エクストリームフォトニクスセミナー

Extreme Photonics Seminar

No. 3

Date: June 3rd (Fri), 2011, 15:00 ～ 17:00

Location: Cooperation Center, 5F Meeting Room, W524
(研究交流棟5階会議室 W524)

Language: English

Title: 3D controllable microstructures and functional devices by laser microfabrications

Speaker: **Dr. Dong Wu** (RIKEN)

With the development of science and technologies, there are mainly two opposite directions: one is "micro"; another is "Macro". Among many research areas, high precision micro-optical devices and large-area biomimetic hydrophobic surfaces have recently became two hot topics due to their important potential applications. Here, based on the basic principle of light and mater interaction, we propose two kinds of maskless laser microfabrication methods – direct laser writing and laser **interference lithography to realize high-quality micro-optical devices and large-area bio-inspired hydrophobic surfaces, which is an important step towards their wide applications. Moreover, a combined top-down/bottom-up technology was presented to obtain large-area, regular, controlled, functional, complex micro/nanostructures.**

Language: Japanese

Title: Competition of sequential and direct paths in resonant two-photon ionization of He

Speaker: **Dr. Kenichi L. Ishikawa**
(Associate Professor, Photon Science Center, The University of Tokyo)

The advent of intense XUV sources such as high-harmonic generation (HHG) and X-ray free-electron lasers (XFEL) has enabled two-photon ionization (TPI) of species with a deep ionization potential such as He and N_2. The He atom is especially important, since its simple electronic structure allows for a detailed theoretical analysis, in great contrast to alkali atoms. In resonant TPI, the sequential path via the resonant level and the direct one via nonresonant intermediate levels compete with each other. In this study, we theoretically show that their competition in resonant TPI of He manifests itself in the photoelectron angular distribution by ultrashort (~ a few fs) XUV pulses and varies with the pulse width T.
The photoelectron angular distribution is given by,

$$I(q) = (s / 4p)\,[1 + b_2 P_2(\cos q) + b_4 P_4(\cos q)]\,, \qquad (1)$$

where q is the angle between the laser polarization and the electron velocity vector, and the anisotropy parameters b_2 and b_2 are given by,

$$b_2 = (2 / 7 - X \cos d) / (X^2 / 4 + 1 / 5),\ b_4 = 72 / 35\ (X^2 + 4 / 5)\,, \qquad (2)$$

with X being the ratio of the amplitude of the S and D wave packets, d the phase shift difference between them. One can show that, in addition to the intrinsic phase of the continuum wave functions, d contains an extra phase d_{ex} originating from the competition of sequential and direct TPI. It should be noted that d_{ex} is finite even for the exactly resonant case. We can also show that the two paths depend on pulse width T differently and, thus, that d_{ex} varies with T for ultrashort pulses (< 15 fs). This manifests itself clearly in the variation of the angular distribution with pulse width. Hence, the state-of-the-art ultrashort XUV pulses (HHG and XFEL) are suitable to probe the competition of the sequential and direct TPI.

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