

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

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Takeshi SATO

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(Wednesday, 16:50-18:35)

<http://ishiken.free.fr/english/lecture.html> (for course
materials by Ishikawa and Sato)
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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 calculation

Shuichi Hasegawa

- Spectroscopy and laser manipulation of atoms and ions

Schedule

4/8	Ishikawa	Laser fundamentals
4/15	Hasegawa	Electronic structure of atoms
4/22	Hasegawa	Electron and nuclear spin
5/7	Hasegawa	Principle of laser spectroscopy
5/13	Hasegawa	Application of laser spectroscopy
5/20	Ishikawa	Rabi oscillation
5/27	Ishikawa	Strong-field physics (atom in an intense laser field)
6/3	Ishikawa	Strong-field physics (high-harmonic generation)
6/10	Sato	Attosecond science
6/17	Sato	Attosecond science
6/24	Sato	First-principles calculations
7/1	Sato	First-principles calculations
7/8, 15	(spare)	

Evaluation/grading

Based on ...

- Attendance
- Reports
- Course materials will be uploaded at <http://ishiken.free.fr/english/lecture.html>
- Check ITC-LMS (and UTAS) for Zoom URL (may change every week!) and report assignments.

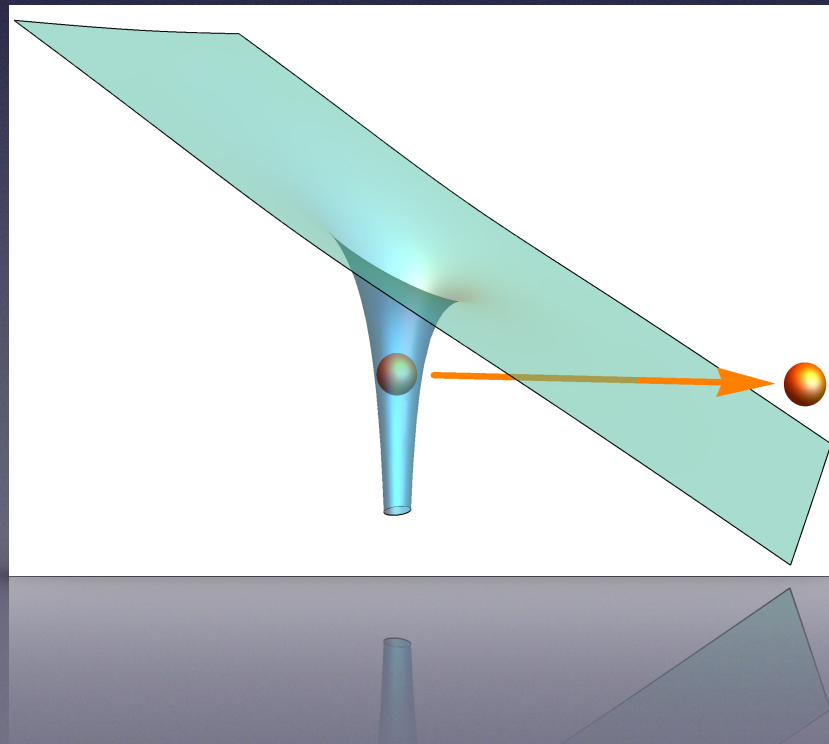
Why intense laser in nuclear engineering

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

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

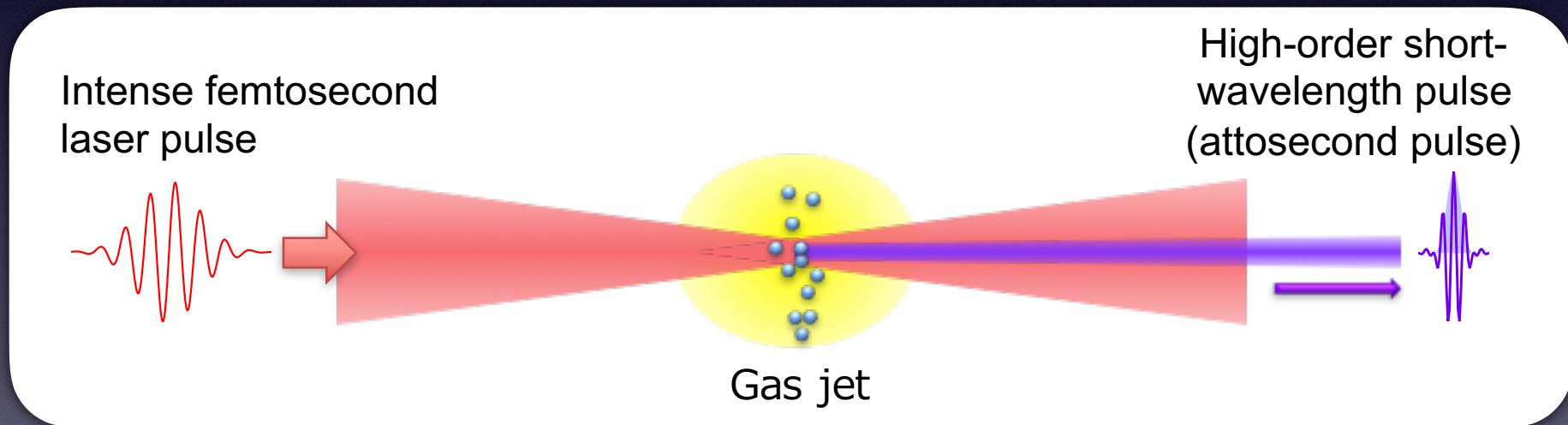
Intense laser is an ionizing radiation!

- 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)