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Interplay between pair-density-wave and charge-density-wave orders in underdoped cuprates DANIEL AGTERBERG, University of Wisconsin-Milwaukee, YUXUAN WANG, Univ of Wisconsin, Madison, ANDREY CHUBUKOV, University of Minnesota — We analyze the interplay between charge-density-wave (CDW) and pair-density-wave (PDW) orders within the spin-fermion model for the cuprates. We show that both orders do emerge in the spin-fermion model as preemptive orders to antiferromagnetism, and are constructed out of pairs of "hot" fermions on the Fermi surface. We that the two orders are nearly degenerate and are related by an approximate SU(2) particle-hole symmetry of the spin-fermion model. The SU(2) symmetry is exact if one neglects the curvature of the Fermi surface in hot regions, in which case the CDW and PDW, each breaking translational U(1) symmetry, become components of an O(4)-symmetric super-vector. We show that the curvature of the Fermi surface breaks this degeneracy and that the mean-field transition temperature is higher for the PDW order. However, we also argue that both CDW and PDW order break additional discrete Z_2 symmetries and show that the feedback from Z_2 order on the CDW order is stronger. This feedback increases the critical temperature for CDW order compared to that for PDW order. Which state develops first depends on system parameters. We also consider the case when both orders are present at low T and argue that simultaneous presence of CDW and PDW orders induce a variety of states.

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