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Quantum phase fluctuations in a correlated lattice d-wave superconductor and Cooper pair density-wave in the underdoped cuprates ASHOT MELIKYAN, University of Florida, ZLATKO TESANOVIC, Johns Hopkins University — We introduce and study an XY-type model of thermal and quantum phase fluctuations in a two-dimensional correlated lattice d-wave superconductor. We investigate the origin of the charge density-wave of Cooper pairs (CPCDW), which we argue is the state behind the periodic modulation of LDOS discovered in recent STM experiments. We illustrate how Mott-Hubbard correlations near half-filling suppress superfluid density and favor an incompressible state which breaks translational symmetry of the underlying atomic lattice. The formation of CPCDW in such a strongly quantum fluctuating superconductor can naturally be understood as an Abrikosov-Hofstadter problem in a type-II dual superconductor, with the role of the dual magnetic field played by the electron density. The resulting Abrikosov lattice of dual vortices translates into the periodic modulation of the BdG gap function and the electronic density. A 4×4 checkerboard modulation pattern naturally arises as an energetically favored ground state at and near the $x = 1/8$ doping and produces LDOS in good agreement with experimental observations. Z. Tešanović, Phys. Rev. Lett. **93**, 217004 (2004), A. Melikyan and Z. Tešanović, cond-mat/0408344. Supported in part by the NSF grant DMR00-94981.

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