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Signatures of integrability/non-integrability in two-dimensional quantum spin systems: local conserved quantities, operator growth, and complex-time evolution

Wednesday, June 11, 2025 11:30 AM (1h 30m)

In the first part of the talk, I will discuss our recent result on the absence of local conserved quantities in a wide class of standard S=1/2 quantum spin systems in two or higher dimensions. This is an extension of Shiraishi's 2019 work on spin chains. I will also discuss related observations about the absence of quasi-local conserved quantities and spectrum generating algebra.

In the second part, I will discuss closely related (but essentially different) problems of operator growth. We shall present some rigorous results for the Lanczos coefficients that are consistent with the universal operator growth hypothesis of Parker, Cao, Avdoshkin, Scaffidi, and Altman. More precisely, we prove that the Kitaev honeycomb model exhibits the behavior expected for an integrable model, while the XY or the Heisenberg model exhibits the behavior expected in quantum chaotic systems. We shall also discuss the related problem of complex-time evolution of operators.

The present talk is mostly based on my joint work with Naoto Shiraishi.

Presenter: TASAKI, Hal