Quantum freezing and re-entrant melting in a quantum spin liquid
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NEIL HARRISON, National High Magnetic Field Laboratory, Los Alamos, NM 87545 — Exchange interactions in piperazinium hexachlorodicuprate (PHCC) produce a frustrated bilayer antiferromagnet. We report the field-temperature phase diagram of this system as determined via high field (up to H = 50 T) susceptibility and neutron scattering (H = 14.2 T) experiments. There are two quantum critical points: Hc1 = 7.6 T separates the singlet phase from a three dimensional spin-ordered state while Hc2 = 37 T marks the onset of saturated ferromagnetism. The long range ordered phase is embedded in a gapless quasi-two dimensional paramagnetic regime with short range spin correlations. Close to the low field quantum critical point, a reentrant phase transition between long range order and the singlet phase indicates that weak interactions with lattice or nuclear spin degrees of freedom become important.

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