Incommensurate magnetic structure in a hyperkagome lattice

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In materials exhibiting asymmetric terms in the Lifshitz invariant, Landau-Ginzburg-Wilson theory is unable to adequately describe phase transitions. Given the expectation of a new phase transition accompanied by an inhomogeneous order parameter under these conditions, we have searched for a new phase transition in magnetic materials lacking inversion symmetry [1,2]. A case in point is the skyrmion, which manifests as a topologically protected order in magnets without central symmetry, predominantly involving Dzyaloshinskii-Moriya interactions, although alternative mechanisms have been put forth [3]. In contrast, in Mn_3CoGe with the same crystal structure of Mn_3RhSi [1], the SRO was no longer observed, and a magnetic superlattice peak emerged. This indicates that the fluctuating magnetic SRO was replaced by ordered lattice-mismatched magnetic triangular clusters under frustration. An incommesurate magnetic phase has been observed in Mn_3RhGe [4], which is regarded as an intrinsic phase in the hypercagome lattice [5]. The magnetic phase diagram has been the subject of theoretical study in the hypercagome lattice, with the discovery of five distinct magnetic structures, including the incommensurate magnetic phase and an antiferromagnetic phase with Q = 0 [5, 6]. In the present study, the Mn_3CoGe single crystal was examined at FONDER. No incommensurate peaks were identified below the Néel temperature (160 K) at this diffractometer, which suggests a discrepancy between the crystal and the polycrystal, potentially involving site exchange between Mn and Co only in the polycrystal sample.

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Fig. 1. Mn_3CoGe single crystal measured at FONDER.

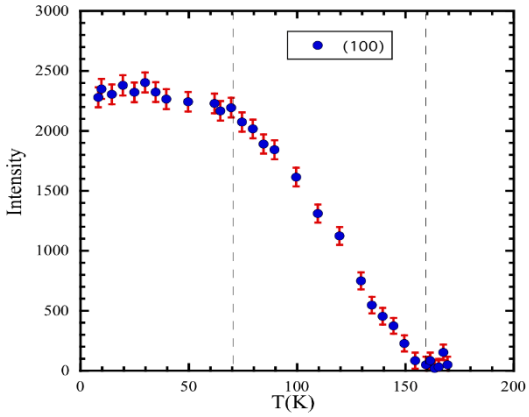

Fig. 2. Temperature dependence of magnetic Bragg peak (100) measured at FONDER.