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Chiral Spin Liquid Ground State in YBaCo3FeO7

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A chiral spin liquid state is discovered in the highly frustrated, layered kagome system YBaCo3FeO7 by polarized diffuse neutron scattering [1]. From the antisymmetric part of scattering, related to vector chirality, we determine the chiral correlation function by Fourier analysis. The chiral short-range order indicates the emergence of chiral lumps. It can be described by cycloidal waves, which originate from the trigonal sites and extend into the kagome layers. The observed vector chirality agrees with the underlying antisymmetric Dzialoshinsky-Moriya exchanges arising from broken spatial parity. This chiral spin liquid state is stable down to lowest temperatures despite of strong antiferromagnetic spin exchange. The observation of a possible short-range ordered ground state raises a fundamental challenge. However, based on the classical theory of magnetic order, we show that such a ground state may arise from the antisymmetric exchange acting as a frustrating gauge background stabilizing local spin lumps. This scenario may appear in many highly frustrated magnetic systems in non-centrosymmetric compounds and has similarities to the avoided phase transition in coupled gauge- and matter-fields for subnuclear particles.
[1] W. Schweika, M. Valldor, J.D. Reim, and U.K. Rößler, Chiral Spin Liquid Ground State in YBaCo3FeO7, Phys. Rev. X 12, 021029 (2022).

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