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Chiral phase near quantum critical point ZHENTAO WANG, The University of Tennessee, OLEG STARYKH, University of Utah, ADRIAN FEIGUIN, Northeastern University, ANDREY CHUBUKOV, University of Minnesota, CRISTIAN BATISTA, The University of Tennessee, Oak Ridge National Laboratory — We study the sequence of quantum phase transitions between a quantum paramagnetic state and a magnetically ordered state for a 2D spin one triangular XXZ model with easy plane single-ion anisotropy DS_z^2. The mean field phase diagram of the model exhibits a direct transition between an XY antiferromagnetic state and a quantum paramagnetic phase (PM) induced by a large enough D value. The two phases are separated by a quantum critical point at $D = D_c$. The Ising-like J_z interaction creates an attraction between quasiparticles of the quantum paramagnet with opposite spin. Upon approaching D_c from the quantum paramagnetic side, we find that the resulting two-particle bound states condense before the single particle gap closes at $D = D_c$. This two-magnon bound state condensation signals the onset of a chiral liquid, which spontaneously breaks the inversion symmetry, while leaving the $U(1)$ symmetry intact. This leads to an emergent chiral liquid phase, which supports non-zero spin currents (vector spin chirality) without long range magnetic order. In our analytical treatment, the chiral phase appears for arbitrary small value of the Ising interaction. We further show evidence of the chiral phase by means of density matrix renormalization group calculations.

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