Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Annihilation of Domain Walls in a Ferromagnetic Wire[1] ANIRBAN GHOSH, KEVIN HUANG, OLEG TCHERNYSHYOV, Department of Physics and Astronomy, Johns Hopkins University — We study the annihilation of topological solitons in one of the simplest systems that support them: a one-dimensional ferromagnetic wire with an easy axis along its length. In the presence of energy dissipation due to viscous losses, two solitons (domain walls) on the wire, when released from afar, approach each other and eventually annihilate to create a uniformly magnetized state. Starting from a class of exact solutions for stationary two-domain-wall configurations in the absence of dissipation [1], we develop an effective theory that describes this annihilation in terms of four collective coordinates: a) the two zero modes corresponding to the location of the center and the average azimuthal angle of the full structure and b) their two conjugate momenta which describe the relative twist and the relative separation of the two domain walls respectively [2]. Comparison with micromagnetic simulation on OOOMF confirms that this theory captures well the essential physics of the process. We believe this work will be a good starting point for studying the annihilation of more complicated topological solitons like vortices and skyrmions in ferromagnetic thin films. [1]A.M. Kosevich, B.A. Ivanov, A.S. Kovalev, Phys. Rep. 194, 117 (1990). [2]O. Tchernyshyov, Ann. Phys. 363, 98 (2015).

[1]This work is supported by the U.S. Department of Energy, Office of Basic Energy Sciences, Division of Materials Sciences and Engineering under Award DE-FG02-08ER46544.

Anirban Ghosh
Department of Physics and Astronomy, Johns Hopkins University

Date submitted: 10 Nov 2016 Electronic form version 1.4