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Unusual UUDD magnetic chain structure of the spin-1/2 tetragonally distorted spinel $GeCu_2O_4$. TAO ZOU, Quantum condensed matter division, Oak Ridge National Lab, YUNQI CAI, Institute of Physics, Chinese Academy of Sciences, CLARINA DELA CRUZ, V. OVIDUE GARLEA, Quantum condensed matter division, Oak Ridge National Lab, S.D. MAHANTI, Michigan State University, JINGUANG CHENG, Institute of Physics, Chinese Academy of Sciences, XIANGLIN KE, Michigan State Univeristy — $GeCu_2O_4$ exhibits a tetragonal spinel structure due to the strong Jahn-Teller distortion associated with Cu^{2+} ions. We show that its magnetic structure can be described as slabs composed of a pair of layers with orthogonally oriented spin 1/2 Cu chains in the basal ab plane. The spins between the two layers within a slab are collinearly aligned while the spin directions of neighboring slabs are perpendicular to each other. Interestingly, we find that spins along each chain form an unusual up-up-down-down (UUDD) pattern, suggesting a non-negligible nearest-neighbor biquadratic exchange interaction in the effective classical spin Hamiltonian. We hypothesize that spin-orbit coupling and orbital mixing of Cu^{2+} ions in this system is non-negligible, which calls for future calculations using perturbation theory with extended Hilbert (spin and orbital) space and calculations based on density functional theory including spin-orbit coupling and looking at the global stability of the UUDD state.

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