

# Contents

## Part I Laser Light Sources

<b>1 Self-Referenced Scheme for Direct Synthesis of Carrier-Envelope Phase Stable Pulses with Jitter below the Atomic Time Unit</b> .....	3
Günter Steinmeyer, Christian Grebing, Bastian Borchers, and Sebastian Koke	
<b>2 Single Shot Carrier Envelope Phase Stabilization of a 10 kHz, 10 W Regenerative Amplifier</b> .....	9
Chengquan Li, Alex Schill, Florian Emaury, Jack Chu, Philippe Féru, Jean-Marc Héritier, and William Tulloch	
<b>3 Intense Few-Cycle Mid-Infrared Laser Pulse Generation and Applications</b> .....	15
Ruxin Li, Chuang Li, Liwei Song, Ding Wang, Canhua Xu, Cheng Gong, Yuxin Leng, Peng Liu, Zhinan Zeng, and Zhizhan Xu	
<b>4 Few-Cycle, Phase-Locked, Octave IR OPA Using BIBO and 800-nm Pump</b> .....	27
N. Ishii, K. Kitano, T. Kanai, S. Watanabe, and J. Itatani	
<b>5 CEP-Stable, Few-Cycle, kHz OPCPAs for Attosecond Science: Energy Scaling and Coherent Sub-Cycle Pulse Synthesis</b> .....	33
Kyung-Han Hong, Shu-Wei Huang, Jeffrey Moses, Xing Fu, Giovanni Cirmi, Chien-Jen Lai, Siddharth Bhardwaj, and Franz X. Kärtner	

<b>6</b>	<b>Dual-Chirped Optical Parametric Amplification for Generating High-Power Infrared Pulses</b> .....	41
	Q. Zhang, E.J. Takahashi, O.D. Mücke, P. Lu, and K. Midorikawa	
<b>7</b>	<b>Development of High Power Infrared Optical Parametric Amplification Laser System Seeded by Self-difference Frequency Generation Pulses</b> .....	45
	Tsuneto Kanai, Sébastien Weber, Amelle Zaïr, Christopher Hutchinson, Thomas Siegel, Malte Oppermann, Simon Hutchinson, Tobias Witting, Leonardo Brugnera, Rashid A. Ganeev, Toshiyuki Azuma, Katsumi Midorikawa, and Jonathan P. Marangos	
<b>8</b>	<b>Spatially Resolved Characterization of Sub-4-fs Laser Pulses Using Spectral Shearing Interferometry</b> .....	49
	T. Witting, F. Frank, C.A. Arrell, W. Okell, J.P. Marangos, and J.W.G. Tisch	
<b>9</b>	<b>Enhancement of the Photon Flux of a Time-Compensated Monochromator by Phase Matching in a Hollow Fiber</b> .....	53
	H. Igarashi, A. Makida, and T. Sekikawa	
<b>10</b>	<b>Temporal Optimization of the Time-Delay-Compensated Monochromator</b> .....	57
	A. Makida, H. Igarashi, and T. Sekikawa	
<b>11</b>	<b>Characterization of Extreme Ultra-Violet Free-Electron Laser Pulses by Autocorrelation</b> .....	61
	A. Senftleben, T. Pfeifer, K. Schnorr, K. Meyer, Y.H. Jiang, A. Rudenko, O. Herrwerth, L. Foucar, M. Kurka, K.U. Kühnel, M. Kübel, M.F. Kling, A. Yamada, K. Motomura, K. Ueda, R. Treusch, C.D. Schröter, R. Moshhammer, and J. Ullrich	
<b>Part II High-Order Harmonics and Attosecond Pulse Generation</b>		
<b>12</b>	<b>Formation of Attosecond XUV Pulses via Resonance with Hydrogen-Like Atoms Irradiated by Intense Laser Field</b> .....	71
	V.A. Polovinkin, Y.V. Radeonychev, M.Yu. Ryabikin, and Olga Kocharovskaya	
<b>13</b>	<b>Exploration of Below-Threshold Harmonic Generation Mechanisms of Cesium Atoms in Intense Mid-Infrared Laser Pulses</b> .....	79
	Y.-J. Chen, C. Laughlin, and S.-I. Chu	

<b>14</b>	<b>XUV Supercontinuum Generated by Incommensurate Two-Color Mid-IR Optical Parametric Amplifier</b> .....	85
	M. Negro, C. Vozzi, K. Kovacs, C. Altucci, R. Velotta, F. Frassetto, L. Poletto, P. Villoresi, S. De Silvestri, V. Tosa, and S. Stagira	
<b>15</b>	<b>Ionization Gating for the Generation of Tunable XUV Radiation and Isolated Attosecond Pulses</b> .....	91
	F. Calegari, M. Lucchini, K.S. Kim, C. Vozzi, S. Stagira, G. Sansone, and M. Nisoli	
<b>16</b>	<b>Efficient Generation of Isolated Attosecond Pulse with CEP-Unstabilized Multicycle Infrared Double Optical Gating</b> .....	97
	Pengfei Lan, Eiji J. Takahashi, and Kastumi Midorikawa	
<b>17</b>	<b>Frequency-Controlled Isolated Attosecond Pulses Characterized by Both 750 and 400 nm Wavelength Streak Fields</b> ...	101
	H. Mashiko, M.J. Bell, A.R. Beck, M.J. Abel, K.R. Siefermann, P.M. Nagel, J. Robinson, D.M. Neumark, and S.R. Leone	
<b>18</b>	<b>Generation of Highly Phase-Matched Isolated Attosecond Pulses Using Multi-mJ, Carrier-Envelope Phase Stabilized, Few-Cycle Laser Pulses</b> .....	105
	Tsuneto Kanai, Yuxi Fu, Yasuhiro Kamba, Samuel Bohman, Hiroshi Yoshida, Takuya Kanai, Shigeru Yamaguchi, Eiji J. Takahashi, Yasuo Nabekawa, Akira Suda, and Katsumi Midorikawa	
<b>19</b>	<b>Route to One Atomic Unit of Time: Development of a Broadband Attosecond Streak Camera</b> .....	109
	Kun Zhao, Qi Zhang, Michael Chini, and Zenghu Chang	
<b>20</b>	<b>Quantum Path Interference in HHG: Impact on Harmonic Polarization and Molecular Imaging</b> .....	121
	M. Yu. Ryabikin, A.A. Gonoskov, I.A. Gonoskov, and V.V. Strelkov	
<b>21</b>	<b>XUV Interferometry of Attosecond Pulses</b> .....	127
	Yasuo Nabekawa, Eiji J. Takahashi, Yusuke Furukawa, Tomoya Okino, Kaoru Yamanouchi, and Katsumi Midorikawa	
<b>22</b>	<b>Exploiting Energetic XUV Super-Continua</b> .....	137
	P. Tzallas, E. Skantzakis, L.A.A. Nikolopoulos, and D. Charalambidis	
<b>23</b>	<b>The Influence of Plasma Defocusing in High Harmonic Generation</b> .....	145
	Chien-Jen Lai, Kyung-Han Hong, and Franz X. Kärtner	

<b>24</b>	<b>Beam Splitters for High-Order Harmonics Using Transparent Materials to Visible Light</b> .....	151
	Yosuke Kojima, Yuske Furukawa, Yasuo Nabekawa, Eiji J. Takahashi, Fumihiko Kannari, and Katsumi Midorikawa	
<b>25</b>	<b>Enormous Amplification of Full-Coherent Radiation in the Extreme Ultraviolet Region with a Free-Electron Laser</b> .....	155
	Eiji J. Takahashi, Tadashi Togashi, Makoto Aoyama, Koichi Yamakawa, Takahiro Sato, Atsushi Iwasaki, Shigeki Owada, Kaoru Yamanouchi, Toru Hara, Shinichi Matsubara, Takashi Ohshima, Yuji Otake, Hitoshi Tanaka, Takashi Tanaka, Hiromitsu Tomizawa, Takahiro Watanabe, Makina Yabashi, Katsumi Midorikawa, and Tetsuya Ishikawa	
<b>Part III Ionization of Atoms</b>		
<b>26</b>	<b>Breakdown of the Independent Electron Approximation in Sequential Double Ionization</b> .....	165
	C. Cirelli, A.N. Pfeiffer, M. Smolarski, X. Wang, J.H. Eberly, R. Dörner, and U. Keller	
<b>27</b>	<b>Sequential Double Ionization: The Timing of Release</b> .....	169
	A.N. Pfeiffer, C. Cirelli, M. Smolarski, R. Dörner, and U. Keller	
<b>28</b>	<b>Study of Asymmetric Electron Emission in Two-Color Ionization of Helium (XUV-IR)</b> .....	173
	G. Laurent, W. Cao, I. Ben-Itzhak, and C.L. Cocke	
<b>29</b>	<b>Control the Electron Dynamics in Nonsequential Double Ionization with the Orthogonal Two-Color Field</b> .....	179
	Yueming Zhou and Peixiang Lu	
<b>30</b>	<b>Sideband and Angular Distribution Oscillation of Photoelectrons Observed with XUV/IR 3D Momentum Imaging Spectroscopy</b> .....	183
	A. Sperl, H. Rietz, M. Schoenwald, A. Fischer, K. Simeonidis, and J. Ullrich	
<b>31</b>	<b>Attosecond Pump-Probe of Doubly Excited States of Helium through Two-Photon Interferometry</b> .....	187
	Johannes Feist, Stefan Nagele, Christopher Ticknor, Barry I. Schneider, Lee A. Collins, and Joachim Burgdörfer	
<b>32</b>	<b>Controlling and Reading Interference Structures Created by Strong Field Ionizing Attosecond Electron Wave Packets</b> .....	193
	X. Xie, S. Roither, D. Kartashov, L. Zhang, E. Persson, S. Gräfe, M. Schöffler, J. Burgdörfer, A. Baltuška, and M. Kitzler	

<b>33</b>	<b>Electron Wavepacket Interference Observed by Attosecond Transient Absorption Spectroscopy</b> .....	199
	L. Gallmann, M. Holler, F. Schapper, and U. Keller	
<b>34</b>	<b>Observing the Real-Time Evolution of Helium Atoms in a Strong Laser Field</b> .....	203
	Niranjan Shivaram, Henry Timmers, Xiao-Min Tong, and Arvinder Sandhu	
<b>35</b>	<b>Electron Correlation and Interference Effects in Strong-Field Processes</b> .....	209
	Markus C. Kohler, Carsten Müller, Christian Buth, Alexander B. Voitkiv, Karen Z. Hatsagortsyan, Joachim Ullrich, Thomas Pfeifer, and Christoph H. Keitel	
<b>36</b>	<b>Adiabatic Theory of Ionization of Atoms by Intense Laser Pulses</b> ....	219
	Toru Morishita and Oleg I. Tolstikhin	
<b>37</b>	<b>Trajectory-Based Coulomb-Corrected Strong Field Approximation</b> .....	221
	T.-M. Yan, S.V. Popruzhenko, M.J.J. Vrakking, and D. Bauer	

#### Part IV Molecules in Intense Laser Fields

<b>38</b>	<b>Classical Models of <math>H_3^+</math> Interacting with Intense Laser Fields</b> .....	233
	E. Lötstedt, T. Kato, and K. Yamanouchi	
<b>39</b>	<b>Electron-Scattering and Photoionization of <math>H_2^+</math> and <math>HeH^{2+}</math></b> .....	239
	H. Miyagi, T. Morishita, and S. Watanabe	
<b>40</b>	<b>Molecular Orientation by Intense Visible and THz Optical Pulses</b> ...	243
	K. Kitano, N. Ishii, and J. Itatani	
<b>41</b>	<b>Below-Threshold High-Harmonic Spectroscopy with Aligned Hydrogen Molecular Ions</b> .....	247
	Fu-Yuan Jeng, Dmitry A. Telnov, and Shih-I Chu	
<b>42</b>	<b>Two-Center Interference of Heteronuclear Diatomic Molecules in High-Order Harmonic Generation</b> .....	253
	Xiaosong Zhu and Peixiang Lu	
<b>43</b>	<b>Toward the Extension of High Order Harmonic Spectroscopy to Complex Molecules: Investigation of Aligned Hydrocarbons</b> .....	259
	C. Vozzi, R. Torres, M. Negro, L. Brugnera, T. Siegel, C. Altucci, R. Velotta, F. Frassetto, P. Villoresi, L. Poletto, S. De Silvestri, J.P. Marangos, and S. Stagira	

<b>44</b>	<b>Nonlinear Fourier-Transform Spectroscopy of D<sub>2</sub> Using High-Order Harmonic Radiation</b> .....	263
	Yusuke Furukawa, Yasuo Nabekawa, Tomoya Okino, Kaoru Yamanouchi, and Katsumi Midorikawa	
<b>45</b>	<b>Steering of Molecular Multiple Dissociative Ionization with Strong Few-Cycle Laser Fields</b> .....	269
	Yunquan Liu, Xianrong Liu, Yongkai Deng, Chengyin Wu, and Qihuang Gong	
<b>46</b>	<b>A Generalized Approach to Molecular Orbital Tomography</b> .....	277
	C. Vozzi, M. Negro, F. Calegari, G. Sansone, M. Nisoli, S. De Silvestri, and S. Stagira	
<b>47</b>	<b>Tracing Attosecond Electron Motion Inside a Molecule</b> .....	283
	Liang-You Peng, Ming-Hui Xu, Zheng Zhang, and Qihuang Gong	
<b>48</b>	<b>Natural Orbital Analysis of Ultrafast Multielectron Dynamics of Molecules</b> .....	289
	Hirohiko Kono, Takayuki Oyamada, Tsuyoshi Kato, and Shiro Koseki	
<b>49</b>	<b>Protonic Configuration of CH<sub>3</sub>OH within a Diatomic-Like Molecular Picture</b> .....	299
	Tsuyoshi Kato and Kaoru Yamanouchi	
<b>50</b>	<b>Siegert-State Method for Strong Field Ionization of Molecules</b> .....	305
	L. Hamonou, T. Morishita, O.I. Tolstikhin, and S. Watanabe	
<b>51</b>	<b>Ionisation and Fragmentation of Small Biomolecules with Femtosecond Laser Pulses</b> .....	309
	L. Belshaw, O. Kelly, M.J. Duffy, R.B. King, T.J. Kelly, J.T. Costello, I.D. Williams, C.R. Calvert, and J.B. Greenwood	
<b>52</b>	<b>Initial Process of Proton Transfer in Salicylideneaniline Studied by Time-Resolved Photoelectron Spectroscopy</b> .....	313
	T. Sekikawa, O. Schalk, G. Wu, A.E. Boguslavskiy, and A. Stolow	
<b>53</b>	<b>Visualizing Correlated Dynamics of Hydrogen Atoms in Acetylene Dication by Time-Resolved Four-Body Coulomb Explosion Imaging</b> .....	317
	Akitaka Matsuda, Mizuho Fushitani, Eiji J. Takahashi, and Akiyoshi Hishikawa	
<b>54</b>	<b>Ultrafast Delocalization of Protons in Methanol and Allene in Intense Laser Fields</b> .....	323
	Huai-liang Xu, Tomoya Okino, Katsunori Nakai, and Kaoru Yamanouchi	

<b>55</b>	<b>Double Proton Migration and Proton/Deuteron Exchange in Methylacetylene in Intense Laser Fields</b> .....	335
	T. Okino, A. Watanabe, H. Xu, and K. Yamanouchi	
<b>56</b>	<b>High Energy Proton Ejection from Hydrocarbon Molecules Driven by Highly Efficient Field Ionization</b> .....	341
	S. Roither, X. Xie, D. Kartashov, L. Zhang, M. Schöffler, H. Xu, A. Iwasaki, T. Okino, K. Yamanouchi, A. Baltuška, and M. Kitzler	
<b>57</b>	<b>Efficient Ionization of Acetylene in Intense Laser Fields</b> .....	347
	E. Lötstedt, T. Kato, and K. Yamanouchi	
<b>58</b>	<b>Laser-Assisted Electron Scattering and Its Application to Laser-Assisted Electron Diffraction of Molecules in Femtosecond Intense Laser Fields</b> .....	351
	Reika Kanya, Yuya Morimoto, and Kaoru Yamanouchi	
 <b>Part V Laser-Induced Surface and Nanoscale Dynamics</b>		
<b>59</b>	<b>A System for Conducting Surface Science with Attosecond Pulses</b> ...	359
	C.A. Arrell, E. Skopalova, D.Y. Lei, T. Uphues, Y. Sonnefraud, W.A. Okell, F. Frank, T. Witting, S.A. Maier, J.P. Marangos, and J.W.G. Tisch	
<b>60</b>	<b>Attosecond Transversal Streaking to Probe Electron Dynamics at Surfaces</b> .....	365
	Luca Castiglioni, D. Leuenberger, M. Greif, and M. Hengsberger	
<b>61</b>	<b>Dynamics of Coherent Optical Phonons in PbTiO<sub>3</sub> Excited by Impulsive Stimulated Raman Scattering</b> .....	369
	K.G. Nakamura, H. Koguchi, J. Hu, H. Takahashi, M. Nakajima, S. Utsugi, and H. Funakubo	
<b>62</b>	<b>High-Order Harmonic Photoelectron Spectroscopy System towards Measuring Attosecond Electron Dynamics on Solid Surfaces</b> .....	373
	Katsuya Oguri, Hidetoshi Nakano, Keiko Kato, Tadashi Nishikawa, Atsushi Ishizawa, Hideki Gotoh, Kouta Tateno, and Tetsuomi Sogawa	
<b>63</b>	<b>Effect of Light Polarization on Plasma Distribution and Filament Formation</b> .....	379
	L. Arissian, D. Mirell, J. Yeak, S. Rostami, and J.-C. Diels	

**64 Ignition of Doped Helium Nanodroplets in Intense Few-Cycle Laser Pulses** ..... 385  
S.R. Krishnan, L. Fechner, M. Kremer, V. Sharma, B. Fischer, N. Camus, J. Jha, M. Krishnamurthy, T. Pfeifer, R. Moshhammer, J. Ullrich, F. Stienkemeier, and M. Mudrich

**65 Ultrafast Nanoscale Imaging Using High Order Harmonic Generation**..... 391  
Willem Boutu, David Gauthier, Xunyou Ge, Fan Wang, Aura Ines Gonzalez, Benjamin Barbrel, Ana Borta, Mathieu Ducouso, Bertrand Carré, and Hamed Merdji

**66 Strong-Field Effects and Attosecond Control of Electrons in Photoemission from a Nanoscale Metal Tip** ..... 401  
M. Krüger, M. Schenk, and P. Hommelhoff

**67 Femtosecond Laser-Induced X-Ray Emission from Gold Nano-Colloidal Solutions** ..... 407  
K. Hatanaka, K. Yoshida, A. Iwasaki, and K. Yamanouchi

**Index**..... 411





<http://www.springer.com/978-3-642-28947-7>

Multiphoton Processes and Attosecond Physics  
Proceedings of the 12th International Conference on  
Multiphoton Processes (ICOMP12) and the 3rd  
International Conference on Attosecond Physics  
(ATTO3)

Yamanouchi, K.; Katsumi, M. (Eds.)

2012, XVIII, 416 p., Hardcover

ISBN: 978-3-642-28947-7