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Novel Phase Separation and Magnetic Volume Tuning in Underdoped $NaFe_{1-x}Co_xAs$ ($x \simeq 0.01$) LONG MA, J. DAI, X.R. LU, Department of Physics, Renmin University of China, GUOTAI TAN, YU SONG, Department of Physics and Astronomy, The University of Tennessee, PENGCHENG DAI, Department of Physics and Astronomy, The University of Tennessee Institute of Physics, Chinese Academy of Sciences, C.L. ZHANG, Department of Physics and Astronomy, The University of Tennessee, B. NORMAND, WEIQIANG YU, Department of Physics, Renmin University of China — NaFeAs is a quasi-2D pnictide parent compound with a weak magnetic moment and separate structural and antiferromagnetic transitions. Because Co doping leads to a superconductor with $T_c \simeq 20$ K at a very low optimal doping of $x = 0.02$, $NaFe_{1-x}Co_xAs$ is uniquely suited to sensitive studies of the cohabitation and competition between magnetism and superconductivity. Using NMR as a local probe of both antiferromagnetic order and superconductivity, we have compared Knight shifts and relaxation rates on the Na, As, and Co nuclei. Above T_c, we find weak doping inhomogeneity, in the form of residual paramagnetic regions with differing T_N values, and a strongly field-controlled magnetic volume. Below T_c, we observe a strong competition between antiferromagnetism and superconductivity, in which the temperature is the dominant control parameter, suppressing the magnetic volume fraction very significantly in favor of the superconducting one, while the external field suppresses T_c. Our results suggest both a microscale phase separation in real space and in reciprocal space a competition between two order parameters requiring the same electrons on the quasi-2D Fermi surface.

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