

Abstract Submitted  
for the DAMOP15 Meeting of  
The American Physical Society

**Tunable spin-orbit coupling with a periodically driven gradient magnetic field** XINYU LUO, LINGNA WU, JIYAO CHEN, State Key Laboratory of Low Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, China, QING GUAN, KUIYI GAO, Institute of Physics, Chinese Academy of Sciences, Beijing 100080, China, ZHI-FANG XU, Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, Pennsylvania 15260, USA, LI YOU, State Key Laboratory of Low Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, China, RUQUAN WANG, Institute of Physics, Chinese Academy of Sciences, Beijing 100080, China — We report the observation of tunable spin-orbit coupling (SOC) in spin-1 atoms synthesized with a periodically driven gradient magnetic field. Different from all previous experiments which demonstrated synthesized SOC with Raman coupling lasers, the scheme we verify uses only magnetic field, thus could avoid the heating from atomic spontaneous emission in the Raman scheme. The strength of SOC we implemented can be tuned, and the effect of SOC is observed through studying a) the collective dipole oscillation in a harmonic trap after we abruptly turn on SOC, and b) the adiabatically adjusted equilibrium state when we slowly ramp up SOC strength. Our experiment reveals excellent coherence properties for tunable SOC synthesized in atomic condensate through coherent driving gradient magnetic fields. It opens a new avenue for synthesized gauge field aimed at quantum simulation studies with cold atoms.

Xinyu Luo  
State Key Laboratory of Low Dimensional Quantum Physics,  
Department of Physics, Tsinghua University, Beijing 100084, China

Date submitted: 25 Jan 2015

Electronic form version 1.4