Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Spin Transport in Spin-Orbit Coupled BECs ROBERT NIFFENEGGER, Purdue University, CHUNLEI QU, University of Texas Dallas, ABRAHAM OLSON, Purdue University, CHUANWEI ZHANG, University of Texas Dallas, YONG P. CHEN, Purdue University — We measure spin transport induced by synthetic spin-dependent electric fields in spin-orbit coupled (SOC) Bose Einstein Condensates (BECs). The 1D SOC is created with counter propagating Raman lasers which couple hyperfine spins ($m_F = -1$ and 0, of F=1) and momentum states of ^{87}Rb, allowing us to engineer spin dependent vector potentials. Quickly decreasing the spin-orbit Raman coupling strength (Ω_R) separates the spin vector potentials and applies opposite synthetic electric fields to the two dressed spin BECs. We allow them to oscillate in opposite directions within the optical trap (exhibiting a spin dipole mode) and measure the time evolution of their momentum and density after time-of-flight (TOF). The oscillations damp as the spin BECs collide and the damping drastically increases as the Raman coupling is increased, possibly related to the Raman coupling dressing and increasing the effective spin interactions. Over longer time scales, thermalization accompanies the damping of the bare spins' oscillations. However, with Raman coupling, the overdamped dressed spins' oscillations are accompanied by rich excitations in the BEC but less thermalization. The measured damping and its dependence on Raman coupling and detuning agree well with GPE simulations.

Robert Niffenegger
Purdue University

Date submitted: 31 Jan 2014 Electronic form version 1.4