Chaos in a dynamic formation of magnetic vortex structures

Ki-Suk Lee,¹ Mi-Young Im,² Hee-Sung Han,¹ Sukbin Lee,¹ and Peter Fischer²

¹School of Mechanical and Advanced Materials Engineering, Ulsan National Institute of Science and Technology (UNIST), Ulsan, Republic of Korea
²Center for X-ray Optics, Lawrence Berkeley National Laboratory, Berkeley CA 94720, USA

Owing to unique non-trivial dynamic and static properties as well as prominent applications in information technologies, magnetic vortex structures have recently been attracted much attention. To realize such systems in applications, a reliable control of vortex states is necessary and which requires a complete understanding and manipulating of the detailed dynamic formation process of vortex states. From micromagnetic simulations, it will be seen that dynamic formation process is nonlinear as well as chaotic and thus, the resultant vortex state depends sensitively on initial conditions. Moreover, by means of manipulating initial conditions, we propose an efficient method to control the vortex states.

This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (2012R1A1A1041922)