Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Cavity-Assisted Dynamical Spin-Orbit Coupling in Cold Atoms
LIN DONG, Rice University, LU ZHOU, East China Normal University, BIAO WU, Peking University, B. RAMACHANDHRAN, HAN PU, Rice University — In this work, we consider the effect of spin-orbit coupling in ultracold atoms induced by a quantized light field inside an optical cavity, where the back-action from the atom to the cavity light field plays an essential role. The Raman coupling gives rise to effective spin-orbit interaction which couples atom's center-of-mass motion to its pseudospin degrees of freedom. Meanwhile, the cavity photon is dynamically affected by the atom. This system possesses remarkable features. For example, loop structure may emerge in dispersion curves, effective nonlinearity from the atom-photon feedback induces dynamical instability, etc. To understand the intriguing physics, we analytically computed the critical condition for forming loops and performed stability and dynamical analysis. Furthermore, we propose to demonstrate dynamical instability experimentally in terms of counting sudden change of photon number inside the cavity. From a practical point of view, all the ingredients proposed in this work has been demonstrated in various labs. Hence our proposal can be readily tested in experiment.

Lin Dong
Rice University

Date submitted: 08 Nov 2013 Electronic form version 1.4