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Department Colloquium

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Stochastic quantization of Yang-Mills

Abstract:

The Yang-Mills model is a theoretical framework for fundamental forces and elementary particles. It has made deep impacts in various branches of mathematics. A key challenge in mathematical physics is to construct the quantum Yang-Mills theory on four dimensional space and prove the existence of a "mass gap". In this talk, we will discuss stochastic quantization i.e. Langevin dynamics of the Yang-Mills model on two and three dimensional tori. This is a stochastic process on the space of "gauge orbits", induced by the solution to a nonlinear Lie algebra-valued stochastic PDE driven by space-time white noise. The presence of very singular random forcing as well as nonlinearities render it challenging to interpret what one even means by "solutions", "state space", "orbit space" and "gauge invariant observables". We rigorously construct these objects by combining techniques from analysis, PDE, Stochastic PDE, and especially the theory of regularity structures. The talk is based on joint work with Ajay Chandra, Ilya Chevyrev, Martin Hairer, among many other collaborators.

Todd Kemp

January 23, 2023

4:00 PM

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