Speaker: **Wei Wei HO (NUS, Singapore)**

Title: **Asymmetric decay of quantum many-body scars in XYZ quantum spin chains**

Quantum many-body scars are atypical energy eigenstates of chaotic quantum many-body systems that prevent particular non-equilibrium initial conditions from thermalizing. In this talk, I will point out that quantum many-body scarring is in fact a ubiquitous phenomenon in quantum spin chains: concretely, every nearest-neighbor XYZ Heisenberg model in 1D hosts a continuous family of exact high-energy product-state eigenstates, regardless of spin-quantum number S. This set of scars, originally discovered by Granovskii and Zhedanov in 1985, encompasses both the experimentally relevant 'spin helices' for XXZ chains and more complicated helix-like states constructed from Jacobi elliptic functions for generic XYZ chains. I will then describe our theoretical understanding of these scars' dynamical instability to small perturbations of the Hamiltonian. Utilizing time-dependent spin-wave theory, we predict that Granovskii-Zhedanov scars can exhibit a dramatic and surprising asymmetry in their relaxation: for certain perturbations, their decay is either slow and linear, or fast and exponential, depending on the sign of the perturbation. Further, their decay rates are non-analytic with the perturbation strength. Numerical simulations using matrix product states (MPS) and infinite time-evolving block decimation (iTEBD) confirm our predictions remain valid even far from the semiclassical limit. Our findings challenge existing theories of how quantum-many body scars relax.