CIC nanoGUNE
nanoscience cooperative research center

SUMMER INTERNSHIPS 2016

TITLE: Quantum dynamics of electrons and nuclei

DESCRIPTION (Objectives, tasks, materials, equipment…):

In many radiation damage events ionic projectiles travel through condensed matter at high velocities producing all sorts of alterations of the host material. This is a worry for the nuclear industry (they compromise the durability of structural materials in nuclear plants, both for fission and for fusion, and of materials hosting nuclear waste), for the aerospace industry (cosmic rays consist mostly of high-speed protons, which disrupt electronics in air- and spacecrafts), and it can be of importance for the treatment of cancer with ion radiotherapy. The simulations of radiation damage processes are extremely challenging in many ways. In particular, at a theoretical level, the description of the coupled dynamics of electrons and nuclei beyond the adiabatic (Born-Oppenheimer) approximation is hard to formulate. In this project we will attempt to learn from simple models how to describe the correlation between electrons and nuclei in such non-adiabatic processes by a suitable redefinition of electrons and nuclei as quantum particles.

SUPERVISOR: Emilio Artacho

SUITABLE FOR: Physicists and chemists