Title:	Geometric decomposition of geodesics and null-phase curves using Majorana star representation
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Abstract:	Geodesics are the shortest curves between any two points on a given surface. Geodesics in the state space of quantum systems play an important role in the theory of geometric phases, as these are also the curves along which the acquired geometric phase is zero. Null-phase curves (NPCs) are the generalization of the geodesics, which are defined as the curves along which the acquired geometric phase is zero even though they need not be the shortest curves between two points. Here, we present a geometric decomposition of geodesics and NPCs in higher-dimensional state space, which allows understanding of the intrinsic symmetries of these curves. We use Majorana star representation to decompose a geodesic in the n -dimensional Hilbert space to n − 1 curves on the Bloch sphere and show that all the n − 1 curves are circular segments with specific properties that are determined by the inner product of the end states connected by the given geodesic. We also propose a method to construct infinitely many NPCs between any two arbitrary states for (n > 2) -dimensional Hilbert space using our geometric decomposition.
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