Quantum information scrambling in topologically non-trivial systems

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Despite the unitarity of quantum time evolution, initially local quantum information can spread over many degrees of freedom, becoming effectively inaccessible to local measurements. This process, commonly characterized by out-of-time-ordered correlators (OTOCs), provides a dynamical diagnostic of scrambling and operator growth. Recent results indicate that in systems with nontrivial topological invariants, the scrambling of local perturbations can be strongly constrained: information may remain localized near the boundary, preventing its full delocalization into the bulk in both one- and two-dimensional settings [1, 2]. Interactions enrich this picture by introducing additional relaxation and dephasing channels. Although weak interactions need not destroy the underlying topological phase, they can substantially modify the characteristic timescales and spatial structure of OTOCs. In this talk, I will present analytical and numerical results on information scrambling in interacting topological systems, with particular emphasis on the competition between topological boundary protection and interaction-induced many-body dynamics.

Acknowledgments *N.S. and S.G. acknowledge the support from the National Science Centre (NCN, Poland) under the grant 2024/53/B/ST3/02600.*

References

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