



IMPRS UFAST Call for PhD applications 2022/2023

AC3- Investigating the magnetic properties of Light Induced Superconductors



Title of PhD Project	Investigating the magnetic properties of Light Induced Superconductors
Type	Experimental
Supervisor(s)	Prof. Andrea Cavalleri
Affiliation(s):	Max Planck Institute for the Structure and Dynamics of Matter
Number of positions:	1
Abstract:	<p>Ultrashort light pulses can be used to manipulate materials at femtosecond timescales and induce exotic phenomena such as light-induced superconductivity. Recently, we have discovered that in some organic superconductors, intense excitation with mid-infrared pulses induces a metastable superconducting-like state close to room temperature.</p> <p>So far, these out-of-equilibrium superconducting-like states have been investigated only using optical spectroscopy techniques, revealing signatures of a state with perfect conductivity, the first requirement for a material to be a superconductor. The second cornerstone of superconductivity necessitates a material to expel magnetic field flux from its volume, in a phenomenon known as Meißner effect. To ascertain whether these out-of-equilibrium superconducting-like states also satisfy this second requirement, we have developed a novel optical magnetometry technique that is able to track subtle changes in magnetic fields at the sub-picosecond timescale.</p> <p>As a PhD student working on this project, you will focus on furthering development of this novel optical magnetometry techniques. You will design and realize cutting-edge pump-probe setups that make use of intense mid-infrared excitation pulses to drive unconventional superconductors. You will perform experiments, aimed at measuring the magnetic properties of these materials in the perturbed state. This will provide a deeper understanding of the light-induced superconducting state, allowing to ascertain whether it has full similarity with equilibrium superconductivity or is a completely new state of matter without any equilibrium analogue.</p>
Contact person for scientific questions about the project:	Andrea Cavalleri andrea.cavalleri@mpsd.mpg.de Michele Buzzi michele.buzzi@mpsd.mpg.de