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Algebraic vortex liquid in spin-1/2 triangular antiferromagnets: Scenario for Cs_2CuCl_4

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Motivated by inelastic neutron scattering data on Cs_2CuCl_4, we explore spin-1/2 triangular lattice antiferromagnets with both spatial and easy-plane exchange anisotropies, the latter due to an observed Dzyaloshinskii-Moriya interaction. Exploiting a duality mapping followed by a fermionization of the dual vortex degrees of freedom, we find a novel "critical" spin-liquid phase described in terms of Dirac fermions with an emergent global SU(4) symmetry minimally coupled to a non-compact U(1) gauge field. This "algebraic vortex liquid" supports gapless spin excitations and universal power-law correlations in the dynamical spin structure factor which are consistent with those observed in Cs_2CuCl_4. We suggest future neutron scattering experiments that should help distinguish between the algebraic vortex liquid and other spin liquids and quantum critical points previously proposed in the context of Cs_2CuCl_4.