Advanced Laser and Photon Science
レーザー・光量子科学特論

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（Wednesday, 16:50-18:35）

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With recent progress in laser technology, it is increasingly important to understand laser-matter interaction for atomic, molecular, and condensed-matter physics research as well as for materials processing, medicine, and quantum technology.

Kenichi Ishikawa & Takeshi Sato

- Interaction between intense femtosecond laser pulse with atoms (strong-field physics)
- Attosecond science, one of the hottest field in laser science
- First-principles computation

Shuichi Hasegawa

- Spectroscopy and laser manipulation of atoms and ions

Yuya Morimoto

- Generation and application of infrared laser pulses

Schedule

4/6	Ishikawa	Laser fundamentals
4/13	Ishikawa	Rabi oscillation
4/20	Ishikawa	Strong-field physics (atom in an intense laser field)
4/27	Ishikawa	Strong-field physics (high-harmonic generation)
5/11	Sato	Attosecond science
5/18	Sato	Attosecond science
5/25	(no lecture)	
6/1	Sato	First-principles calculations
6/8	Sato	First-principles calculations
6/15	Hasegawa	Electronic structure of atoms
6/22	Hasegawa	Electron and nuclear spin
6/29	Hasegawa	Principle of laser spectroscopy
7/6	Hasegawa	Application of laser spectroscopy
7/13	Morimoto	Generation and application of infrared laser pulses
7/20, 27	(spare)	

Evaluation/grading

Based on ...

- Attendance
- Reports

Check ITC-LMS for course materials and report assignments.

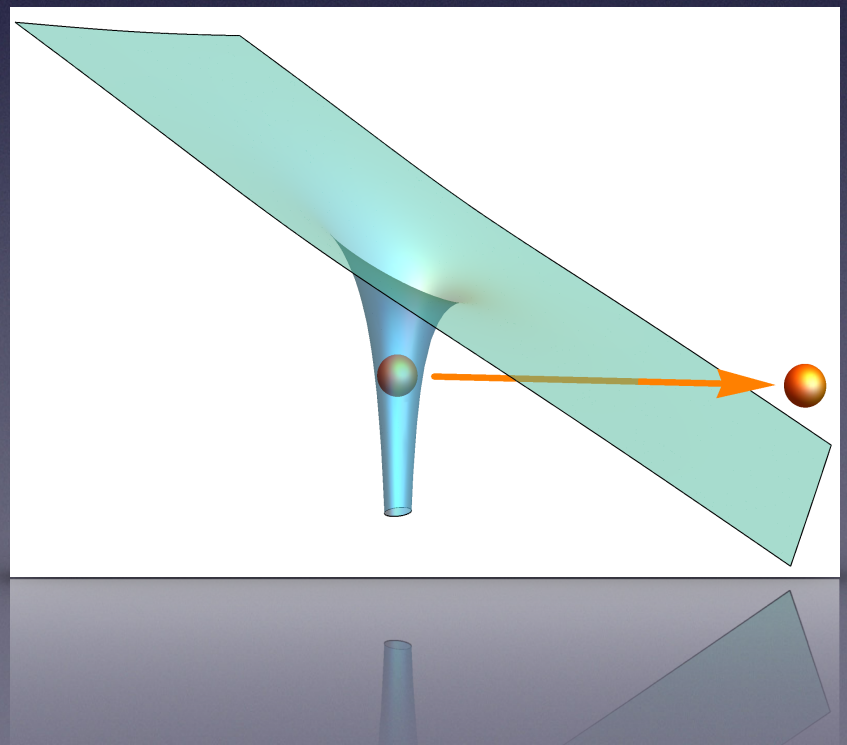
Why intense laser in nuclear engineering

Nuclear research institutes have always been main driving force of intense laser technology. For example ...

- Laurence Livermore National Laboratory (USA)
- Atomic Energy Commission (France)
- Japan Atomic Energy Agency (Japan)

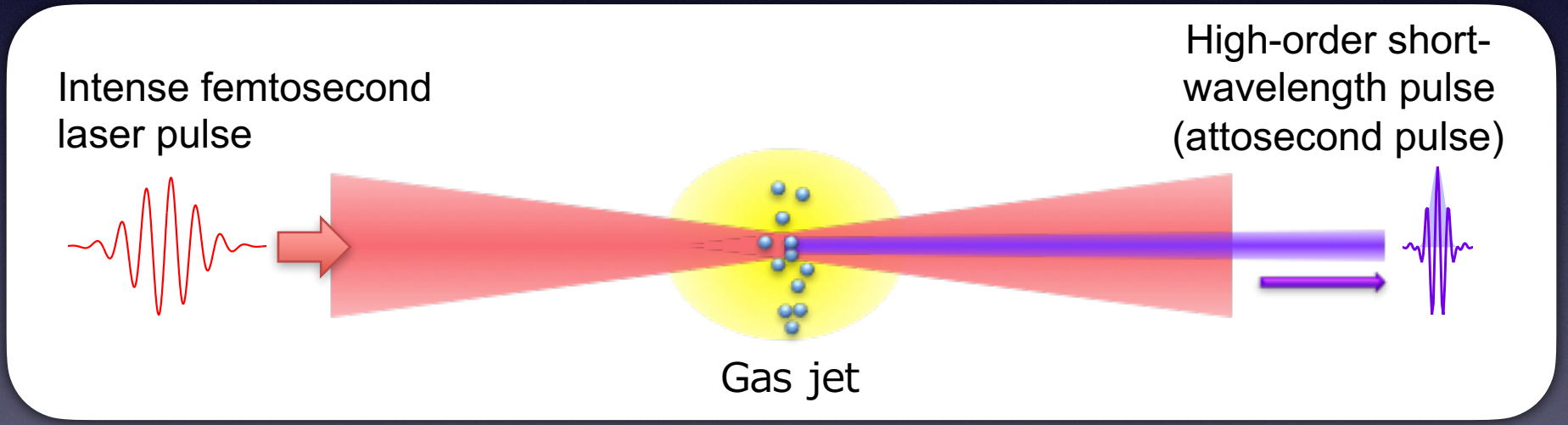
Intense laser is an ionizing radiation!

- Above-threshold ionization (ATI, 超閾イオン化)
- Tunneling ionization (トンネル電離)



Intense laser produces high-quality ionizing radiation!

- High-harmonic generation (HHG, 高次高調波発生)



- Proton & electron acceleration (レーザー加速)