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Faculty of Physics

Seminar

Theoretische Physik—Theorie der kondensierten Materie

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Quantum scars and Hilbert space fragmentation of color and ice

Non-equilibrium properties of quantum materials present many intriguing properties, among them athermal behavior, which violates the eigenstate thermalization hypothesis. Such behavior has pri-marily been observed in disordered systems. More recently, experimental, and theoretical evidence for athermal eigenstates, known as \quantum scars", has emerged in non-integrable disorder-free models in one dimension with constrained dynamics [1]. I will focus on directions that my group is pursuing in the context of geometrically frustrated magnets. First, I show the existence of quantum scar eigenstates and investigate their dynamical properties in many simple two-body Hamiltonians with staggered interactions, involving ferromagnetic and antiferromagnetic motifs, in arbitrary dimensions. These magnetic models include simple modcations of widely studied ones (e.g., the XXZ model) on a variety of lattices [2]. I will demonstrate our ideas by focusing on the two-dimensional frustrated spin 1/2 kagome antiferromagnet, which was previously shown to harbor a special exactly solvable point with "three-coloring" ground states in its phase diagram [3,4,5]. Next, I discuss how Hilbert space fragmentation naturally arises in many frustrated magnets with low energy \ice manifolds" which gives rise to a broad range of relaxation times for diﬀerent initial states [6]. We study the Balents-Fisher-Girvin Hamiltonian, and a phenomenological three-coloring model with loop excitations (previously explored in the context of quantum spin liquids), both with constrained Hilbert spaces. We characterize the formation of the fragmented Hilbert space of these Hamiltonians, their level statistics, and initial state dependence of relaxation dynamics to develop a coherent picture of glassiness in various limits of the XXZ model on the kagome lattice.

Thursday, 06. May 2021, 16.00 hrs MESZ

Zoom Konferenzschaltung— Please contact Jürgen Schnack (jschnack@uni-bielefeld.de) for details regarding access

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[2] K. Lee, R. Melendrez, A. Pal, H.J. Changlani, Phys. Rev. B 101, 241111(R) (2020)

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