	Dynamique ultra rapide dans les atomes ou molécules en champs intenses	Semestre 2nd
:	M2 LUMI modules optionnels	

Teachers :	**Teacher in charge of the course** : Richard TAÏEB (LCPMR/UPMC) **Co-teachers:** Pr. Alain Dubois (LCPMR/UPMC) Emily Lamour/Christophe Prigent (INSP/UPMC)	
Course type	CM 28h	**3 ECTS**
Language of tuition	English or French	

Course Objectives:
Ultrafast phenomena represent an important part of atomic and molecular physics and deal with small systems interacting with strong and ultrashort electromagnetic fields. The latter could be obtained either with laser or through collisions with very highly charged ions. The main objectives of this course are to introduce a number of fundamental aspects that are used to predict, describe and analyze the highly non-linear response of these systems. Experimental and theoretical (analytical and numerical) methods to study the processes involved will be extensively presented. Differences and similarities will be exemplified throughout the course.

Course prerequisites
A master 1 background in advanced quantum mechanics, in the description of electronic structures and notion of electrodynamics is required.

Syllabus
- Introduction to laser-matter interaction as well as collisions with an emphasis on timescale.
- Atomic/molecular processes involved in the different interactions.
- Main features of experimental investigations: beams (particles and laser, either table-top or large facilities) and detection (light or electron/ion spectroscopies).
- Femtochemistry and attoscience
- Presentation of a few applications.

On completion of the course students should be able to:
The students should get a better knowledge of atoms and molecules and their dynamics triggered by short intense fields. They should be able to pursue a "research career" (at least a Master internship and/or a PhD) in studying processes where small systems (atoms/molecules) interact with short intense laser pulses or fast ions.

Bibliography
- Introduction à l'électroynamique quantique, C. Cohen-Tannoudji, J. Dupont-Roc et G. Grynberg.
- Attosecond physics, F. Krausz and M. Y Ivanov. Reviews of Modern Physics **81**, p.163, 2009.
- Physics of atoms and molecules, B.H. Bransden and C.J. Joachain (Pearson, 2003).
- Quantum Collision Theory, C.J. Joachain (North-Holland, 1983).
- Molecular Collision Theory, M.S. Child (Dover, 1984).

Assessment
Final exam will be oral, where a critical analysis of a research article will be performed.