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Type : Poster

Correlating the effects of non-magnetic doping with structural anomaly in the multiferroic material Cu_2OSeO_3

Unconventional topological spin structures such as chiral spin systems offer a plethora of fascinating phenomena for fundamental research and future technological applications. Cu_2OSeO_3 is an insulating multiferroic material that was shown to host skyrmions under specific conditions. It possesses a 3D Kagome lattice of Cu^{2+} sites, such that a triangular network lattice connects the magnetic ions. Although Kagome lattices are generally associated with hosting frustrated magnetic structures, Cu_2OSeO_3 lacks any significant frustration due to both ferromagnetic and antiferromagnetic superexchange interactions being present, as satisfied by a 3-up 1-down ferrimagnetic arrangement. The lack of inversion symmetry in the corner shared O-Cu4 tetrahedra that make up the 3D Kagome lattice results in an appreciable Dzyaloshinskii-Moriya interaction between Cu^{2+} sites; this competes with ferromagnetic/antiferromagnetic interactions leading spin canting that underpins the formation of helical/conical spin textures. While no change in the overall cubic symmetry has been observed alongside the formation of the above magnetic phases, low-temperature powder and single crystal diffraction data (lab, synchrotron and neutron) on pure and Te-doped Cu_2OSeO_3 indicate an anomalous trend in Cu-Cu bond distances below room temperature. Inverse trends in the Cu(1)-Cu(2) and Cu(1)-Cu(2) distances between the 'strongly' and 'weakly' interacting O-Cu4 tetrahedra with the distance decreasing and increasing, respectively. This is reminiscent of distortions found in 2D breathing AFM Kagome lattices, which trend towards trimers of magnetic sites sitting on a triangular lattice. The strongest distortion of the Cu-Kagome lattice correlates with the temperature with which the magnetic skyrmions are stable (56 - 58 K).

Level of Expertise

Student

Presenter Gender

Woman

Pronouns

She/Her

Do you intend to attend UM2022

In person - Melbourne

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Yes

Students Only – Do you wish to take part in the Student Poster Slam

Yes

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Yes

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