Department of Physics
Condensed Matter Physics
Clarendon Laboratory, Parks Road, Oxford OX1 3PU

UNIVERSITY OF OXFORD

CONDENSED MATTER PHYSICS SEMINAR

Thursday 7 May at 14:30
Simpkins Lee Seminar Room, Department of Physics
(https://maps.app.goo.gl/WjG71uLF2D48n85B6)

Unconventional superconductivity in materials with strong spin-orbit coupling

Professor Irina Grigorieva
University of Manchester

I will overview our recent work on layered superconductors where signatures of unconventional superconductivity are revealed or sometimes promoted by their response to magnetic fields. Magnetic correlations and superconductivity are usually antagonistic. However, in some situations external magnetic fields can be helpful in bringing to light new superconducting properties. An example is magnetic field induced transitions between superconducting states with different pairing symmetries as found in a heavy Fermion superconductor $CeRh_2As_2$, ion-intercalated MoS_2, and a layered centrosymmetric superconductor β-$PdBi_2$. Our tunnelling spectroscopy on β-$PdBi_2$ under in-plane magnetic fields revealed a transition from conventional s-wave pairing to a nodal p-wave superconducting state. We show that the transition, marked by a discontinuous change in the tunneling spectra, originates from spin polarization and spin–momentum locking due to locally broken inversion symmetry. Remarkably, signatures of this transition also appear in magnetization, indicating the formation of a novel domain structure consisting of coexisting p-wave superconducting and normal regions. These findings offer a new experimental window into how spin textures, symmetry breaking, and strong spin–orbit coupling can stabilize unconventional superconductivity and generate emergent magnetic responses in layered materials.

Host: Professor Amalia Coldea