Laboratoire Hubert Curien
UMR ▪ CNRS ▪ 5516 ▪ Saint-Étienne

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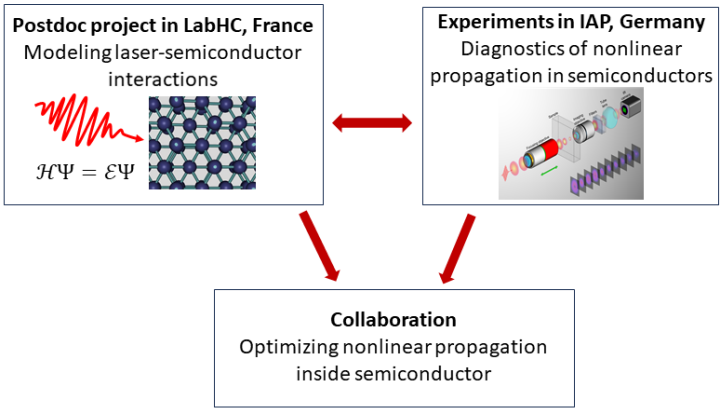
Postdoc Position

Quantum-mechanical modeling of ultrafast photoexcitation inside semiconductors

A postdoctoral position is available for up to 2 years at Laboratoire Hubert Curien (LabHC) in Saint-Étienne, France. The postdoc will work in the framework of the international project funded by French National Research Agency in collaboration with the Institute of Applied Physics, Jena, Germany. LabHC is jointly run by the CNRS (The French National Center for Scientific Research) and Jean Monnet University.

Objectives*:* The objective of the postdoc project is to develop a computationally efficient quantum-mechanical model of a femtosecond laser pulse propagation inside semiconductors such as Si and GaAs. It will be then used to plan and interpret experiments on laser energy deposition in the volume of semiconductors, performed in Germany. The final goal is to better understand and optimize the highly-precise three-dimensional modification of semiconductors, widely used in micro-electronics industry.



Research program*:*

- *Quantum-mechanical simulations* using Density Functional Theory (DFT) will be performed to calculate electronic properties of semiconductors (band structure, band gap, transition dipole moments).
- *Semiconductor Bloch Equations (SBE)* will be used to model electron excitation and relaxation processes after the interaction with an ultrafast infrared laser pulse.
- *Unidirectional Pulse Propagation Equation* (UPPE) will be coupled with DFT and SBE to describe the nonlinear propagation and estimate the absorbed laser energy.

Keywords: DFT, SBE, UPPE, nonlinear propagation, ultrafast laser pulse, semiconductors, simulation, theory

Qualifications*:* We are seeking a highly motivated candidate for working at the interface between condensed matter physics and photonics. The candidate should hold a PhD in physics or closely related field no later than May 2025. The candidate must have academic records/publications in the field of quantum mechanics and solid-state physics. Additional programming skills (Python, Fortran, Matlab, Julia, etc.) are requested.

Start date: April-May 2025
Salary conditions*:* monthly net salary 2000-2500€ depending on experience and skills.

How to apply*:* Interested candidate should send a CV and a short cover letter to:
Dr. Elena Kachan (elena.kachan@univ-st-etienne.fr)
Application deadline*:* April 1st, 2025.