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The electronic phase diagram of $NaFe_{1-x}Co_xAs$ studied by scanning tunneling microscopy

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Similar to the high T_C cuprates, the iron pnictide superconductors also lie in close proximity to a magnetically ordered phase. The interplay between magnetism and superconductivity (SC) is a central issue concerning the pairing mechanism. A key step for resolving this issue is to acquire a comprehensive picture regarding the nature of various phases and interactions in the iron-based compounds. In this talk we present doping, temperature, and spatial evolutions of the electronic structure of $NaFe_{1-x}Co_xAs$ studied by scanning tunneling microscopy. The spin density wave (SDW) gap in the parent state is directly observed, which shows a strongly asymmetric lineshape that is incompatible with conventional Fermi surface nesting. In the underdoped regime the SDW and SC phases are shown to microscopically coexist and compete with each other. The optimally doped sample exhibits a single SC gap, but in the overdoped regime another asymmetric gap-like feature emerges near the Fermi level. In contrast to the rich variations of the low energy electronic states, the high energy spectra of the $NaFe_{1-x}Co_xAs$ system remain nearly unchanged until the system enters the strongly overdoped non-SC regime. The implications of the local electronic structures on the pairing mechanism of the iron pnictides will be discussed.