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Investigating magnetic skyrmion in Pt/CoFeB/Ru multilayers with low-energy MuSR

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After the first observation of magnetic skyrmion in 2009, the so-called skyrmionics research field is still rapidly evolving. To this day, intense research effort is still carrying on in understanding their intrinsic properties for the potential realization of future energy efficient nanodevices. Magnetic skyrmion in thin multilayer films are appealing because their emergence, stability, and physical properties can be engineered by controlling dipolar, perpendicular anisotropy and Dzyaloshinskii–Moriya (DM) interactions at interfaces through the choice of materials, layer thickness, and film stacks. Among numerous multilayers systems, Pt/CoFeB/Ru is an excellent platform to study the skyrmion phase, but also other magnetic fluctuations that may arise from competing orders. In addition to the DMI at the Pt/CoFeB interface, in thick multilayers, dipolar interactions favorize the formation of the Néel-type chiral domain walls close to the edges of the multilayer, and results in the creation of skyrmions with hybrid chirality.
Here, we present a low-energy muon spin rotation study on Pt/CoFeB/Ru multilayers as function of temperature and magnetic field. From both transverse field (TF) and longitudinal fields (LF) measurements, a clear magnetic transition between T= 475-500 K is observed, with fluctuations appearing at T ≤ 550 K. Interestingly, the relaxing components for the LF measurements show a change of fractions and depolarization rates as function of temperature, but not as a function of magnetic field. Our results suggest the presence of domain wall dynamics in these systems, which are independent of the skyrmion phase.

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