

CONDENSED MATTER SCIENCES SEMINAR

Professor Anshul Kogar

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Host

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Title

Breaking symmetries by shining light through transparent solids

Friday, September 12th, 2025

1st Floor – B101

15:00-16:00

Abstract

For centuries, we have known that when light propagates through a transparent solid, it can exhibit birefringence, refraction and dispersion. However, until relatively recently, it has been more challenging to experimentally address the corresponding question: what happens to the solid as light propagates through it? In this talk, I will outline processes by which rectified responses can be observed when the electronic degree of freedom is driven with the oscillating electric field of light. I will share data from our group on Cr₂O₃, a system where antiferromagnetic order breaks inversion symmetry, but crucially, preserves PT symmetry. When linearly polarized light is transmitted through this system, the crystal exhibits broken rotational symmetry through optical rectification. Using interferometric time-resolved second harmonic generation, I present evidence which indicates that the broken symmetry state occurs only in the electronic subsystem, leaving the spin and lattice largely unperturbed. The axis of broken rotational symmetry can be controlled with the polarization of the incident light. Last, I will speculate on the origin of this response by considering the possibilities of orbital magnetization, electronic polarization and light-induced photo-currents. Based on recent controversial theoretical work predicting such a phenomenon, I suggest that the observations stem from light-induced photo-currents.