Abstract Submitted for the MAR17 Meeting of The American Physical Society

Nonlinear Magnus-induced dynamics and Shapiro spikes for ac and dc driven skyrmions on periodic quasi-one-dimensional substrates CHARLES REICHHARDT, CYNTHIA J. OLSON REICHHARDT, Los Alamos National Laboratory — We numerically examine skyrmions interacting with a periodic quasi-one-dimensional substrate. When we drive the skyrmions perpendicular to the substrate periodicity direction, a rich variety of nonlinear Magnus-induced effects arise, in contrast to an overdamped system that shows only a linear velocityforce curve for this geometry. The skyrmion velocity-force curve is strongly nonlinear and we observe a Magnus-induced speed-up effect when the pinning causes the Magnus velocity response to align with the dissipative response. At higher applied drives these components decouple, resulting in strong negative differential conductivity. For skyrmions under combined ac and dc driving, we find a new class of phase locking phenomena in which the velocity-force curves contain a series of what we call Shapiro spikes, distinct from the Shapiro steps observed in overdamped systems. There are also regimes in which the skyrmion moves in the direction opposite to the applied dc drive to give negative mobility.

> Charles Reichhardt Los Alamos National Laboratory

Date submitted: 09 Nov 2016

Electronic form version 1.4