

# FIR CENTER セミナー

題目：「Incommensurate and Multiple-q  
Magnetic Misfit Order in the Frustrated  
Quantum Spin Ladder Material Antlerite,  
 $\text{Cu}_3\text{SO}_4(\text{OH})_4$ 」

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場所：遠赤外領域開発研究センター

**6階図書室 (←ご注意ください)**

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## Abstract:

In frustrated magnetic systems, the competition amongst interactions can introduce extremely high degeneracy and prevent the system from readily selecting a unique ground state. In such cases, the magnetic order is often exquisitely sensitive to the balance among the interactions, allowing tuning among novel magnetically ordered phases. We present antlerite,  $\text{Cu}_3\text{SO}_4(\text{OH})_4$ , as a potential platform for tuning frustration. Contrary to previous reports, the low-temperature magnetic state of its three-leg zigzag ladders is a quasi-one-dimensional analogue of the magnetic state recently proposed to exhibit spinon-magnon mixing in botallackite [1]. In addition to this low-temperature phase of coupled ferromagnetic and antiferromagnetic spin chains, in zero field antlerite hosts an incommensurate helical+cycloidal state, an idle-spin state, and a multiple-q phase which is the magnetic analog of misfit crystal structures [2]. The antiferromagnetic order on the central leg is reentrant. Density functional theory calculations indicate that antlerite's magnetic ground state is exquisitely sensitive to fine details of the atomic positions [3], with each chain independently on the cusp of a quantum phase transition, indicating an excellent potential for tunability, and making antlerite a particularly promising platform for pursuing exotic magnetic order.

[1] H. Zhang *et al.*, Phys. Rev. Lett. **125**, 037204 (2020).

[2] A.A. Kulbakov *et al.*, arXiv:2207.05606

[3] A.A. Kulbakov *et al.*, Phys. Rev. B **106**, L020405 (2022)