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Resilience of d-wave superconductivity to nearest-neighbor repulsion[1] A.G.R. DAY, D. SENECHAL, V. BOULIANE, A.-M.S. TREMBLAY, Universite de Sherbrooke — Many theoretical approaches find d-wave superconductivity in the one-band Hubbard model for high-temperature superconductors. At strong-coupling ($U \geq W$, where U is the on-site repulsion and $W = 8t$ the bandwidth) pairing is controlled by the exchange energy $J = 4t^2/U$. One may then surmise, ignoring retardation effects, that near-neighbor Coulomb repulsion V will destroy superconductivity when it becomes larger than J, a condition that is easily satisfied in cuprates for example. Using Cellular Dynamical Mean-Field theory with an exact diagonalization solver for the extended Hubbard model, we show that pairing *at strong coupling* is preserved, even when $V \gg J$, as long as $V \lesssim U/2$. While at weak coupling V always reduces the spin fluctuations and hence d-wave pairing, at strong coupling, in the underdoped regime, the increase of $J = 4t^2/(U-V)$ caused by V increases binding at low frequency while the pair-breaking effect of V is pushed to high frequency. These two effects compensate in the underdoped regime, in the presence of a pseudogap. While the pseudogap competes with superconductivity, the proximity to the Mott transition that leads to the pseudogap, and retardation effects, protect d-wave superconductivity from V. PRB 87, 075123 (2013)

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