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Quantum state reconstruction of the 16 dimensional hyperfine manifold in cesium via continuous measurement and control[1] CARLOS RIOFRIO, University of New Mexico, AARON SMITH, BRIAN ANDERSON, POUL JESSEN, University of Arizona, IVAN DEUTSCH, University of New Mexico —
Quantum state reconstruction techniques based on weak continuous measurement have the advantage of being fast, robust, and almost non-perturbative. Moreover, they have been successfully implemented in experiments on large spin systems, e.g., the F=3 7 dimensional hyperfine manifold in cesium (PRL 97, 180403 (2006)). In this talk, we extend the tomographic algorithm developed by Silberfarb et al. (PRL 95, 030402 (2005)) to the reconstruction of quantum states stored in the complete 16 dimensional ground-electronic hyperfine manifolds (F=3, F=4) of an ensemble of Cs atoms controlled by microwave and radio-frequency magnetic fields. Simulations show that randomly generated control fields produce informationally complete measurement records and thus give high fidelity reconstructed states. Furthermore, appropriate operation regimes are found for possible experimental implementation.

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