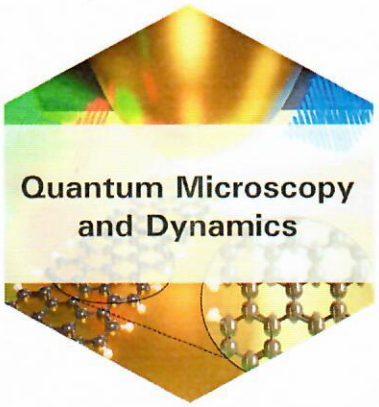
Max-Planck-Institut für Festkörperforschung

Seminar Abteilung Kern



Friday, May 24th, 2024, 11:00 AM, 4D2

Ravi Bhardwaj

University of Ottawa, Canada

Selective and tunable absorption of helical light beams in matter

Selective absorption of light at certain frequencies is responsible for the color of an object and is a consequence of discrete energy levels of atoms or molecules in matter. Selective absorption also occurs by changing the handedness of the polarization of light interacting with a non-superimposable mirror image of a chiral object, for example in circular dichroism. As for tunability of light absorption, it is typically achieved by fabrication of optoelectronic devices consisting of plasmonic nanostructures or by electrical tuning of a thin film absorber. In my presentation, I will demonstrate that the phase of light can be exploited to achieve selective and dynamic tuning of absorption in liquids, solids, plasmonic metasurfaces and gas-phase atoms and molecules. First, I will introduce a conceptually new form of chiroptical detection technique based on nonlinear absorption of linearly polarized helical light beams. The handedness of such helical light beams is defined by the twisting of the wavefront undergoing l intertwined rotations in one wavelength resulting in an orbital angular momentum (OAM) of lħ. Since there is no upper bound on the l value, this additional degree of freedom leads to enhanced and scalable enantioselectivity in chiral systems. Second, I will show that differential absorption of polarized light called dichroism exists in achiral systems and can be precisely controlled by displacing the phase singularity present in helical beams. Third, I will discuss the feasibility of achieving sub-wavelength spatial resolution in imaging using helical light beams and extend the ideas to strong field ionization of atoms and molecules.

M. Garg (1637)