

Direct Observation of Temperature Dependent Vortex Dynamics in a $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ Micromagnet

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Although it is well documented that the vortex core in a micromagnet can switch polarisation in response to magnetic field pulses[1], the temperature dependence of this process has not yet been addressed by experiments. Using scanning transmission x-ray microscopy, we investigate the magnetic vortex dynamics in a $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ microplatelet at temperatures ranging from 150 K up to T C at 350 K [2]. The time-resolved images reveal qualitatively different dynamic regimes as function of temperature and applied field, as the relative strengths of the micromagnetic energy terms strongly vary over this temperature range. By explicitly accounting for the temperature dependence of the magnetic parameters in our micromagnetic simulations[3], we found an excellent agreement with the experiments over the full measurement range. In line with previous models, the simulations reveal that the vortex core switches polarisation when it reaches a critical velocity [4] that mainly depends on the strength of the exchange interaction. It is therefore strongly temperature dependent, thus explaining our observation of the different dynamical regimes

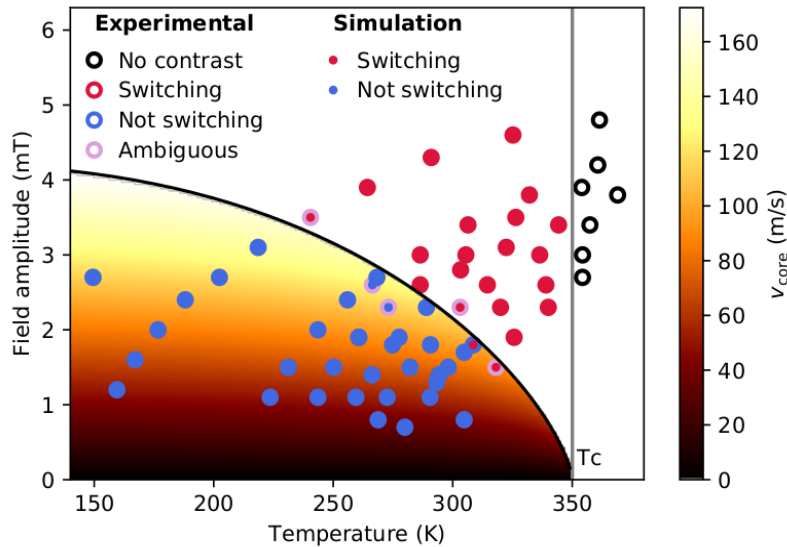


Figure 1: Classification of dynamics for experimental data points (edge color) and simulations (center color). Background is estimated maximum vortex core velocity for excitations up to critical field (solid black line).

References

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