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3.4 Magnetic Characterization of Ferromagnetic Structures 3.4.1 Spin-Reorientation Transition in Ferromagnetic Multilayers on Nanospheres; 3.4.2 Magnetic Characterization of Magnetic Vortex Structures; 3.4.2.1 In-Plane Magnetization of a Vortex Structure; 3.4.2.2 Out-of-Plane Magnetization of a Vortex Structure; 3.5 Magnetization Dynamics in Ferromagnetic Vortex Structures; 3.5.1 Differential Imaging of Magnetic Vortex Structures; 3.5.2 Gyrotropic Mode; 3.5.2.1 Resonant Behavior under Pulsed Excitation; 3.5.2.2 Resonant Sine Excitation; 3.5.3 Nonlinear Response of Magnetic Vortex Structures 3.5.3.1 Vortex Core Reversal by Burst Excitation 3.5.3.2 Vortex Core Reversal - Mechanism; 3.5.3.3 Final Remarks; 3.6 Conclusion and Outlook; Acknowledgments; References; 4 Scanning Photoelectron Microscopy for the Characterization of Novel Nanomaterials; 4.1 Introduction; 4.2 Photoelectron Spectroscopy; 4.3 Scanning Photoelectron Microscopy; 4.3.1 The Focusing Optics; 4.3.2 The Electron Energy Analyzer; 4.3.3 The Sample Scanning Mechanism; 4.4 The Application of Scanning Photoelectron Microscopy; 4.4.1 Oxidation States in Scanning-Probe-Induced Si<sub>3</sub>N<sub>4</sub> to SiO<sub>x</sub> Conversion 4.4.2 Well-Aligned Carbon Nanotubes 4.4.3 GaN Nanowires; 4.4.4 Well-Aligned ZnO Nanorods; 4.4.5 Diameter Dependence of the Electronic Structure of ZnO Nanorods Determined by Scanning Photoelectron Microscopy; 4.4.6 Comparison of the Electronic Structures of Zn<sub>1-x</sub>CoxO and Zn<sub>1-x</sub>MgxO Nanorods; 4.5 Conclusion; Acknowledgments; References; 5 Coherent X-Ray Diffraction Microscopy; 5.1 Introduction; 5.1.1 A Brief History of the Phase Problem; 5.1.2 Scattering of X-Rays by Homogeneous Media; 5.1.2.1 The First Born Approximation; 5.1.3 The First Rytov Approximation 5.1.4 Comparison of CXDM with other X-Ray Microscopes

## Sommario/riassunto

An up-to-date overview of the different x-ray based methods in the hot fields of nanoscience and nanotechnology, including methods for imaging nanomaterials, as well as for probing the electronic structure of nanostructured materials in order to investigate their different properties. Written by authors at one of the world's top facilities working with these methods, this monograph presents and discusses techniques and applications in the fields of x-ray scattering, spectroscopy and microscope imaging. The resulting systematic collection of these advanced tools will benefit graduate studen