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Magnetic Fluctuations in FeSi

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Our research focuses on the magnetic properties of FeSi, particularly investigating the potential presence of magnetic chirality through neutron spin-dependent scattering experiments. FeSi, which crystallizes in the P213 space group, shows a distinct increase in bulk magnetic susceptibility with temperature, peaking around T = 500 K. Despite this, it exhibits no long-range magnetic order across the entire temperature range. However, magnetic fluctuations are observed at ambient and higher temperatures. This study expands on previous work exploring the magnetic behaviour of FeSi and the related compound MnSi, which also belongs to the P213 space group. MnSi has been shown to demonstrate a skyrmion lattice phase, a unique magnetic state with chiral fluctuations, which we aim to compare with FeSi.

Using polarized neutron beams and xyz-polarization analysis on the IN12 triple-axis spectrometer, we conducted a detailed examination of the magnetic fluctuations in FeSi. We aimed to determine whether chiral magnetic scattering is an intrinsic feature of crystals with the B20 structure, a crystal structure known for its non-centrosymmetric properties. We measured the differences in neutron scattering intensities for distinct spin configurations and applied flipping ratio corrections to enhance the accuracy of our results. While magnetic fluctuations were observed, the analysis showed only a small chiral component, suggesting that chirality is not a pervasive magnetic feature in FeSi, unlike in MnSi.

Our findings' comparison with the magnetic fluctuations in MnSi provides insights into FeSi's magnetic behaviour that could have a significant impact on the scientific community. It may help explain the enhancement of the topological Hall effect observed in Mn(1-x)Fe(x)Si alloys. These results contribute to understanding the complex magnetic ground states in materials with non-centrosymmetric crystal structures.

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