Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Collisional spin evolution in microwave-dressed F=1 spinor Bose-Einstein condensates[1] QIMIN ZHANG, DELARAM NEMATOLLAHI, ARNE SCHWETTMANN, University of Oklahoma, EITE TIESINGA, Joint Quantum Institute, NIST and the University of Maryland — Spin-exchange collisions in F=1 spinor Bose-Einstein condensates, where two atoms with magnetic quantum number m=0 collide and change into a pair with m=+/-1, are useful to implement matter-wave quantum optics in spin space, because the collisions generate entanglement and they can be precisely controlled using microwave dressing. Here, we numerically investigate the collisional evolution of spin populations in a single spatial mode for different initial superposition states and applied microwave pulse sequences. To find the parameter regime where quantum effects dominate, we compare results from our fully quantum simulation involving a large basis set to those obtained from a semi-classical model based on quasi-probability distributions. Our simulations are motivated by our planned experiments on matter-wave quantum optics in this system, including the creation and characterization of two-mode squeezing between the m=+/-1 spin projections as well as the construction of a nonlinear spin-exchange based interferometer to measure phase with uncertainties that improve upon the shot-noise limit in the number of atoms in the m=+/-1 states.

[1]We acknowledge support of the Vice President for Research of the University of Oklahoma

Delaram Nematollahi
University of Oklahoma

Date submitted: 28 Jan 2016