

Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter



IMPRS UFAST Call for PhD applications 2022/2023

HC1- Convergent-beam diffraction using synchrotron and XFEL sources



Title of PhD Project	Convergent-beam protein crystallography
Type	Experimental
Supervisor(s)	Prof. Henry Chapman Dr. Chufeng Li
Affiliation(s):	UHH, DESY
Number of positions:	2
Abstract:	Using new multilayer diffractive lenses developed at DESY, it is now possible to focus X-rays to spot sizes of several nanometers—smaller than the size of a single protein molecule or the unit cell of a protein crystal. When a crystal is placed in the focus, the Bragg peaks that are usually observed in protein crystallography are spread out and interfere with each other. This interference directly encodes the phases of the diffraction orders, but is sensitive to the relative position of the focus to the crystal lattice. Algorithms originally developed for ptychography or image classification will be used to determine these positions and extract the diffraction phases used to synthesize 3D molecular images. When the crystal is placed far out of focus, there is a correlation between the location of the intersection of a ray with the crystal and its angle of incidence, opening a new way to tomographically measure crystal morphology at high resolution and improve the accuracy of crystallographic analysis for structure determination. These projects will explore both regimes in experimental campaigns at synchrotron sources and the European XFEL. Candidates will contribute to these experiments and develop algorithms and analysis methods to solve the molecular structure as well as the crystal structure and defects. The multiscale X-ray imaging methods described above are applied in both materials and life sciences.
Contact person for scientific questions about the project:	Henry Chapman, henry.chapman@desy.de Chufeng Li, chufeng.li@desy.de

