



JOB POSTING

The **Max Planck Advanced Study Group** at the Center for Free Electron Laser Science (CFEL), located at DESY in Hamburg, Germany offers **PhD and postdoctoral positions** in **theoretical atomic, molecular and optical physics**

We offer one postdoctoral and two graduate student positions (PhD-thesis positions) in the field of theoretical/computational atomic, molecular and optical physics, with the focus of studying the interaction of ultrashort, high-intensity x-ray pulses with matter.

Project Description

The theoretical/computational projects will be in close collaboration with ongoing and future experimental campaigns at the new x-ray free-electron laser (XFEL) facilities, including the XUV FEL FLASH at DESY, Hamburg, Germany and the Linac Coherent Light Source (LCLS) at SLAC National Accelerator Laboratory, Stanford, USA.

Intensities achievable at these XFEL facilities enable, for the first time, the study of non-linear interactions of x-rays with matter and open the pathway to extend the field of quantum optics into the x-ray region. The interaction of a focused, non-attenuated XFEL beam with matter creates transient plasmas of high-ionization degree far from thermal equilibrium. Depending on the sample, a wide variety of plasma densities can be obtained, ranging from optically thin low-density plasmas (basically single atoms in a field), optically thick plasma channels in dense gases (strong coupling of matter and radiation), nano-plasmas (resulting from nano-sized objects like biomolecules or nano crystals) to warm-dense matter of solid-state density. Present theoretical descriptions of high-intensity XFEL-matter interaction are either limited to the quantum mechanical description of single atoms and small molecules, or are focused on the classical description of radiation-matter interaction (typically molecular dynamics codes) and thereby lacking the description of quantum phenomena in the proper way. The projects are aimed to the development of a theoretical testbed, to describe the creation and evolution of non-equilibrium plasmas by interaction of high-intensity x-ray radiation with dense gases and nano-sized solid-state density systems.

The successful candidates will develop quantum-classical descriptions of XFEL matter interaction, combining classical molecular dynamics with a quantum stochastic wave function approach. This method allows the study of the non-linear interaction of high-intensity x-rays with matter on both, microscopic (atomistic) and macroscopic scale. Specifically we will study the creation of plasmas by high-intensity x-rays and the propagation and scattering of x-rays through these plasmas. Resonant and non-
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inelastic x-ray scattering will be studied and new diagnostics based on non-linear resonant inelastic x-ray scattering will be explored. !

The positions offer a multidisciplinary and multicultural research environment and excellent working conditions through the Max Planck Society. The Phd students can join the **International Max Planck Research School (IMPRS)** on “**Dynamical Processes in Atoms, Molecules and Solids**” at the Technische Universität Dresden ([http:// www.imprs-dynamics.mpg.de](http://www.imprs-dynamics.mpg.de)) or the recently approved IMPRS on “**Ultrafast Imaging and Structural Dynamics**” (<http://www.imprs-ufast.de/>) at the University of Hamburg.

Requirements

Applicants for the PhD / postdoc positions are expected to have an excellent track record, a master or diploma / PhD in physics and excellent skills in spoken and written English. ! We are looking for highly motivated individuals with a background in theoretical atomic, molecular and optical physics, quantum optics, quantum chemistry or related fields. A diploma/PhD in theoretical physics or quantum chemistry is preferred, but applicants from the field of experimental physics with experience in ultrafast, high-field laser physics or experience in working at synchrotron or FEL user facilities with a strong interest in theoretical modeling are welcome to apply.

The Max Planck Society is an equal opportunity employer and seeks to increase the percentage of female employees in areas where they are under-represented. Qualified women are strongly encouraged to apply. The Max Planck Society is committed to employing more handicapped individuals and especially encourages them to apply.

Candidates should send their formal application per email as a single pdf-file, containing - a brief motivation letter, indicating interests and former research experience - a Curriculum Vitae, including publication list and references. Please arrange also for two letters of recommendation to be sent per email to nina.rohringer@asg.mpg.de

Review of applications begins immediately and positions remain open until filled.

Further information

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