

Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Effect of Induced Spin-orbit Coupling in Cold Atomic Gas XIONG-JUN LIU, MARIO F. BORUNDA, XIN LIU, JAIRO SINOVA¹, Department of Physics, Texas A&M University, College Station, Texas 77843-4242, USA, JAIRO SINOVA'S GROUP AT TAMU TEAM — Spin-orbit (SO) coupling effect in semiconductors has emerged in the solid-state community as a very active field of research, fueled in part by the field of spintronics, e.g. spin current injection with spin Hall effect [1]. Recently, new schemes are developed to generate the SO interaction in cold atoms [2], which opens new possibilities in studying Spintronics in atomic systems. Here we shall report our recent proposal of SO coupling effects in Fermi atomic systems via optical method [3]. The induced SO coupling can be of the Dresselhaus and Rashba type with a Zeeman term. We show that the optically induced SO coupling can lead to a spin-dependent effective mass under proper condition, with one of them able to be tuned between positive and negative effective masses. As a direct observable we show that in the expansion dynamics of the atomic cloud the initial atomic cloud can split into two or four clouds depending on the effective mass regimes. Reference: [1] S. Murakami et al., *Science* 301, 1348 (2003); J. Sinova et al., *Phys. Rev. Lett.* 92, 126603 (2004). [2] X.-J. Liu et al., *Phys. Rev. Lett.* 98, 026602 (2007); S.-L. Zhu et al., *ibid.*, 97, 240401 (2006); T. D. Stanescu et al., *ibid.*, 99, 110403 (2007). [3] X.-J. Liu, M. F. Borunda, X. Liu, J. Sinova, submitted to PRL for publication, arxiv:0808.4137 (2008).

¹Principal Investigator

Xiong-Jun Liu
Department of Physics, Texas A&M University,
College Station, Texas 77843-4242, USA

Date submitted: 17 Nov 2008

Electronic form version 1.4