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The Ground State of the Pseudogap in Cuprates[1] T. VALLA, Brookhaven National Laboratory, A. V. FEDOROV, Lawrence Berkeley National Laboratory, JINHO LEE, J. C. DAVIS, Cornell University, G. D. GU, Brookhaven National Laboratory — In conventional superconductors, the appearance of an energy gap in the electronic spectrum indicates pairing of electrons into Cooper pairs and a simultaneous transition into a macroscopic superconducting state. In contrast, in the underdoped high temperature superconductors, an energy gap is already present in the normal state. An understanding of this normal state gap or 'pseudogap' has proven elusive, because its ground state electronic structure was unknown. Here, we present studies of electronic structure in $La_{2-x}Ba_xCuO_4$, a unique system where the superconductivity is strongly suppressed and static spin and charge orders or 'stripes' develop near a doping level of x =1/8. Using angle-resolved photoemission and scanning tunneling microscopy, we detect an energy gap at the Fermi surface with magnitude consistent with d-wave symmetry and with linear density of states, vanishing only at four nodal points, even when superconductivity disappears at x =1/8. Thus, the non-superconducting, 'striped' state at x =1/8 is consistent with a phase incoherent d-wave superconductor whose Cooper pairs form spin/charge ordered structures instead of becoming superconducting.

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