Abstract Submitted
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Scaling of the superfluid density in severely underdoped $\mathbf{YBa_2Cu_3O_{6+y}}$[1] C.C. HOMES, Condensed Matter Physics and Materials Science Dept., Brookhaven National Laboratory, Upton, New York, W.A. HUTTEMA, P.J. TURNER, D.M. BROUN, Dept. of Physics, Simon Fraser University, Burnaby, British Columbia, RUIXING LIANG, W.N. HARDY, D.A. BONN, Dept. of Physics and Astronomy, University of British Columbia, Vancouver, British Columbia — Microwave impedance techniques have been used to determine the critical temperature (T_c), the in-plane superfluid density (ρ_{s0}), and the dc conductivity (σ_{dc}) just above T_c in a highly-underdoped sample of $YBa_2Cu_3O_{6+y}$ for $y \simeq 0.333$. In this state the sample may be annealed to yield different levels of chain oxygen order and electronic doping in the copper-oxygen planes, resulting in a range of $T_c \simeq 2 - 17$ K.[2] The linear relation between ρ_{s0} and T_c is not observed, instead $\rho_{s0} \propto T_c^2$. However, the results do follow the more general scaling relation $\rho_{s0}/8 \simeq 4.4\,\sigma_{dc}T_c$,[3] extending the validity of this relation for the in-plane data by an order of magnitude. In addition, these new results now provide a region of overlap between the scaling observed in the copper-oxygen planes, and perpendicular to the planes along the poorly-conducting c axis.

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[2]D. M. Broun *et al.*, Phys. Rev. Lett. **99**, 237003 (2007).
[3]C. C. Homes *et al.*, Phys. Rev. B **72**, 134517 (2005).

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