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Multiple Most Likely Paths in Diffusive Quantum Trajectories of Pure-State Qubits[1] PHILIPPE LEWALLE, AREEYA CHANTASRI, ANDREW JORDAN, University of Rochester — We examine most-likely paths (MLPs) in the diffusive quantum trajectories for continuously-monitored pure-state qubits, obtained as extrema of a stochastic path integral. MLPs are expressed as solutions to a Hamiltonian dynamical system. By considering the evolution of the Lagrange Manifold in the MLP phase space, we locate multiple-path solutions (multipaths), mathematically analogous to optical caustics. We explicitly show how multipaths arise in two sample systems, including a qubit subject to Rabi drive and continuous monitoring of one observable, and a qubit subject to simultaneous measurement of two non-commuting observables[1]. The MLP phase-spaces for these systems include multipaths generated by different winding numbers about the Bloch sphere, and multipaths within elliptic periodic islands. Experimental confirmation of multipaths in a continuously monitored fluorescing qubit system was recently found in collaboration with the Murch group at Washington University. This work is an important step towards understanding how to use our MLP formalism to predict the onset of dynamical instabilities in continuously-monitored quantum systems.

[1] S. Hacohen-Gourgy, L. S. Martin, E. Flurin, V. V. Ramasesh, K. B. Whaley, I. Siddiqi. Nature **538**, 491-494 (2016).

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