

Disordered skyrmion phase stabilized by magnetic frustration in a chiral magnet $\text{Co}_7\text{Zn}_7\text{Mn}_6$

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Magnetic skyrmions are vortex-like topological spin textures often observed to form a triangular-lattice skyrmion crystal in structurally chiral magnets with the Dzyaloshinskii-Moriya interaction. Recently, beta-Mn structure-type Co-Zn-Mn alloys were identified as a new class of chiral magnet to host such skyrmion crystal phases, while beta-Mn itself is known as hosting an elemental geometrically frustrated spin liquid. Here we report detailed small-angle neutron scattering, ac susceptibility and Lorentz microscopy measurements that show the intermediate composition system $\text{Co}_7\text{Zn}_7\text{Mn}_6$ to be a unique host of two disconnected, thermal-equilibrium topological skyrmion phases; one is a conventional skyrmion crystal phase stabilized by thermal fluctuations and restricted to exist just below the magnetic transition temperature T_c , and the other is a novel three-dimensionally disordered skyrmion phase that is stable well below T_c . The stability of this new disordered skyrmion phase is argued to be due to a cooperative interplay between the chiral magnetism with Dzyaloshinskii-Moriya interaction, and the frustrated magnetism inherent to beta-Mn [1].

[1] K. Karube, J.S. White, D. Morikawa, C. D. Dewhurst, R. Cubitt, A. Kikkawa, X.Z. Yu, Y. Tokunaga, T. Arima, H. M. Rønnow, Y. Tokura, and Y. Taguchi, *Science Advances* 4, eaar7043 (2018).

Position

Scientist

Primary authors: WHITE, Jonathan (Laboratory for Neutron Scattering, Paul Scherrer Institut); Dr KARUBE, Kosuke (RIKEN Japan); Dr MORIKAWA, Daisuke (RIKEN, Japan); Dr DEWHURST, Charles (Institut-Langevin (ILL), France); Dr CUBITT, Robert (Institut Laue-Langevin (ILL), France); Ms KIKKAWA, Akiko (RIKEN, Japan); Dr YU, Xiuzhen (RIKEN, Japan); Dr TOKUNAGA, Yusuke (University of Tokyo, Japan); Prof. ARIMA, Taka-hisa (University of Tokyo and RIKEN, Japan); Prof. RONNOW, Henrik (EPFL, Switzerland); Prof. TOKURA, Yoshinori (University of Tokyo and RIKEN, Japan); Dr TAGUCHI, Yasujiro (RIKEN, Japan)

Presenter: WHITE, Jonathan (Laboratory for Neutron Scattering, Paul Scherrer Institut)

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