

Quantum oscillations hosted by unconventional pseudogap state in the underdoped cuprate superconductors

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Abstract: The underdoped cuprate superconductors host a breadth of intriguing behaviours. High temperature superconductivity, the mysterious pseudogap phenomenon and charge density wave order all interplay with each other in the underdoped regime of the cuprates. The observation of quantum oscillations with Fermi Dirac statistics in this mysterious regime presents a conundrum. We discuss the nature of the unconventional pseudogap state that we find to host quantum oscillations while remaining superconducting up to high magnetic fields.

Bio: Suchitra Sebastian is Professor in Physics and EPSRC Established Career Fellow at the University of Cambridge. Her research seeks to discover exotic quantum phases of matter in complex materials. To this end, her group's experiments involve tuning the co-operative behaviour of electrons within these materials by subjecting them to extreme conditions including low temperature, high applied pressure, and intense magnetic field. Under these conditions, interactions between a trillion trillion electrons, as many as the stars in the observable universe, create surprising and unpredictable collective quantum phases akin to new materials 'universes'. Emergent quantum phenomena studied by Suchitra's research group include high-temperature superconductivity and a new unconventional insulating state of matter they recently discovered. Most recent awards Suchitra has received include the New Horizons in Physics Prize (2022) awarded by the Breakthrough Foundation and the Schmidt Science Polymath award (2022). Suchitra is founder director of the Cavendish Arts Science programme, and co-founder of Bread Theatre and Film Company. She participates in scientific research for non-imperialistic, non-militaristic purposes.

