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 2023/2024

AC2-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:	Ultrashort light pulses can be used to manipulate materials at femtosecond timescales and induce exotic phenomena. Recently, we have discovered that in some unconventional superconductors, intense excitation with mid-infrared pulses induces a superconducting-like state close that persists up to room temperature. 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. 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 determine whether it has full similarity with equilibrium superconductivity or is a completely new state of matter without any equilibrium analogue.
Contact person for scientific questions about the project:	Prof. Andrea Cavalleri: andrea.cavalleri@mpsd.mpg.de Dr: Michele Buzzi: michele.buzzi@mpsd.mpg.de