

Theory of Condensed Matter: Hard Condensed Matter

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Media Room 03-431 (Staudingerweg 7)

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Emergent topology and symmetry-breaking order in correlated quench spin dynamics

Quenching a quantum system involves three basic ingredients: the initial phase, the post-quench target phase, and the induced non-equilibrium dynamics which carries the information of the former two. In this talk, I will introduce how to characterize topological quantum phases by far-from-equilibrium quantum dynamics induced by quench, and further probe dynamically both the topology and symmetry-breaking orders in correlated topological systems. The generic theory is established by showing a dynamical bulk-surface correspondence, which connects the bulk topology of topological phases to dynamical topological pattern of quench dynamics emerging in the so-called band-inversion surfaces (BISs) in momentum subspace, similar to the well-known bulk-boundary correspondence in the real space. In the interacting regime, we show that the complex (pseudo)spin dynamics are governed by a microscopic Landau-Lifshitz-Gilbert-Bloch equation and find that, with the particle-particle interaction playing crucial roles, the correlated quench dynamics exhibit robust universal behaviors on the BISs, from which the nontrivial topology and magnetic orders can be extracted. In particular, the topology of the post-quench system can be characterized by an emergent dynamical topological pattern of quench dynamics on BISs, which is robust against dephasing and heating induced by interactions; the pre-quench symmetry-breaking orders can be read out from a universal scaling of the quench spin dynamics emerging on the BIS, which is valid beyond the mean-field approximation. These results may show insights into the exploration of novel correlation physics with nontrivial topology by quench dynamics.

References:

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