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Chiral phase of a simple two-dimensional spin-1 quantum magnet[1] OLEG STARYKH, University of Utah, ZHENTAO WANG, Rice University, CRISTIAN D. BATISTA, T-Division and CNLS, Los Alamos National Laboratory — We investigate the evolution of the ground state of a simple spin-1 antiferromagnet with easy-axis single-ion anisotropy $D(S^z)^2$, with $D < 0$, on a two-dimensional triangular lattice. The ground state changes from a quantum paramagnet one, at sufficiently large $|D|$, to a magnetically ordered 120° one at small $D \sim 0$. Besides breaking the continuous $U(1)$ symmetry of global spin rotations along the z-axis, this non-collinear ordering also breaks the discrete Z_2 *chiral* symmetry, which raises the possibility of an intermediate chiral spin liquid state, spontaneously breaking spatial inversion and mirror symmetries. We show that this interesting novel state indeed appears as a result of the condensation of bound $\langle S_n^+ S_m^- - S_n^- S_m^+ \rangle$ pairs. The resulting Ising-like nematic state supports a regular pattern of spin currents on the bonds of the triangular lattice. It represents quantum analogue of the classical chiral spin liquid proposed by Villain in 1977.

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Oleg Starykh
University of Utah

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