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Scaling analysis of the static and dynamic critical exponents in $Pr_{2-x}Ce_xCuO_4$ films as a function of doping[1] R.A. ISAACS, M.C. SULLIVAN, M.F. SALVAGGIO, J. SOUSA, C.G. STATHIS, J.B. OLSON, Ithaca College, Ithaca NY — We investigate the static and dynamic critical exponents of the electron-doped superconductor $Pr_{2-x}Ce_xCuO_4$. Our results are based on current vs. voltage measurements in zero-field of the normal-superconducting phase transition in $Pr_{2-x}Ce_xCuO_4$ films as a function of doping. We find that these materials posses an unusually small critical regime ($\sim$25mK) that gives rise to mean-field behavior at the phase transitions and a static critical exponent of about $\nu \sim 0.5$ for all dopings. This is quite unexpected when compared to the critical behavior seen in well-known hole-doped superconductor $YBa_2Cu_3O_7$, where $\nu \sim 2/3$. In addition, mean-field behavior is also exhibited in the dynamic critical exponent (z). We find that $Pr_{2-x}Ce_xCuO_4$ behaves not like other cuprate superconductors, but similarly to conventional superconductors in this regard. Only as transition width decreases to zero does the dynamic critical exponent (z) approach the value found in $YBa_2Cu_3O_7$.

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