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Rapid State-Reduction of Quantum Systems Using Feedback Control[1] JOSHUA COMBES, Griffith University, KURT JACOBS, Louisiana State University — Many potential applications of quantum devices, particularly in information processing, require quantum systems to be prepared in pure states. Due to environmental noise quantum systems often exist naturally in mixed states, and as a result a process of cooling or measurement must be used to purify them. In this work we consider the use of measurement for this purpose. The speed with which a measurement can purify, or reduce, the state of a quantum system is determined by the interaction between the system and measuring device, and places a limit on the speed of state-preparation. Here we consider using feedback control during the measurement to increase the rate of state-reduction. It was shown in [1] that for a single qubit this rate could be increased by a factor of 2. Here we show that for higher dimensional systems feedback control can provide a much larger speed-up. In particular, we show that for a measurement of an observable with N equally spaced eigenvalues, there exists a feedback algorithm which will increase the rate of state-reduction by a factor proportional to N. References: 1. K. Jacobs, Phys. Rev. A **67**, 030301(R) (2003). 2. J. Combes and K. Jacobs, Phys. Rev. Lett. (in press).

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