

FDITE218 Theoretical methods in strong-field and attosecond physics

Lecturer: Dr. Attila Czirják (czirjak@physx.u-szeged.hu)

Course description: The primary goal of the course is to provide the PhD student with an overview of i) The basics of the theoretical description of atomic systems interacting with an intense laser field; ii) Typical processes and their theoretical models, their applicability limits; iii) Proven numerical methods; iv) Some current research directions. As a result, the student will be well informed about the theoretical foundations of the typical phenomena and processes of strong-field and attosecond physics, and becomes able, with the help of a supervisor, to start a theoretical or numerical research work in this area.

Topics:

1. Atoms, molecules, high intensity laser pulses: review of the fundamentals
2. „Free” electron in a high intensity laser field
3. Atoms in a high intensity laser field: theoretical foundation
4. Atoms in a high intensity laser field: ionization mechanisms and theories
5. Atoms in a high intensity laser field: HHG and its theory
6. Atoms in a high intensity laser field: quantized electromagnetic fields
7. Molecules in a high intensity laser field: theoretical foundation
8. Molecules in a high intensity laser field: selected topics
9. Attosecond pump-and-probe methods, attosecond streaking, RABITT
10. Overview of numerical methods

Suggested reading:

- Lin, Le, Jin, Wei: Attosecond and Strong-Field Physics, (Cambridge University Press, 2018)
- Joachain, Kylstra, Potvliege: Atoms In Intense Laser Field, (Cambridge University Press, 2012)