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Signatures of the Berezinskii–Kosterlitz–Thouless transition in highly underdoped $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ ¹ ZHENZHONG SHI, PAUL BAITY, XIAOYAN SHI, DRAGANA POPOVIĆ, Dept. of Phys. & Natl. High Magnetic Field Lab., Florida State Univ. — We investigated the nature of the thermally driven transition to a superconducting state on MBE-grown 100 nm thick $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ films ($x = 0.07$ and 0.08) by studying a) superconducting fluctuations (SCFs), as determined from the magnetoresistance, b) current-voltage ($I - V$) characteristics, and c) fluctuations of conductance with time (noise). Noise was studied on confined width ($20 \mu\text{m}$) samples specifically designed for measurements in the eight-probe double-bridge configuration. We observe: a) the contribution of the SCFs to the conductivity increases monotonically with decreasing T and diverges exponentially at T_{BKT} , where resistance also goes to zero; b) power-law behavior $V \propto I^{\alpha(T)}$ with $\alpha(T) \geq 3$ for $T \leq T_{BKT}$; and c) an orders-of-magnitude enhancement of the noise near T_{BKT} . Possible long-range correlations in the phase fluctuations near T_{BKT} are also studied with higher-order spectrum analysis. Our observations suggest that the transition from superconductor to the normal state exhibits signatures of the Berezinskii–Kosterlitz–Thouless (BKT) transition.

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