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Control of spinor dynamics in an anti-ferromagnetic F=1 Bose-Einstein condensate ZACHARY GLASSMAN, DONALD FAHEY, Joint Quantum Institute, National Institute of Standards and Technology and the University of Maryland, RYAN WILSON, United States Naval Academy, EITE TIESINGA, PAUL LETT, Joint Quantum Institute, National Institute of Standards and Technology and the University of Maryland — Spin-exchange collisions driving coherent population oscillations of the $F = 1$ ground state magnetic sublevels can be used for precision quantum measurements in a condensed Bose gas. Entanglement generated by these dynamics enables below standard quantum limit phase estimation by way of an SU(1,1) interferometer and antiferromagnetic spin-nematic squeezing. In order to observe these effects, we have simulated the spinor dynamics in the single mode approximation with both fully quantum and semi-classical models. We present a study of microwave pulse sequences, which can be used to control the spinor dynamics via energy level shifts and rotations, and discuss improved methods for future experiments in this field.

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