Doping dependence of excitations in the electron-doped cuprate superconductor $Nd_{2-x}Ce_xCuO_4$

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The understanding of the mechanism at the origin of the superconductivity with high transition temperatures is an extremely attractive issue in condensed matter physics. In the cuprate family, the superconductivity is induced via doping charge carriers into antiferromagnetic ordered insulators [1]. While the mechanism remains unclear, some promising works have been focused on the electronic excitations (spin and charge), which are very dependent to the charge carrier concentration [2, 3, 4]. The $Nd_{2-x}Ce_xCuO_4$ (NCCO) electron-doped cuprate is a good example of the richness of the emerging field of electronic excitations in high-temperature superconductors. Recent resonant inelastic X-ray scattering (RIXS) experiments at the Cu L_3-edge revealed the presence of a branch of collective excitations near the first brillouin zone center [5], not reported in the literature for the hole-doped compounds [3, 4]. Furthermore, the doping evolution of the magnetic excitations is surprising: it persists beyond the AFM phase boundary and hardens in the superconductivity phase. To complete this study, we have probed the dynamical properties of the $Nd_{2-x}Ce_xCuO_4$ (NCCO) electron-doped superconductor using RIXS measurements at the Cu L_3-edge through out the phase diagram. Anomalies of both magnetic excitations and the collective excitations were observed near AFM-SC phase boundary, indicating their strong doping dependence and possible connection to the emergence of superconductivity.

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