Disappearance of antiferromagnetic spin excitations in overdoped \( \text{La}_{2-x}\text{Sr}_x\text{CuO}_4 \) JOHN TRANQUADA\(^1\), Brookhaven National Lab, S. WAKIMOTO, Japan Atomic Energy Agency, K. YAMADA, IMR, Tohoku Univ., C.D. FROST, ISIS Facility, RAL, R.J. BIRGENEAU, UC Berkeley, H. ZHANG, Univ. of Toronto — We have used time-of-flight neutron spectroscopy to study magnetic excitations, for energies up to \( \sim 100 \) meV, in overdoped \( \text{La}_{2-x}\text{Sr}_x\text{CuO}_4 \) with \( x = 0.25 \) and 0.30 \([1]\). Comparison of spectra integrated over the width of an antiferromagnetic Brillouin zone demonstrates that the magnetic scattering at intermediate energies, \( 20 < \omega < 100 \) meV, progressively decreases with overdoping. Previous work has shown that the low-energy magnetic excitations also disappear with overdoping \([2]\). This strongly suggests that the magnetism is a vestige of the parent antiferromagnet; spatial segregation of the doped holes, as in the stripe picture, provides a natural way for this to occur. Both the magnetism and superconductivity disappear as the system becomes a homogeneous metal. \([1]\) S. Wakimoto \textit{et al.}, Phys. Rev. Lett. \textbf{98}, 247003 (2007). \([2]\) S. Wakimoto \textit{et al.}, Phys. Rev. Lett. \textbf{92}, 217004 (2007).

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