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FÜR MATHEMATIK, INFORMATIK
UND NATURWISSENSCHAFTEN
Fachbereich Mathematik

Kolloquium über Mathematische Statistik und Stochastische Prozesse

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Hydrodynamic Limits and Non-Equilibrium Fluctuations for the Symmetric Inclusion Process with Long Jumps

Abstract:
In this talk, we explore scaling behaviors of the symmetric inclusion process—a stochastic particle system where particles can randomly "attract" each other. Unlike classical models where particles interact only with nearby neighbors, we focus on systems where particles can interact over arbitrarily large distances (long jumps).
Despite the fundamental difference between inclusion dynamics (attraction) and exclusion dynamics (repulsion), we demonstrate striking parallels in their large-scale behaviors. Our work establishes two key results:

1. Under appropriate scaling, the macroscopic density profile of the inclusion process evolves according to the same non-local equation that governs the exclusion process with identical jump rates.

2. More significantly, we characterize how random fluctuations in the particle density evolve when starting from non-equilibrium conditions. We prove that these fluctuations converge to a time-dependent generalized Ornstein Uhlenbeck process—a type of infinite-dimensional random evolution. Remarkably, this process bears a direct mathematical relationship to the one observed in the exclusion process with long jumps. This is joint work with Johannes Zimmer.

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