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Electronic phase separation in $La_{2-x}Sr_xCuO_{4+y}$ H.E. MOHOTTALA, B.O. WELLS, J.I. BUDNICK, H.A. HINES, University of Connecticut, CH. NIEDERMAYER, Paul Scherrer Institute, A.R. MOODENBAUGH, Brookhaven National Lab, F.C. CHOU, Massachusetts Institute of Technology — We have performed a combination of μSR and bulk magnetization experiments on oxygen-intercalated single crystals of $La_{2-x}Sr_xCuO_{4+y}$, with various Sr contents x. All of the samples were both superconducting with $T_C{\sim}40$ K and magnetic with a spin density ordering temperature $T_M{\sim}40$ K. Interpretation of our results suggests that the superconducting and magnetic states arise from separate regions of the sample and comprise separate phases. The coexistence of these phases implies a phase separation that is purely electronic. In fact, we have seen no evidence for a structural phase separation in x-ray diffraction studies. The magnetic region is not superconducting and appears to be closely related to the anomalous, 1/8 hole doped, weakly superconducting versions of $La_{2-x}M_xCuO_4$. While the superconducting regions are harder to characterize, there is evidence that these regions are completely non-magnetic. This work reveals the subtleties of a more complex relationship between magnetism and superconductivity in the copper oxides than has previously been assumed. This work was partially supported by the US-DOE through contract DE-FG02-00ER45801 and the Cottrell Scholar Program of the Research Corporation.

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