Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Dynamics of domain walls in nanostrips via collective coordinates
D. CLARKE, Johns Hopkins University, O. TRETIAKOV, New York University, G.-W. CHERN, JHU, YA. B. BAZALIY, University of South Carolina, O. TCHERNYSHYOV, JHU — The rich internal structure of domain walls in nanostrips [1-2] greatly affects the motion when an external magnetic field or electric current is applied, leading to reduced mobility when the driving force is strong. We generalize Thiele's equations [3] to describe arbitrary wall motion with any number of collective coordinates [4]. The formalism is sufficiently general as to allow the inclusion of spin current, and can be applied to films with in- or out-of-plane magnetic anisotropy. We examine a model wall [5] with two soft modes corresponding to the coordinates of a vortex core. As in a one-dimensional domain wall [6], the system has a steady-state regime below a critical field and an oscillatory regime above it. We calculate the drift velocity in both regions. The results are compared to numerical simulations and to available experimental data [7]. This work was supported in part by the NSF Grant DMR-0520491. [1] R. D. McMichael and M. J. Donahue, IEEE Trans. Magn. 33, 4167 (1997). [2] O. Tchernyshyov and G.-W. Chern, Phys. Rev. Lett. 95, 197204 (2005). [3] A. A. Thiele, Phys. Rev. Lett. 30, 230 (1973). [4] O. Tretiakov et. al, arXiv:0705.4463 [5] H. Youk et al., J. Appl. Phys. 99, 08B101 (2006). [6] N. L. Schryer and L. R. Walker, J. Appl. Phys. 45, 5406 (1974). [7] G. S. D. Beach et al., Nature Mater. 4, 741 (2005)

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Date submitted: 27 Nov 2007 Electronic form version 1.4