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Studies of superconductivity (SC) and competing-order (CO) interplay in cuprates and Fe-base compounds using scanning tunneling spectroscopy (STS) M.L. TEAGUE, C.-C. CHEN, N.-C. YEH, Dept. of Physics, Caltech, Pasadena, CA 91125, USA, Z.J. FENG, Dept. of Physics, Shanghai University, Shanghai, China — STS studies of $YBa_2Cu_3O_{7-\delta}$ (Y-123) and Ca-doped Y-123 from under- to over-doped regimes demonstrate that the origin of the pseudogap (PG) is due to competing orders (COs), and that the presence (absence) of PG above the SC transition T_c is associated with a CO energy Δ_{CO} larger (smaller) than the SC gap Δ_{SC}. We find that for hole doping level $p \leq 0.16$, $\Delta_{CO} > \Delta_{SC}$, whereas both Δ_{SC} and Δ_{CO} decrease with p for $p >$0.16, and Δ_{CO} ($\sim$ 10 meV) $< \Delta_{SC}$ ($\sim$ 13 meV) at $p \sim 0.23$. The CO wave-vectors Q_{CDW} and Q_{PDW} along the Cu-O bond are determined from Fourier transformation of the STS as a function of p, and are found to occur at 1/3 and 2/3 of the reciprocal lattice constant ($2\pi/a$) for $p = 0.16$. The pairing symmetry also evolves from pure $d_{x^2-y^2}$ to ($d_{x^2-y^2} + s$) for $p >$0.16, where the s-wave component increases with p. Moreover, under a finite magnetic field the ratio of the vortex "halo" radius (ξ_{halo}) relative to the SC coherence length (ξ_{SC}) decreases with p, from $\sim$ 8 for $p = 0.16$ to $\sim$ 3 for $p = 0.216$, suggesting PG contributions to the vortex halo. Magnetic resonance mode at $\Omega_r \sim 2\Delta_{SC}$ is also observed as a function of p. Finally, we present comparative STS studies of Fe-based superconductors, including $Ba(Fe_{1-x}Co_x)_2As_2$ and $Rb_{0.8}Fe_{1.6}Se_2$. This work was supported by NSF.

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