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Doping-dependent critical Cooper-pair momentum p_c in thin underdoped cuprate films[1] THOMAS LEMBERGER, JOHN DRASKOVIC, STANLEY STEERS, THOMAS MCJUNKIN, ADAM ANMED, Ohio State Univ - Columbus — We apply a low-field (<100 G) technique to measure the critical Cooper pair momentum p_c in thin, underdoped films of $Y_{0.7}Ca_{0.3}Ba_2Cu_3$ $O_{7-\delta}$ and $Bi_2Sr_2CaCu_2O_{8+\delta}$, where doping is effected by adjusting the oxygen stoichiometry through post-deposition annealing. The technique is based on applying a perpendicular magnetic field to the center of a superconducting film and measuring the field at which screening of the field catastrophically fails. Theory together with measurements on thin films of conventional superconductors Nb and MoGe argue for the validity of the technique. In underdoped cuprates, spectroscopy identifies multiple characteristic energy scales, e.g., the pseudogap and the "nodal" gap, neither of which is proportional to T_c. On general grounds, we expect to find that $p_c \propto 1/\xi$ is proportional to the characteristic superconducting energy scale. We observe that $p_c \propto T_c$ as T_c decreases with underdoping, identifying $k_B T_c$ as the characteristic energy. While this result is trivial in conventional superconductors whose spectroscopic gaps are proportional to T_c, it is significant in cuprates.

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