Abstract Submitted
for the DAMOP18 Meeting of
The American Physical Society

Quantum Interferometry with Microwave-Dressed Spinor Bose-Einstein Condensates in the Regime of Long Evolution Times SHAN ZHONG, QIMIN ZHANG, ISAIAH MORGENSTERN, HIO GIAP OOI, LOGAN BAKER, JUSTIN KITTEL, ARNE SCHWETTMANN, University of Oklahoma
— We recently achieved all-optical generation of Na spinor Bose-Einstein condensates (BEC) in our crossed far-off resonant trap at 1064 nm. Using our BEC, we experimentally investigate atom interferometry based on spin-exchange collisions in the regime of long evolution times where the Bogoliubov and truncated Wigner approximations break down, and compare the results with our numerical simulations. Spin-exchange collisions in the F= 1 spinor Bose-Einstein condensate can be precisely controlled by microwave dressing, and generate pairs of entangled atoms with magnetic quantum numbers m_F= +1 and m_F= -1 from pairs of m_F= 0 atoms. Spin squeezing created by the collisions can reduce the noise in an atom interferometer below the shot noise limit. For long evolution times, $t \gg h/c$, where c is the spin-dependent interaction energy, $c \simeq h \cdot 30$ Hz, there are large numbers of atoms with m_F= +1 or m_F= -1 in the arms of the interferometer, allowing for easier detection via Stern-Gerlach time-of-flight absorption imaging.

Shan Zhong
University of Oklahoma

Date submitted: 26 Jan 2018 Electronic form version 1.4