**Prof. Pratap Raychaudhuri**

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## Introduction to speaker:

Prof. Pratap Raychaudhuri is currently Professor of Physics at Indian Institute of Technology (IIT), Bombay, India. He did his Integrated M.Sc. in Physics at Indian Institute of Technology (IIT), Kharagpur. He pursued his Ph.D in Physics from IIT Bombay. He has worked as post-doctoral fellow at University of Birmingham & University of St. Andrews, UK. His major research interests are; study of unconventional and disordered superconductors using a variety of techniques such as, scanning tunneling spectroscopy, planar junction spectroscopy, penetration depth measurements, magnetotransport and Hall Effect measurements. He is the recipient of Elected as a member of the IUPAP commission for Low Temperature Physics (2018), Elected Fellow of the Indian Academy of Science, Bangalore (2015), Shanti Swarup Bhatnagar Prize in Physical Sciences (2014) and NASI-Scopus Young Scientist Award (2009).He is has many journal publications in the area of superconductivity.

**Title:**

# "Observation of hexatic vortex fluid in a thin superconducting film"


**Abstract:**

In 1969, working on a theoretical problem out of pure mathematical curiosity, David Thouless stumbled upon a new kind of phase transition, across which physical properties show abrupt change but the free energy varies smoothly. Very soon, Michael Kosterlitz and David Thouless realized that this kind of phase transition could be ubiquitous across 2-dimensional (2D) systems. For the particular case of a 2-dimensional crystalline solid, the (Berezinski)-Kosterlitz-Thouless (BKT) theory predicts that the solid melts via a novel intermediate state, called the hexatic fluid, which possesses the orientational order of a solid but the flow properties of a fluid.

Over the years there have been several attempts to test the BKT theory in diverse 2D systems such as electrons over a liquid He surface, inert-gas monolayers adsorbed on graphite, vortices in superconducting thin films and colloidal crystals, but unambiguous identification of hexatic fluid phase has been very few. Indeed, according to the various experimental conditions one can either prove the occurrence of the melting transition at the expected value, or the existence of an orientational order when the translational one is lost, but the simultaneous observation of the two features has so far been available only in the case of some magnetic colloidal crystals. Recently, using a combination of real space imaging and transport measurements we unraveled the hexatic vortex fluid state in a thin film of the amorphous superconductor, MoGe [1]. In this talk I will discuss the properties of this hexatic vortex fluid, and present results that points towards the possibility of this state being a quantum fluid. I will also contrast the hexatic vortex fluid with the hexatic glass observed in more disordered superconductors.


**Reference**


1. I. Roy et al, arXiv:1805.05193 (to appear in Phys. Rev. Lett.)