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Geometrical, response, and gap properties of Lindbladians VICTOR V. ALBERT, Yale University, BARRY BRADLYN, Princeton University, MARTIN FRAAS, University of Munich, LIANG JIANG, Yale University — We study Lindbladians admitting multi-dimensional steady-state subspaces (SSS) which can be used to store, protect, and process quantum information. We derive an analytical formula for the left eigenmatrices of such Lindbladians corresponding to purely imaginary eigenvalues. This formula resolves how Lindbladian evolution affects perturbative response and geometrical features of the SSS and allows us to generalize recent work to all types of SSS. We show that Hamiltonian and certain jump operator perturbations induce, to first order, exclusively unitary evolution on the SSS. Similarly, the holonomy (generalization of geometric phase) induced on the SSS after adiabatic traversal of a closed path in parameter space is unitary. We derive a new Riemannian metric tensor in parameter space induced by one type of SSS, generalizing the Fubini-Study metric to Lindbladians possessing one or more mixed steady states. We derive a Kubo formula governing linear response of the SSS to Hamiltonian perturbations. Finally, we show that the energy scale governing leakage out of the SSS is different from the conventional Lindbladian dissipative gap.

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