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Nota di contenuto	Contents; Preface; 1. Nonlinear Optics for Characterizing XUV/Soft X-ray High-order Harmonic Fields in Attosecond Regime Yasuo Nabekawa and Katsumi Midorikawa; 1. Introduction; 1.1. Nonlinear phenomena in XUV/soft X-ray region for ultrafast optics; 1.2. Autocorrelation measurement; 2. Generation of Intense Harmonic Fields; 2.1. Single atom response; 2.2. Propagation of the harmonic fields with pumping laser field: Phase matching; 2.3. Development of intense high-order harmonic generator; 3. Two-Photon Double Ionization; 4. Measurement of Attosecond Pulse Train with Two-Photon ATI 5. Interferometric Autocorrelation of APT with Two-Photon Coulomb Explosion 5.1. Similarity of APT with mode-locked laser pulses; 5.2. Why do we need interferometric autocorrelation?; 5.3. Two-photon Coulomb explosion; 5.4. Interferometric autocorrelation; 6. Summary and Prospects; Acknowledgements; References; 2. Signatures of Molecular Structure and Dynamics in High-Order Harmonic Generation

Manfred Lein and Ciprian C. Chiril a; 1. Introduction; 2. Theory of High-Order Harmonic Generation; 2.1. Basic theory; 2.2. Three-step model; 2.3. The strong-field approximation
 2.4. Odd and even harmonics
 3. Influence of Molecular Structure on HHG; 3.1. Ionization step; 3.2. Recombination step; 4. Dynamical Effects; 5. Conclusions; Acknowledgments; References; 3. Molecular Manipulation Techniques and Their Applications Hirofumi Sakai; 1. Introduction; 2. Theoretical Background; 3. Molecular Orientation with Combined Electrostatic and Intense, Nonresonant Laser Fields; 3.1. One-dimensional molecular orientation; 3.2. Three-dimensional molecular orientation; 4. Applications with a Sample of Aligned Molecules
 4.1. Optimal control of multiphoton ionization processes in aligned I2 molecules with time-dependent polarization pulses 4.2. High-order harmonic generation from aligned molecules; 5. Summary and Outlook; Acknowledgments; References; 4. Sum Frequency Generation: An Introduction with Recent Developments and Current Issues Mary Jane Shultz; 1. Introduction; 2. Electric Fields and Orientation Factors; 2.1. Fresnel factors and propagation direction; 2.2. Orientation factors; 2.2.1. Simplification of the orientation tensor; 2.3. Observed intensity; 2.3.1. Molecular examples; 3. Recent Developments
 3.1. Absolute orientation determination with a reference 3.2. Orthogonal resonances; 3.3. Null angle; 3.3.1. Visible angle null, VAN; 3.3.2. Polarization angle null, PAN; 3.3.3. Connection with previous work; 3.3.4. Example; 4. Current Issues in Sum Frequency Generation; 4.1. Interfacial optical constants and bulk contributions; 4.2. Collective modes - a theoretical challenge; 4.3. Probe depth; 4.4. Nanoparticle SFG; 4.5. Time resolution; 4.6. Surface 2D imaging; 5. Selected Results; 5.1. Ions at aqueous surfaces: The case for surface H₃O⁺; 5.2. Interactions at nanostructured interfaces
 6. Summary

Sommario/riassunto

This book presents the latest developments and issues in both experimental and theoretical studies of multi-photon processes and the spectroscopy of atoms, ions and molecules in physics, chemistry, biology and material science. It contains review papers suitable for both active researchers and non-experts who wish to enter the field. Special attention is paid to the recent progress of non-linear photon-matter interactions in atoms, molecules and interfaces: XUV/soft X-ray, high-order harmonic generation in attosecond regime, high-order harmonic generation, sum frequency generation, four-wave