Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Current-Induced Dynamics in Antiferromagnetic Metal: Domain Wall Dynamics and Spin Wave Excitation RAN CHENG, QIAN NIU, Department of Physics, University of Texas at Austin — When a spin-polarized current flows through a ferromagnetic (FM) metal, angular momentum is transferred to the magnetization via spin transfer torque. However, corresponding theory is absent in antiferromagnetic (AFM) metals due to the absence of spin conservation. We solve this problem via effective gauge theory without the necessity of spin conservation. By identifying the adiabatic dynamics of conduction electrons as a non-Abelian gauge theory on degenerate band, we derive the AFM version of Landau-Lifshitz-Gilbert equation with current-induced dynamics from a microscopic point of view. Quite different from its FM counterpart, current-induced dynamics in AFM materials does not behave as a torque, but a driving force triggering second order derivative of local staggered order with respect to time. Its physical consequences are studied in two examples: 1. A domain wall is accelerated to a terminal velocity without a Walker's threshold; 2. A sufficiently large spin current will generate spin wave excitation.

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Date submitted: 12 Dec 2012 Electronic form version 1.4