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Disordered skyrmion phase stabilized by magnetic frustration in a chiral magnet Co7Zn7Mn6

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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 Co7Zn7Mn6 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 Tc, and the other is a novel three-dimensionally disordered skyrmion phase that is stable well below T . 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).

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