomena.

One of the intellectually most appealing fields in the realm of dielectric properties of matter is that of materials with negative index of refraction. While no natural material with that property exists, composite materials involving lattices of electric and magnetic resonance circuits, so called metamaterials, have been made and exhibit most unusual optical properties. With further progress in the preparation of artificial structures of nanometer dimensions application of metamaterials for optics in the visual range is at hand. We have devoted a new panel to this exciting field.

Here, as well as in nearly all other fields of current interest, progress largely depends on the progress in the preparation of nanostructures. We have included a new panel on various preparation techniques. We have also updated the panels on photoemission and neutron diffraction.

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Solid-State Physics

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