

Abstract Submitted
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Dephasing representation of quantum fidelity for general pure and mixed states JIRI VANICEK, Institute for Advanced Study, Princeton — General semiclassical expression for quantum fidelity (Loschmidt echo) of arbitrary pure and mixed states is derived. It expresses fidelity as an interference sum of dephasing trajectories weighed by the Wigner function of the initial state, and does not require that the initial state be localized in position or momentum. This general *dephasing representation* is special in that, counterintuitively, all of fidelity decay is due to dephasing and none due to the decay of classical overlaps. Surprising accuracy of the approximation is justified by invoking the shadowing theorem: *twice*—both for physical perturbations and for numerical errors. It is shown how the general expression reduces to the special forms for position and momentum states and for wave packets localized in position or momentum. The superiority of the general over the specialized forms is explained and supported by numerical tests for wave packets, non-local pure states, and for simple and random mixed states. The tests are done in non-universal regimes in mixed phase space where detailed features of fidelity are important. Although semiclassically motivated, present approach is valid for abstract systems with a finite Hilbert basis provided that the discrete Wigner transform is used. This makes the method applicable, via a phase space approach, e. g., to problems of quantum computation.

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