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SEMINAIRE SPAM / LFP

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Le Jeudi 13 septembre 2012 à 11h00
Bâtiment 522 - Salle 138

« Generation, metrology and applications of intense quasi-isolated attosecond pulses»

The exploration of electronic motion in real time as well as the control of electronic dynamics requires the development of new light sources in the XUV spectral region and with pulse durations of the order of attoseconds. One of the basic requirements for the examination and observation of such dynamics is to control the generation of these pulses. High-harmonic generation provides a powerful source of ultrashort coherent radiation in the XUV and soft-x-ray range. For time domain spectroscopic applications, the exploitation of isolated attosecond pulses is more advantageous for the interpretation of the acquired data than a train of attosecond pulses. Isolated attosecond pulses are generated when XUV emission is confined within half a cycle of the IR driving pulse. The non-linear medium is then emitting only one XUV light burst, i.e. a coherent XUV continuum.

Nowadays, two possible solutions are proposed towards the generation of intense isolated attosecond pulses. The first approach requires the development of high-peak-power few-cycle laser systems, which are not commercially available, while the second approach utilizes the already commercially available high-peak-power many-cycles laser systems.

The implementation of new Interferometric Polarization Gating (IPG) technique, leading to the emission of sub-100 nJ coherent ultra-broadband XUV continua, supporting asec confinement, from a gas target interacting with many cycle high peak power laser pulses is presented in this seminar. These energy levels are sufficient to induce observable two-XUV-photon ionization. We present the main intricacies of the very recently observed two-XUV-photon direct double ionization of Xe and its exploitation in the measurement of the temporal width of the XUV continuum. We further elaborate on the first XUV-pump-XUV-probe experiment in the temporal scale of 1fs, tracking the evolution of an induced atomic coherence i.e. of a coherent superposition of a dense manifold of autoionizing states that are single photon resonant with part of the broad XUV spectrum.

These intense coherent XUV continua allow for time-resolved linear and non-linear spectroscopy in this spectral region and thus are of great importance to a broad field of scientific disciplines.

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2. P. Tzallas, E. Skantzakis, L. A. A. Nikolopoulos, G. D. Tsakiris and D. Charalambidis, Nature Physics, **7**, 781–784 (2011)
3. P. Tzallas, E. Skantzakis and D. Charalambidis, Physical Review A **82**, 061401(R)(2010)
4. E. Skantzakis, P. Tzallas, J. Kruse, C. Kalpouzos, O. Faucher, G.D. Tsakiris and D. Charalambidis, Phys. Rev. Lett. **105**, 043902 (2010)
5. E. Skantzakis, P. Tzallas, J. Kruse, C. Kalpouzos, and D. Charalambidis, Opt. Lett. 34, 1732-1734 (2009)
6. D. Charalambidis, P. Tzallas, E.P. Benis, E. Skantzakis, G. Maravelias, L.A.A. Nikolopoulos, A. Peralta Conde and G.D. Tsakiris, New J. Phys. **10**, 025018 (2008).
7. P. Tzallas, E. Skantzakis, C. Kalpouzos, E.P. Benis, G.D. Tsakiris and D. Charalambidis, Nature Physics **3**, 846 (2007).

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