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 2026/2027

NH - Understanding light-initiated quantum pathways in catalytic transition metal complexes with ultrafast X-ray spectroscopy

Title of PhD Project	**Understanding light-initiated quantum pathways in catalytic transition metal complexes with ultrafast X-ray spectroscopy**
Type	Experimental
Supervisor(s)	Nils Huse
Affiliation(s):	UHH
Number of positions:	1
Abstract:	Transition-metal complexes are widely found in natural enzymes. Their ability to exist in different oxidation states allows storing and withdrawing valence charge density without the need for radical formation. We study light-induced processes in transition-metal complexes to elucidate reaction pathways[1-3] that require high time-resolution because the excited states and product intermediates are short-lived and thereby elusive to techniques that lack femtosecond response functions. We employ time-resolved spectroscopy to understand catalytic systems with emphasis on fundamental research and method development. Of particular interest is the use of X-ray spectroscopy because of its inherent element-specificity. The short wavelengths also permit the measurement of atomic distances by ultrafast X-ray scattering. The project will employ X-ray and optical lasers to investigate small molecular systems in solution. Ultrafast in-house laser labs require good understanding of optics and lasers as well as quantum mechanics and/or quantum chemistry. Measurement campaigns at large-scale user facilities such as X-ray lasers in Hamburg, Switzerland, Korea and California will also be part of the project which is international and interdisciplinary in character. 1. R. Jay et al, *J. Am. Chem. Soc.* **146**, 14000 (2024) 2. A. Banerjee et al, *Chem Sci.* **15**, 2398 (2024) 3. R. Jay et al, *Science* **380**, 6648, (2023)
Contact person for scientific questions about the project:	Nils Huse: nils.huse@uni-hamburg.de
Research Group Website:	https://www.physik.uni-hamburg.de/en/inf/ag-huse.html