

Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Controlling skyrmion helicity via engineered Dzyaloshinskii-Moriya interactions SEBASTIAN DIAZ, Department of Physics, University of California, San Diego, ROBERTO TRONCOSO, Departamento de Física, Universidad Técnica Federico Santa María, Chile — Single magnetic skyrmion dynamics in chiral magnets with a spatially inhomogeneous Dzyaloshinskii-Moriya interaction (DMI) is considered. Based on the relation between DMI coupling and skyrmion helicity, it is argued that the latter must be included as an extra degree of freedom in the dynamics of skyrmions. An effective description of the skyrmion dynamics for an arbitrary inhomogeneous DMI coupling is obtained through the collective coordinates method. The resulting generalized Thiele's equation¹ is a dynamical system for the center of mass position and helicity of the skyrmion. It is found that the dissipative tensor and hence the Hall angle become helicity dependent. The skyrmion position and helicity dynamics are fully characterized by our model in two particular examples of engineered DMI coupling: half-planes with opposite-sign DMI and linearly varying DMI. In light of a recent experiment² on the magnitude and sign of the DMI, our results constitute the first step toward a more complete understanding of the skyrmion helicity as a new degree of freedom that could be harnessed in future high-density magnetic storage and logic devices.

¹Tretiakov et al., Phys. Rev. Lett. **100**, 127204 (2008).

²Shibata et al., Nature Nanotech. **8**, 723 (2013).

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Date submitted: 05 Nov 2015

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