74th RAP Seminar

The 74th Seminar on RIKEN Center for Advanced Photonics

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Title: **Attosecond electron beams: production, characterization, and potential applications**

アト秒電子ビームの発生、検出、応用

Speaker: **Dr. Yuya MORIMOTO**

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Pre-registration

Motion of electrons in a molecule or a material occurring on the attosecond (1 attosecond = 10-18 second) time scale is closely related to the material's optical property and the mechanism of a chemical reaction. High-energy electron beams are widely used for Angstrom or nanometer-scale imaging and the time-resolved measurement with pulsed electron beams can capture ultrafast phenomena, for example, the motion of atoms during a chemical reaction, with high spatial resolution. However, the temporal resolution had been limited to sub-picoseconds (1 picosecond = 10-12 second) due to the available electron pulse durations.

In this talk, we report the light-wave-driven electron pulse compression down to attosecond durations. We produce a train of attosecond electron pulses at 70-keV energy as well as an electron pulse having an isolated attosecond peak. We then report proof-of-principle attosecond electron diffraction and microscopy experiments. We discuss potential applications of the attosecond electron beams to the direct recording of light-cycle-driven electron dynamics on atomic scale, the space-time imaging of optical electromagnetic fields in and around nano-scale objects, and the quantum control of atomic and molecular collisional reactions.

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