Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Universal Behavior of Spin Dipolar Relaxation in Atomic Condensates YUANGANG DENG, YIQUAN ZHOU, MIN DENG, QI LIU, MENGKHOON TEY, State Key Laboratory of Low Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, China, BO GAO, Department of Physics and Astronomy, University of Toledo, Mailstop 111, Toledo, Ohio 43606, USA, LI YOU, State Key Laboratory of Low Dimensional Quantum Physics, Department of Physics, Tsinghua University, Beijing 100084, China — The dipolar relaxation of atomic spinor condensates is studied in terms of the semi-analytical scattering wave functions by utilizing the quantum-defect theory. At nonzero magnetic fields, inelastic dipolar relaxation of exothermic reaction leads to loss of the atomic population. By tuning the bias field, we find that the dipolar relaxation rate exhibits a universal behavior involving a unique dip and peak structure, different from the commonly referenced result based on the Born or the distortedwave Born approximations. The positions for the dip and the peak are shown to be determined dominantly by the short-range s-wave scattering length and the Van der Waals radius, independent of the dipolar interaction strength of ultracold atoms. This is confirmed by the precision measured dipolar relaxation decay rate for both spin-polarized atomic coherent spin states and twin-Fock states of $F = 1$ ^{87}Rb BoseEinstein condensates. We observe the dipolar relaxation suppression as predicted by our theory for the large bias field, a feature not previously studied experimentally. Our results implicate the possibility of extracting the short-range scattering length and the Van der Waals dispersion coefficient from spin dipolar decay measurements.

Min Deng
Tsinghua University

Date submitted: 06 Feb 2017 Electronic form version 1.4