Theoretical Statistics and Mathematics Unit, Kolkata
INDIAN STATISTICAL INSTITUTE

SEMINAR

Date: July 30, 2025
Time: 04:15 PM

VENUE:

L- Infinity
(5th Floor, A.N. Kolmogorov Bhavan), ISI Kolkata

TITLE:

Stochastic systems with long-range correlation structures

SPEAKER:

Dipranjan Pal
Stat-Math Unit, ISI Kolkata

ABSTRACT:

The long-range dependence is a common feature in models from statistical physics and random networks such as the Ising and Potts model, (dependent) percolation models, random hypergraphs, etc. In this talk, I shall discuss two random ensembles where long-range correlation structure is intrinsic in nature. The first model is a Gaussian symmetric random matrix X_n, with zero-mean, unit variance entries satisfying the condition $\sup_{(i,j)\neq(i',j')} |E[X_{ij}X_{i'j'}]| = O(n^{-(1+\varepsilon)})$, where $\varepsilon > 0$. It follows from Catalano et al.(2024) that the empirical spectral distribution of $n^{-1/2}X_n$ converges weakly almost surely to semi-circle law. We show that the largest eigenvalue of $n^{-1/2}X_n$ converges to 2 almost surely. Also we study fluctuation of the largest eigenvalue when entries of X_n have a non-zero mean. The second model is a dependent percolation model. Fix an integer $d \geq 3$ and $\alpha > 0$, consider a sequence of d-regular α-expanders $(\mathcal{G}_n)_{n\geq 1} = ((V_n, E_n))_{n\geq 1}$ such that $\lim_{n\to\infty} |V_n| = \infty$. We consider the level-set percolation of zero-average Gaussian Free Field (GFF) on the metric graph $\widetilde{\mathcal{G}}_n$ associated with $\mathcal{G}_n$. In this recent work, we have discovered that a unique giant component arises in supercritical regime but the volume of the second largest cluster remains $O(\log |V_n|)$ with high probability. This behavior is quite different from Bernoulli percolation on finite expander graphs. Also we present some results about the volume of the largest cluster in critical and near-critical regimes.

ALL ARE CORDIALLY INVITED