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Time-Continuous Bell Measurements SEBASTIAN G. HOFER, Vienna Center for Quantum Science and Technology, Faculty of Physics, University of Vienna, Austria, DENIS V. VASILYEV, Institute for Theoretical Physics, Institute for Gravitational Physics, Leibniz University Hannover, Germany, MARKUS ASPELMEYER, Vienna Center for Quantum Science and Technology, Faculty of Physics, University of Vienna, Austria, KLEMENS HAMMERER, Institute for Theoretical Physics, Institute for Gravitational Physics, Leibniz University Hannover, Germany — We combine the concept of Bell measurements, in which two systems are projected into a maximally entangled state, with the concept of continuous measurements, which concerns the evolution of a continuously monitored quantum system. For such time-continuous Bell measurements we derive the corresponding stochastic Schrödinger equations, as well as the unconditional feedback master equations. Our results apply to a wide range of physical systems, and are easily adapted to describe an arbitrary number of systems and measurements. Time-continuous Bell measurements therefore provide a versatile tool for the control of complex quantum systems and networks. As examples we show show that (i) two two-level systems can be deterministically entangled via homodyne detection, tolerating photon loss up to 50%, and (ii) a quantum state of light can be continuously teleported to a mechanical oscillator, which works under the same conditions as are required for optomechanical ground state cooling.

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