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Critical Charge Fluctuations and Ingap Collective Modes in the Superconducting State of the $NaFe_{1-x}Co_xAs$ Iron Pnictide Superconductor[1] VERNER THORSMOLLE, University of California at San Diego, MAXIM KHODAS, Racah Institute of Physics, The Hebrew University, ZHIPING YIN, Rutgers, The State University of New Jersey, CHENGLIN ZHANG, The University of Tennessee, SCOTT CARR, PENGCHENG DAI, Rice University, GIRSH BLUMBERG, Rutgers, The State University of New Jersey — We use polarization-resolved Raman spectroscopy to study the Raman susceptibility ($\chi(\omega$,T,x)) of the x-T phase diagram of $NaFe_{1-x}Co_xAs$ [1]. Above the structural $T_S(x)$ and the superconducting $T_c(x)$ transition, $\chi(\omega$,T,x) is dominated by a low-frequency quasielastic peak in B_{2g} symmetry displaying critical behavior across the entire phase diagram. Below $T_c(x)$, sharp ingap modes emerge for $x \geq 0.0165$ in A_{1g} ($\approx$65 cm^{-1}) and B_{2g} ($\approx$25 and $\approx$55 cm^{-1}) symmetry. The critical charge fluctuations are interpreted in terms of plasma waves of quadrupole excitations which below $T_c(x)$ undergo a metamorphosis into the ingap modes. The A_{1g} mode is a particle-hole (p-h) charge exciton consistent with a non-conventional s+- superconducting groundstate. The minor B_{2g} mode is a Bardasis-Schrieffer Cooper pair exciton of d-wave symmetry which exists only in a narrow doping window of density wave and superconductivity coexistence. The major B_{2g} mode is a bound state of d+- p-h plasma oscillations.

[1] V. K. Thorsmølle *et al.* arXiv:1410.6456v1.

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