Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Simulations of random defects for fast domain wall motion in ferromagnetic nanowires[1] KYLE KIMMINAU, ANDREW KUNZ, Marquette University, PHYSICS DEPARTMENT TEAM — Domain walls in ferromagnetic nanowires move slowly when driven by large magnetic fields due to a process known as Walker breakdown. During Walker breakdown vortices are formed which slow the domain wall leading to low average speeds. Vortex formation is driven by the precessional motion of the magnetic moments in the domain wall. Techniques which disturb the coherent precession can be used to disrupt Walker breakdown and therefore recover fast domain wall speeds which could be useful for future technological devices. We used a combination of micromagnetic simulation and theoretical modeling to simulate the effects of random defects (voids) on the motion of a domain wall. Simulations find there is critical defect density associated with the destruction of the breakdown. We then use a magnetostatic charge model to calculate the strength of the perturbing field, created by the defects, necessary to disrupt the precessional motion of the moment in the domain wall. For an appropriate defect density the domain walls move quickly, without experiencing breakdown or a change in magnetic structure, for applied fields at least an order of magnitude greater than the typical breakdown field.

[1]NSF DMR 1006947, NASA Wisconsin Space Grant Consortium

Andrew Kunz
Marquette University

Date submitted: 11 Nov 2011 Electronic form version 1.4