INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE
2A & 2B, Raja S.C. Mullick Road, Jadavpur, Kolkata-700032, India

Seminar Notice

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School of Physical Sciences

Title:	**Vortex state in a thin film of disordered superconductor in the presence of an orbital magnetic field**
Speaker:	**Amit Ghosal, IISER, Kolkata**
Date:	**October 17, 2019 (Thursday)**
Time:	**16:00**
Venue:	**Physics Seminar Room (C-406), 3rd Floor, Centenary Building, IACS**
Abstract:	Orbital magnetic field and strong disorder weaken superconducting correlations acting individually on a type-II s-wave superconductor. The Abrikosov vortex lattice, resulting from the applied magnetic field, melts with an increase of the strength of the field, turning the system into a metal. Similarly, the presence of disorder causes a superconductor to insulator transition beyond a critical strength of disorder. Here we show that the interplay of these two perturbations, when present simultaneously in a two-dimensional superconductor, leads to its intriguing evolution. In particular, we show that the local superconductivity can actually strengthen due to interesting spatial reorganization or order parameters in the presence of strong disorder. While at weak disorder strengths the critical magnetic field for the suppression of superconducting energy gap matches with the critical field at which superfluid density vanishes, the two 'critical' fields diverge from each other with the increase of the disorder strengths. Our results provides natural explanation for the strong magnetoresistance peak observed in disordered superconducting thin films of Indium Oxide and Titanium Nitride. We illustrate this by calculating the dynamical conductivity using Kubo formula and analyzing its low-frequency behavior. We also demonstrate that the presence of even weak disorder causes the Caroli-deGennes-Matricon zero-bias peak in vortex-core density of states to disappear. The origin and consequences of such dramatic behaviors will be discussed. This intriguing result is consistent with the scanning tunneling microscopy measurements on amorphous vortex state of disordered Niobium Nitride films. The degree and nature of disorder induced inhomogeneities in the experiment will be shown to match surprisingly well with our theoretical calculations.

All are cordially invited to attend the seminar