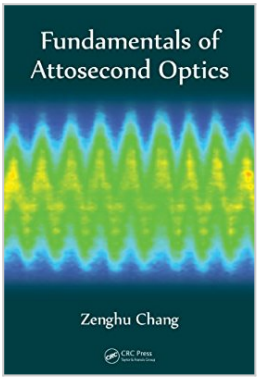

Fundamentals of Attosecond Optics

By Zenghu Chang

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Attosecond optical pulse generation, along with the related process of high-order harmonic generation, is redefining ultrafast physics and chemistry. A practical understanding of attosecond optics requires significant background information and foundational theory to make full use of these cutting-edge lasers and advance the technology toward the next generation of ultrafast lasers. **Fundamentals of Attosecond Optics** provides the first focused introduction to the field. The author presents the underlying concepts and techniques required to enter the field, as well as recent research advances that are driving the field forward.

A stand-alone textbook for courses on attosecond optics and the interaction of matter with ultrafast, high-power lasers, the book begins with basic theory and gradually advances to more complex ideas. Using both semi-classical models and quantum mechanics theories, the author explains foundational concepts and mechanisms including femtosecond lasers, high-order harmonic generation, and the technological leap that inspired attosecond pulse generation. The book introduces techniques for generating attosecond train using the basis of high-order harmonics, followed by an explanation of gating methods for extracting single isolated pulses.

Chapters examine the connection between attosecond pulses and high harmonic generation, the use of driving lasers as key tools in attosecond generation, the mechanism of chirped pulse amplification, and the generation of few-cycle pulses. The book looks at carrier-envelope phase stabilization and the theoretical foundations for single atom and dipole phase response. It discusses propagation effects, introducing several approaches for improving phase matching; attosecond pulse generation and characterization, covering attosecond pulse train

and single isolated pulses; and several examples of experimental applications for attosecond pulses.

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Fundamentals of Attosecond Optics By Zenghu Chang Bibliography

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Editorial Review

Review

"The book is written in a way to be accessible to anyone having knowledge of lasers without requiring any in-depth specialisation. … a clear, up-to-date and self-contained presentation of the phenomena involved in the production and use of as pulses. It is recommended to postgraduate students and researchers. It is also a basic source of information for those who wish to [get] insight into this advanced field as well as for people working in the production of advanced systems in industry."
?Mario Bertolotti, *Contemporary Physics*, 2013

"This is an excellent textbook on attosecond optics … . At the attosecond time scale, optics could reveal new phenomena in solid state physics, biology and chemistry. This book could help in this quest, since it is written clearly and in a very comprehensive manner. … This book is an invaluable source of knowledge for students or scientists who want to learn about this new domain of optics."
?Daniela Dragoman, *Optics & Photonics News*, February 2012

"Dr. Chang's book is truly amazing: One of the leading researchers of the field finds the time to write a book that covers the most important aspects of attosecond technology and physics. The book starts with a detailed presentation of the generation of attosecond pulses, carries on with the fundamentals of strong-field and attosecond laser physics, and concludes with applications. Having this book available at this early stage of attosecond science is immensely helpful ? my students love the book, too."
?Professor Gerhard G. Paulus, Texas A&M University and Max Planck Institute of Optics and Quantum Electronics

"An extremely useful textbook … . This book provides not only a basic introduction to the concepts and techniques of attosecond pulse generation, characterization and application, but also a broad overview of the current state-of-the-art including some of the latest advances. Definitely a must-have in any ultrafast optics lab!"
?Dr. Pascal Salières, Group Leader, CEA-Saclay

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