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Atomic Interferometry in Antiferromagetic Spinor Bose-Einstein Condensates in the Regime of Long Evolution Time SHAN ZHONG, QIMIN ZHANG, ISAIAH MORGENSTERN, HIO GIAP OOI, ARNE SCHWETTMANN, University of Oklahoma — We experimentally investigate nonlinear atom interferometry based on spin-exchange collisions in a F=1 Na spinor Bose-Einstein condensate in the long evolution time regime, $t \gg h/c$, where hc is the spin-dependent interaction energy. Spin-exchange collisions 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. We apply a microwave-dressing pulse during spin evolution to imprint a phase-shift. Using Stern-Gerlach absorption imaging, we then detect the interference fringes as the change of final m_F=0 population vs. phase-shift. For long evolution times, we observe non-sinusoidal interference fringes with significantly enhanced slope, useful for sensing applications, and signaling the breakdown of the Bogoliubov and truncated Wigner approximations.

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