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

Seminar Notice

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Theoretical Physics Department

Title:	**Classical and quantum melting of Wigner "solids" in confinements**
Speaker:	**Amit Ghoshal, IISER, Kolkata**
Date:	**May 12,2017 (Friday)**
Time:	**04:00 p.m.**
Venue:	**Theoretical Physics Seminar Room (R/No.-C406), 3rd Floor, Centenary Building, IACS**
Abstract:	We present responses of a small number of Coulomb-interacting particles confined in two-dimensional geometries, across the crossover from their solid- to liquid-like behaviors. Here, irregular geometries emulate the role of disorder on such `melting'. Focusing first on the thermal melting, where zero-point motion of the particles are frozen out, we explore the signatures of a hexatic-glass like behavior in irregular confinements. While static correlations, that investigate the translational and bond orientational order, resemble hexatic-like phase at low temperatures, dynamics of the particles slow down considerably. Using density correlations we probe intriguing inhomogeneities arising from the interplay of the irregularity in the confinement and long-range interactions. The relaxation at multiple time scales show stretched-exponential decay of spatial correlations in irregular traps~\cite{Ref1,Ref2}. Temperature dependence of characteristic time scales, depicting the structural relaxation of the system, show strong similarities with those observed for the glassy systems. Our results indicate that some of the key features of supercooled liquids emerge in confined systems with lower spatial symmetries.

	Subsequently, we extend our studies to include the effects of quantum fluctuations. Our results, using quantum (path integral) Monte Carlo techniques for Boltzmann particles, seem to indicate complementary mechanisms for the quantum and thermal crossovers in Wigner molecules~\cite{Ref3}. The phase diagram as a function of thermal and quantum fluctuations are determined using independent criteria. Both the thermal and quantum crossovers are associated with production of defects. However, these defects appear to play distinct roles in driving the quantum and thermal "melting". We will also discuss our recent analyses upon including the effects of quantum statistics.

All are cordially invited to attend the seminar