

Abstract Submitted
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Lattice fermion models with spontaneous orbital currents in strong-interaction limit¹ CHRISTOPHER L. HENLEY, Cornell University —

A suggestion that the cuprate pseudogap state has a hidden order, in the form of staggered currents [1], led to toy spinfull fermion models on ladders and bilayers which exhibit such a symmetry breaking [2]. This invites the question, which features of the model are conducive to such phases? Taking (for maximal simplicity) spinless fermions, with large or infinite repulsion, I find a ground state with spontaneous-current order in two models: each consists of rings of sites, coupled by weak hopping to form a ladder or a $d = 2$ lattice. So far, all my examples require lattices modulated with alternately strong and weak hopping. I also argue that spontaneous currents depend on the presence of Berry-like phases as one takes the system around loops in the abstract graph of all configurations coupled by hops: it would follow that spontaneous currents are impossible in lattice boson models.

[1] S. Chakravarty et al, Phys. Rev. B 63, 094503 (2001).

[2] M. Tsuchiizu and A. Furusaki, %%% spontaneous currents Phys. Rev. B 66, 245106 (2002); U. Schollwöck et al, Phys. Rev. Lett. 90, 186401 (2003); S. Capponi, C. Wu, and S.-C. Zhang, Phys. Rev. B 70, 220505 (2004).

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