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Continuous Measurement of Atomic Motion

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Quantum mechanics is fundamentally a theory of measurement, and recently a paradigm in quantum optics has arisen for describing the *continuous* measurement of quantum systems. Interesting phenomena can happen in continuously observed systems, due to the interplay of the dynamical evolution and the measurement process. In particular, the evolution of a quantum system under a continuous measurement process is both *nonlinear* and *stochastic*. I will describe our interests in continuous measurements of atomic motion, especially in applying continuous measurements to realizing quantum feedback control of atomic motion and to understanding the quantum–classical transition. I will also describe our experimental progress towards studying these systems. Finally, I will end with a model of a continuous measurement of the position of an atom that operates via the imaging of scattered laser light—a "continuous Heisenberg microscope"—that has a surprising result: the information gained via the measurement in an intuitively "good" setup is much less that you would expect by considering the *efficiency* of the measurement.