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Doping Dependence of the Magnetic Penetration Depth and Coherence Length in $YBa_2Cu_3O_y$ JEFF SONIER, FERGAL CALLAGHAN, Simon Fraser University, JESS BREWER, WALTER HARDY, DOUG BONN, RUIXING LIANG, University of British Columbia — While linear scaling of T_c with superfluid density has been inferred from early muon depolarization rate (σ) measurements on high-temperature superconductors, this interpretation of μSR data assumes an invalid relation between σ and the in-plane magnetic penetration depth λ_{ab}. From detailed measurements and analysis of the μSR line shapes in $YBa_2Cu_3O_y$ single crystals, we have accurately determined the doping dependence of λ_{ab} and the superconducting coherence length ξ_{ab}. We find that T_c exhibits a sublinear dependence on $1/\lambda_{ab}^2$, and that ξ_{ab} increases with decreasing hole doping. In addition, the μSR line shapes for $y = 6.50$ are found to be consistent with $y = 0$ antiferromagnetism in and around the vortex cores, compatible with static stripes. We find that the antiferromagnetic order occurs only where superconductivity is suppressed, indicating that the ordering of copper spins competes with high-temperature superconductivity.

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