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Action principle for continuous quantum measurement and quantum trajectories with pre and post-selection AREEYA CHANTASRI, Rochester Theory Center, University of Rochester, New York, JUSTIN DRESSEL, Department of Electrical Engineering, University of California, Riverside, California, STEVEN WEBER, Quantum Nanoelectronics Laboratory, University of California, Berkeley, California, KATER MURCH, Department of Physics, Washington University, St. Louis, IRFAN SIDDIQI, Quantum Nanoelectronics Laboratory, University of California, Berkeley, California, ANDREW JORDAN, Rochester Theory Center, University of Rochester, New York; Institute of Quantum Studies, Chapman University, Orange, California — We apply an action principle to continuous quantum measurement by introducing a joint probability density function of measurement outcomes and quantum state trajectories in a path integral form. Using a modified principle of least action, we find the paths of maximum likelihood connecting boundary states between any two points in time, at which we call the most-likely paths. We present, as an example, the most-likely paths for a continuous qubit measurement with pre and post-selected states, along with a preliminary comparison to data from a superconducting qubit coupled to a microwave cavity. We, furthermore, introduce other interesting statistical characterizations of the quantum trajectories such as mean paths, variances and most-likely times, that can be derived from our path integral formalism.

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