# Investigating Kosterlitz-Thouless physics in the triangular lattice antiferromagnet $TmMgGaO_4$

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The transverse-field Ising model on a triangular lattice is predicted to support a topological Kosterlitz-Thouless (KT) phase at nonzero temperature through a mapping of the Ising spins to a complex order parameter defined for each triangular unit. Recently, the triangular lattice antiferromagnet $TmMgGaO_4$ has emerged as a candidate material to realize this theoretical scenario. Through the complementary use of neutron diffraction and magnetic pair distribution function (mPDF), we have quantitatively investigated the spin correlations in $TmMgGaO_4$ in the temperature region of interest, tracking their evolution across the proposed transitions into and out of the KT phase. We confirm the presence of the three-sublattice order predicted for the ground state and show that the local magnetic structure undergoes distinct changes in the temperature range expected for the KT phase. Modeling the real-space mPDF reveals a preferential tendency for the system to form bound vortex-antivortex pairs, the hallmark of the KT phase, precisely in the expected temperature range [1]. These findings constitute promising evidence for the KT phase, potentially establishing $TmMgGaO_4$ as a rare platform for studying KT physics in a dense spin system.

[1] Dun, Z., Daum, M., Baral, R., Fischer, H.E., Cao, H., Liu, Y., Stone, M.B., Rodriguez-Rivera, J.A., Choi, E.S., Huang, Q., Zhou, H., Mourigal, M., & Frandsen, B. A. (2021). *Phys. Rev. B* **103**, 064424.

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