Dynamic critical behavior of YBCO thin films/crystals

HUA XU, SU LI, CHRISTOPHER LOBB, STEVEN ANLAGE, Center for Nanophysics and Advanced Materials, University of Maryland, College Park — The zero-field phase transition of high \(T_c\) superconductors has been studied by a number of techniques. However, transport properties (such as the conductivity) which probe the dynamics near \(T_c\) are less explored, and a wide range of critical exponents have been reported experimentally. We studied fluctuation effects of YBa\(_2\)Cu\(_3\)O\(_{7-\delta}\) thin films around \(T_c\) by doing frequency-dependent microwave conductivity and DC nonlinearity measurements. The length scales involved in the measurements and their influence on the fluctuation conductivity have been examined systematically, and this helps to clarify the historical discrepancy between experimental results and scaling predictions. Our results give a dynamical scaling exponent \(z = 1.55 \pm 0.15\), which indicates the superconducting to normal phase transition of high-\(T_c\) materials likely belongs to the model E-dynamics.

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