PHYSICAL REVIEW B **00**, 000400 (2021)

Letter

Magnetic skyrmion binning

Charles Kind[1] and David Foster[2]

[1] *School of Mathematics, University of Bristol, Bristol BS8 1TW, United Kingdom*

[2] *UKAEA, Culham Centre for Fusion Energy, Abingdon OX14 3DB, United Kingdom*

(Received 27 January 2021; revised 16 March 2021; accepted 17 March 2021; published xxxxxxxxxx)

When spin-polarized electrons flow through a magnetic texture a transfer torque is generated. We examine the effect of this torque on skyrmions and skyrmion bags, skyrmionic structures of arbitrary integer topological degree, in thin ferromagnetic films. Using micromagnetic simulations and analysis from the well-known Thiele equation, we explore the potential for sorting or binning skyrmions of varying degrees mechanically. We investigate the applicability of the Thiele equation to problems of this nature and derive a theory of skyrmion deflection ordered by topological degree. We show that skyrmions and skyrmion bags have the potential to move in different directions under a constant current, which has significant potential for technical applications.

DOI: 10.1103/PhysRevB.00.000400

I. INTRODUCTION

where $\boldsymbol{n}(\boldsymbol{x})$ is the unit vector field of magnetization. Under this definition, a single skyrmion has the degree $Q = -1$ and