MAR16-2015-020406

Abstract for an Invited Paper
for the MAR16 Meeting of
the American Physical Society

Soliton-like magnetic domain wall motion induced by the interfacial Dzyaloshinskii-Moriya interaction

TERUO ONO, Kyoto University

Topological defects such as magnetic solitons, vortices, Bloch lines, and skyrmions start to play an important role in modern magnetism due to their extraordinary stability which can be hailed as future memory devices. Recently, novel type of antisymmetric exchange interaction, namely the Dzyaloshinskii-Moriya interaction (DMI), has been uncovered and found to influence on the formation of topological defects. Exploring how the DMI affects the dynamics of topological defects is therefore an important task. Here we investigate the dynamics of the magnetic domain wall (DW) under a DMI by developing a time-of-flight measurement scheme which allows us to measure the DW velocity for magnetic fields up to 0.3T. For a weak DMI, the trend of DW velocity follows the Walker's model which predicts that the velocity of DW increases with field up to a threshold (Walker field) and decreases abruptly. On the other hand, for a strong DMI, velocity breakdown is completely suppressed and the DW keeps its maximum velocity even far above the Walker field. Such a distinct trend of the DW velocity, which has never been predicted, can be explained in terms of magnetic soliton, of which topology can be protected by the DMI. Importantly, such a soliton-like DW motion is only observed in two dimensional systems, implying that the vertical Bloch lines (VBLs) creating inside of the magnetic domain-wall play a crucial role. This work was partly supported by JSPS KAKENHI Grant Numbers 15H05702, 26870300, 26870304, 26103002, 254251, Collaborative Research Program of the Institute for Chemical Research, Kyoto University, and R & D Project for ICT Key Technology of MEXT from the Japan Society for the Promotion of Science (JSPS).