Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Highly efficient in-line magnetic domain wall injector TIMOTHY PHUNG, AAKASH PUSHP, LUC THOMAS, CHARLES RETTNER, SEE-HUN YANG, KWANG-SU RYU, JOHN BAGLIN, BRIAN HUGHES, STUART PARKIN, IBM Almaden Research Center — The creation and manipulation of domain walls (DWs) in magnetic nano-wires is of considerable interest, and forms the basis of several logic and memory devices. Traditionally, the DWs are created in the nano-wires using local magnetic fields from current injection lines fabricated orthogonal to the nano-wires, whereas the synchronous motion of a series of DWs along a nano-wire is achieved using spin transfer torque (STT) from charge currents that transport spin angular momentum. Here we demonstrate a highly efficient and simple DW injection scheme that uses a combination of STT from nanosecond long, uni-polar, current pulses that cross a 90° magnetization boundary along with the fringing fields inherently prevalent at the boundary. The 90° magnetization boundary is created by local ion-irradiation at the end of a nano-wire exhibiting perpendicular magnetic anisotropy. Remarkably, we find that the currents needed for this "in-line" DW injection scheme are at least one hundred times smaller than conventional methods. Additional advantages are its significantly smaller footprint than that of conventional methods, its compatibility to the smallest lithographic dimensions, and, its ability to continuously inject DWs using uni-polar current. This simplified scheme bodes well for the fruition of spintronics based memory and logic devices.

Timothy Phung
IBM Almaden Res Ctr

Date submitted: 14 Nov 2014 Electronic form version 1.4