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**Quantum Fluctuations of Superconductivity in Critically Underdoped  $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$**  N.P. ARMITAGE, Y. LUBASHEVSKY, L.S. BILBRO, R.V. AGUILAR, Department of Physics and Astronomy, The Johns Hopkins University, G. LOGVENOV, I. BOZOVIC, Brookhaven National Laboratory — In the underdoped pseudogap regime of the high-temperature superconductors, one expects that due to low superfluid densities and short correlation lengths, superconducting fluctuations will be very significant for transport and thermodynamic properties. We have used THz time-domain spectroscopy (TTDS) to probe the fluctuations of superconductivity in extremely underdoped  $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$  films close to and beyond the superconducting quantum critical point. On the approach to the transition from above, we find a significant range of quantum superconducting fluctuations that we quantify through a comparison of the low and high frequency phase stiffnesses. An explicit measure of these fluctuations through the quantity we propose as a “quantum Debye-Waller factor” shows that these fluctuations diverge and drive the transition.

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