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Scanning tunneling spectroscopic studies of the iron-arsenic superconducting $Ba(Fe_{1-x}Co_x)_2As_2$ single crystals M.L. TEAGUE, H. CHU, R. T.-P. WU, N.-C. YEH, Dept. of Physics, Caltech, Pasadena, CA 91125, USA, P. CHEN, B. SHEN, H.-H. WEN, Institute of Physics, Chinese Academy of Sciences, China — Scanning tunneling spectra of $Ba(Fe_{1-x}Co_x)_2As_2$ (x=0.06, 0.08, 0.12) single crystals are studied as a function of temperature (T) and magnetic field (H). For $H = 0$, direct evidence for two-gap superconductivity at energies $\omega = \Delta_\beta$ and $\Delta_{\alpha,\gamma/\delta}$ ($\approx 2\Delta_\beta$) and for magnetic resonance modes at $\Omega \approx \Delta_\beta + \Delta_{\alpha,\gamma/\delta}$ are found for all samples at $T < T_c$. Fourier transformation of the tunneling spectra reveals x- and ω-dependent quasiparticle interference (QPI) wave-vectors $\mathbf{q}_2$ near $(\pm\pi,0)/(0,\pm\pi)$ and $\mathbf{q}_1$ near $(\pm 2\pi,0)/(0,\pm 2\pi)$. The spectral intensity of $\mathbf{q}_2$ exhibits strong ω-dependence, peaking sharply at $\omega = \Delta_\beta$, $\Delta_{\alpha,\gamma/\delta}$ and Ω. This is in stark contrast to the Bragg diffraction peaks that are independent of ω, T and x. For $H > 0$, additional QPI wave-vector $\mathbf{q}_3$ appears near $(\pm\pi,\pm\pi)$. These findings are consistent with the sign-changing s-wave pairing symmetry. Additionally, for the optimally doped sample, a pseudogap at $\omega \sim \Delta_{\gamma/\delta}$ is found inside the vortex core, possibly due to coexisting superconductivity and spin density waves. This result is in contrast to the zero-bias conductance peaks observed inside the vortex core of $(Ba_{1-x}K_x)Fe_2As_2$, implying asymmetry in the hole and electron-doping of the iron arsenides. This work was supported by NSF DMR-0907251.

Marcus Teague
Dept. of Physics, Caltech, Pasadena, CA 91125, USA

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