

Abstract Submitted  
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**Spinless massless and massive Dirac fermions in  
a checkerboard lattice magnet**<sup>1</sup>

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— We investigated the theory of the interplay of itinerant electrons and localized magnetic moments on the frustrated checkerboard lattice as function of the super-exchange interaction between the localized moments and the band filling of fermions. We find that at half filling a very robust magnetic “flux” phase is lowest in energy. The ordering of the localized spins induces an effective gauge field flux of  $\pi$  for the electrons. Consequently, this phase preserves time-reversal symmetry and the low-energy effective theory of the electrons is that of massless Dirac fermions, resembling the situation in graphene except that the spin degree of freedom is absent here. The robustness of this state originates from the geometrical frustration of the checkerboard lattice. In the crossover regime from this flux state and the saturated FM state at vanishing super-exchange coupling, these Dirac fermions become massive with opposite sign of the mass at the two degeneracy points. This chiral spin state is then equivalent to a time-reversal breaking anomalous Quantum Hall phase, precisely in the way once envisioned by Haldane in graphene.

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