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Spin Transport in Perturbed Quantum Integrable Chains

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In the context of quantum transport, the XXZ (or anisotropic Heisenberg) chain is a paradigmatic many-body model, featuring a wide spectrum of spin transport behaviour at finite temperature. Although the unperturbed model is analytically solvable, understanding the effects of even weak integrability-breaking perturbations (IBP) remains an open problem. The primary aim of this talk is to highlight the effects of IBP on the spin transport i) in the easy-axis regime and ii) at the isotropic point of the XXZ chain. In particular, I will show that the anomalous (dissipationless) spin diffusion of the integrable easy-axis XXZ chain is replaced by a normal spin diffusion upon the addition of perturbation. Such a fundamental change in the nature of diffusion is reflected via discontinuous variation of the dc diffusion constant as a function of the perturbation. Next, the impact of the symmetry of IBP on the spin superdiffusion at the isotropic point of the integrable XXZ chain will be addressed. In this context, our study unveils several remarkable properties: i) the effects of IBP preserving spin isotropy being qualitatively different from anisotropic IBP, ii) isotropic IBP leads to a pronounced maximum of the diffusion constant at the isotropic point as the function of spin anisotropy, and iii) robustness of superdiffusion on finite systems even at appreciable perturbation strengths.

Presenter: NANDY, Sourav

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