Quantum driven dissipative systems and their topological properties

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We bring the classical nonlinear vector flow topology to the quantum realm. Using the master equation description and unraveling the density matrix via the truncated Wigner approximation, we demonstrate that these topological features persist in the quantum regime. In my talk, I will show how dynamical topology reveals fundamental differences between unraveled and averaged descriptions, uncovering the topological origin of phase transitions---even without Liouvillian gap closure. Moreover, I highlight the interplay between topological properties and multiphoton resonances, a purely quantum effect with no classical analogue. This work bridges classical and quantum perspectives, paving the way for realizing many-body topological phases in quantum simulators.

Figure

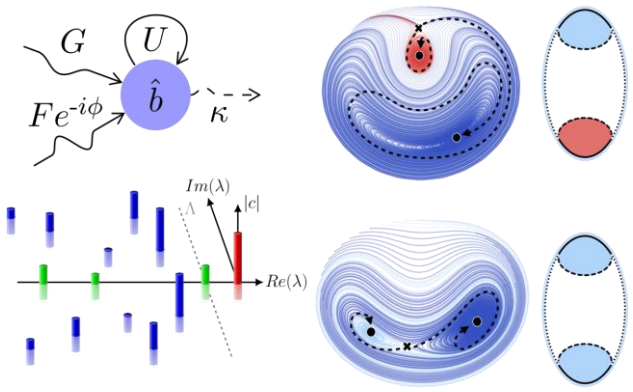

Figure 1: Scheme of the driven dissipative nonlinear quantum system, Liouvillian spectrum description, vector flow, and associated topological graph index that accounts for particle- and hole-like nature of excitations.

References

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