PhD Program between Freie Universität Berlin (FUB) and the China Scholarship Council (CSC)

Open PhD Position at Freie Universität Berlin, offered only to Chinese CSC scholarship candidates 2027

Department/Institute: Physics

Subject area: Theoretical physics, Molecular physics, Quantum Optics

Name of Supervisor: Prof. Dr. Christiane Koch

Number of open PhD positions: 1 full-time

Type of the PhD Study: full-time

Project title: Theory of quantum control for trapped molecular ions

PhD Project description:

Molecules are far richer than atoms: they rotate, vibrate and can be chiral. This makes them ideal probes for precision spectroscopy, tests of fundamental physics, and understanding chemical reactions at the level of individual quantum states. The same richness, however, makes molecules hard to control. Atomic ions, in contrast, can be laser cooled to their motional ground state and controlled with exquisite precision, as demonstrated by today's best atomic clocks. Trapping a molecular ion together with atomic ions brings these two worlds together: the atomic ions serve as a handle on the molecule, to cool it and read out its state. The challenge is to derive control protocols that can cope with the complexity of the molecular structure. We have recently shown how even large molecules can be prepared in a single, well-defined quantum state (Leibscher, Blech, Koch, arXiv:2506.20846). The PhD project will develop this further and design protocols to prepare, control and probe the quantum states of trapped molecular ions. It offers training at the interface of molecular physics, quantum dynamics and scientific computing. All protocols will be developed with a view to their experimental feasibility, such that the student will acquire a solid theoretical foundation together with a working understanding of state-of-the-art experiments, an excellent preparation for a career in academic or industrial research.

Language requirements:

- IELTS: 6,5 oder TOEFL: 95 ibt

Academic requirements:

Master's degree in physics, with specialization in theoretical physics.
Knowledge of open quantum systems theory and/or molecular structure and dynamics as well as some experience with scientific computing are advantageous.

Information of the professor or research group leader (website, awards etc.):

https://www.physik.fu-berlin.de/en/einrichtungen/ag/ag-koch/index.html

Please note:
In a first step, the complete application should be uploaded to the online portal (https://fuberlin.moveon4.de/form/60acfece5d328710e40bdbd5/eng) for evaluation by January 15th, 2027.