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Magnetic skyrmions : new solitons on the track for future memories and logic applications.

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Magnetic skyrmions are arguably the smallest topologically non-trivial magnetic configurations [1]. These solitons are nanoscale spin configurations that hold promise as information carriers in ultra-dense memory and logic devices owing to the extremely low threshold currents densities for initiating their dynamics [2]. Up to now however magnetic skyrmions have been observed mostly at very low temperature in a few exotic materials and ultra-thin films. Here, I will illustrate the wealth of skyrmions with some our recent experimental and numerical results stabilized at room temperature in magnetic multilayers due to interfacial chiral interaction. This discovery of stable sub-100 nm individual skyrmions at room temperature [3,4] in a technologically relevant material opens the way for the development of several concepts of skyrmion based memory devices going from race-track memory type to MRAMS, rf devices, logic gates, transistors. [1] Bogdanov, A. N. and Roessler, U. K. Phys. Rev. Lett. 87, 037203 (2001). ; [2] N. Nagaosa, Y. Tokura, Nature Nanotech. 8, 899 (2013), [3] J. Sampaio, et al, Nat. Nanotech. 8, 839 (2013). ; [4] C. Moreau-Luchaire et al, arXiv: 1502.07853. —- Authors : V. Cros1, C. Moreau-Luchaire1, C. Moutafis2,3, N. Reyren1, J. Sampaio1,5, C.A.F. Vaz2, P. Warnicke2, D. Maccariello1, N. Vanhorne1, F. Garcia-Sanchez3, K. Bouzehouane1, K. Garcia1, C. Deranlot1, S. Rohart4, J.M. George1, J. Raabe2, J.V. Kim3, A. Thiaville4, A. Fert1 1 Unité Mixte de Physique CNRS Thales, Univ. Paris-Sud, Université Paris-Saclay, Palaiseau, France 2 Swiss Light Source, Paul Scherrer Institute, Villigen,Switzerland 3 School of Computer Science, University of Manchester, Manchester, UK 4Institut d'Electronique Fondamentale, Univ. Paris-Sud, CNRS, Orsay, France 5Lab. de Physique des Solides, CNRS, Univ. Paris-Sud, Orsay, France —- Acknowledgements : ANR ULTRASKY and EU grant MAGicSky No. FET-Open-665095 are acknowledged for financial support.