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Antiferromagnetism and superconductivity do not seem to co-exist in $Nd_{2-x}Ce_xCuO_{4\pm\delta}$ EUGENE MOTOYAMA, GUICHUAN YU, INNA VISHIK, Stanford University, OWEN VAJK, University of Missouri, PATRICK MANG, MARTIN GREVEN, Stanford University — High transition-temperature (T_c) superconductivity develops near antiferromagnetic (AF) phases, and it is possible that magnetic excitations contribute to the superconducting (SC) pairing mechanism. In order to assess the role of antiferromagnetism, it is essential to understand the doping and temperature dependence of the two-dimensional AF spin correlations. The phase diagram is asymmetric with respect to electron and hole doping, and for the comparatively less-studied electron-doped materials, the AF phase extends much further with doping and it appears to overlap with the SC phase: the archetypical compound $Nd_{2-x}Ce_xCuO_{4\pm\delta}$ shows bulk superconductivity above $x \approx 0.13$, while evidence for AF order has been found up to $x \approx 0.17$. However, our inelastic magnetic neutron scattering measurements point to the distinct possibility that genuine long-range antiferromagnetism and superconductivity do not co-exist. The data reveal a magnetic quantum critical point where superconductivity first appears, consistent with an exotic quantum phase transition between the two phases. Our measurements also demonstrate that the pseudogap phenomenon in the electron-doped materials arises from a build-up of spin correlations, in agreement with recent theoretical proposals.

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