Abstract:

We report simultaneous measurements of the magnetization and the ac susceptibility across the magnetic phase diagram of single-crystal MnSi. In our study we explore the importance of the excitation frequency, excitation amplitude, sample shape, and crystallographic orientation. The susceptibility, $\mu_0\frac{dM}{dB}$, calculated from the magnetization, is dominated by pronounced maxima at the transition from the helical to the conical and the conical to the skyrmion lattice phase. The maxima in $\mu_0\frac{dM}{dB}$ are not tracked by the ac susceptibility, which in addition varies sensitively with the excitation amplitude and frequency at the transition from the conical to the skyrmion lattice phase. The same differences between $\mu_0\frac{dM}{dB}$ and the ac susceptibility exist for Mn$_{1-x}$Fe$_x$Si ($x=0.04$) and Fe$_{1-x}$Co$_x$Si ($x=0.20$). Taken together our study establishes consistently for all major crystallographic directions the existence of a single pocket of the skyrmion lattice phase in MnSi, suggestive of a universal characteristic of all B20 transition metal compounds with helimagnetic order.
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