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Ultra-Local Flat Bands, Carroll Symmetry, and Higher-Order Topology in 1D and 2D Fermion Models

Tuesday 2 December 2025 13:30 (1 hour)

I will discuss a unified approach to constructing exactly flat bands in 1D and 2D lattice models using algebraic ultra-locality conditions equivalent to emergent Carroll symmetry. In 1D, this leads to compact localised states, commuting Hamiltonian densities, strictly local correlations, and subsystem-size independent entanglement entropy. Carroll-preserving interactions produce solvable quantum phases and Hilbert-space fragmentation. Extending these ideas to 2D yields a minimal four-band model that realises a higher-order topological insulator with protected corner states, along with characteristic entanglement and magnetic-flux responses. The talk highlights how Carroll symmetry provides an organising principle for designing flat-band systems with rich dynamical and topological structure.

Presenter: BASU, Rudranil