Non-equilibrium Dynamics and Random Matrices

Sunday, September 1, 2013 (All day) - Friday, August 1, 2014 (All day)
2013-2014

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Over the past few decades there has been considerable progress in the mathematical analysis of equilbrium statistical mechanics. However, non-equilibrium dynamics is still at early stages of its development. Recent developments suggest that this is a good time for the proposed program. Dynamics related to Dyson's Brownian motion has played a key role in the recent proof of the universality of the local eigenvalue spacing statistics for Wigner matrices. There have also been recent advances in the fluctuations of stochastically driven equations such as KPZ and dynamics of glassy models.

Horng-Tzer Yau (Harvard) will be the School's Distinguished Visiting Professor and will lead the program with Tom Spencer of the Institute. Jürg Fröhlich, Joel Lebowitz and Herbert Spohn will be among the senior participants.

This program will address the following specific topics:

1. Universality of the eigenvalue spacing distribution of random band matrices and of random sparse matrices. These models should shed some light on the original vision of Wigner that random matrices describe highly correlated quantum systems. A closely related goal is the study of the long time dynamics of a quantum particle in a random potential or a phonon heat bath in 3 dimensions.
2. The Kardar-Parisi-Zhang equation (KPZ) is equivalent to a stochastically driven Burgers equation. Its fluctuations are believed to govern the interfaces of a 2D random, ferromagnetic Ising model, asymmetric exclusion processes, and fluctuations of the longest increasing sequence for a random permutation. The aim is to explore the universality of the resulting probability distribution.

terms:

- special year