



CEA - Saclay
Service de Physique de l'Etat Condensé
CNRS UMR 3680
91191 Gif-sur-yvette Cedex



SÉMINAIRE

Mercredi 07 Janvier 2015 à 11h15

Orme des Merisiers SPEC, Salle Itzykson, Bât.774

Real-time Impact Dynamics in Condensed Matter by Laser Pulse

Hervé Cailleau

Institut de Physique de Rennes

UMR Université Rennes 1-CNRS 6251

herve.cailleau@univ-rennes1.fr

There is a remarkable development in the field of ultra-fast time-resolved measurements in solids, in which a pump laser pulse is used to prepare the system into highly excited state, while the real-time induced electronic and/or structural dynamics is tracked with subsequent probe pulses. This adds a temporal dimension on top of energy and momentum. Nowadays, laser sources are able to deliver ultra-short pulses, typically of few femtosecond duration, thereby shorter than the time scale of atomic motions. They cover diverse spectral ranges, from THz to hard X-rays. Moreover, these pulses can be very intense, possessing a macroscopic number of photons and an extremely large instantaneous electric field. We are able to act strongly and timely on the course of atomic processes in a material. The cooperative interaction in solid state may lead to positive feedback, underpinning non-linear responsiveness and threshold effect. These photo-induced phenomena may trigger a spectacular transformation of the macroscopic state and functionality of a material (from insulating to metallic, from non-magnetic to magnetic,...). Several experiments have provided new insights into the transformation of diverse materials, from the melting of charge or spin order in electron correlated system to cooperative molecular switching in the solid state. These real-time experiments allow to disentangle in time complicated electronic and lattice processes ("dissecting" the Hamiltonian). The possibility to trigger the dynamics coherently makes the process particularly efficient ("selecting" inside the Hamiltonian). These different aspects will be discussed, as the recent opportunity to directly act on the motion of electrons ("modifying" the Hamiltonian).

A coffee break will be served at 11h00. The seminar will be given in English.