

INTERNSHIP PROPOSAL

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Thesis possibility after internship: YES

Funding: NO

Optimization of an atomic beam for Rydberg excitation and ionization

Atomic beams lie at the very foundation of most measurements in atomic physics. Rydberg atoms, in turn, are central to a wide range of challenges: quantum control, sensing, charge exchange, and the production of ion and/or electron beams. The proposed project aims to optimize an atomic beam, relying for instance on microchannels, which should significantly improve the beam collimation. Other techniques, such as magnetic compression or transverse (2D) laser cooling and guiding, may also be investigated. The goal is to obtain an intense, dense Cs or Rb atomic beam in the Rydberg excitation region. The experiment will then be transferred to different setups, such as an innovative electron microscope, the HREELM (High-Resolution Electron Energy Loss Microscope). This microscope detects very low-energy electrons with excellent time resolution. The objective is to exploit the space-time correlation between a Rydberg atom and its electron, obtained by ionizing the atom, in order to improve the electron source. The ultimate goal of the project is to combine a new highly monochromatic electron source (LAC) with the electron-controlled chemistry experiments of the Institut des Sciences Moléculaires d'Orsay (ISMO), and with a high-resolution, full-field spectroscopic electron microscope (SPEC, CEA). This unique combination will enable the production and use of a monoenergetic (~ 10 meV), very low-energy (0–20 eV), collimated electron beam for nanoscale surface structuring and as a diagnostic tool.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO Soft Matter and Biological Physics: NO

Quantum Physics: YES

Theoretical Physics: NO