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Supplementary Materials for

Superconductivity in infinite-layer nickelate $La_{1-x}Ca_xNiO_2$ thin films

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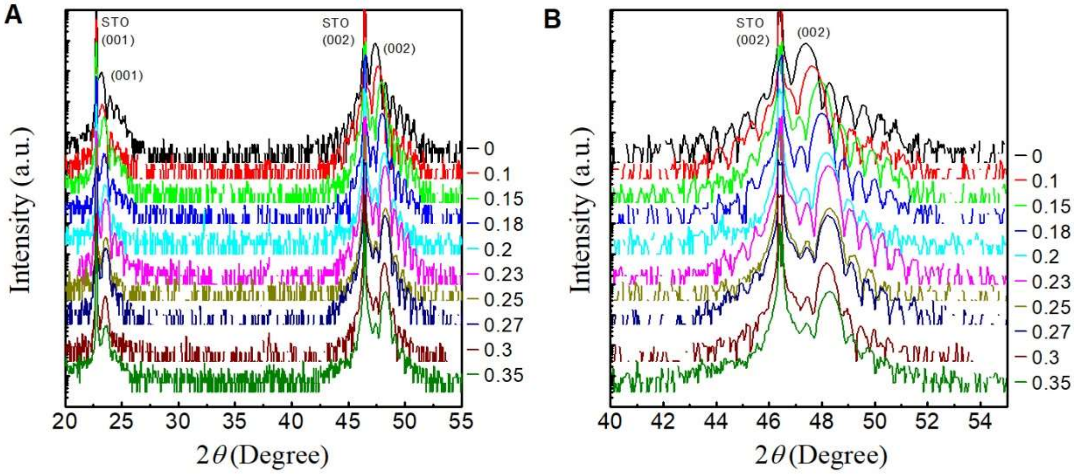
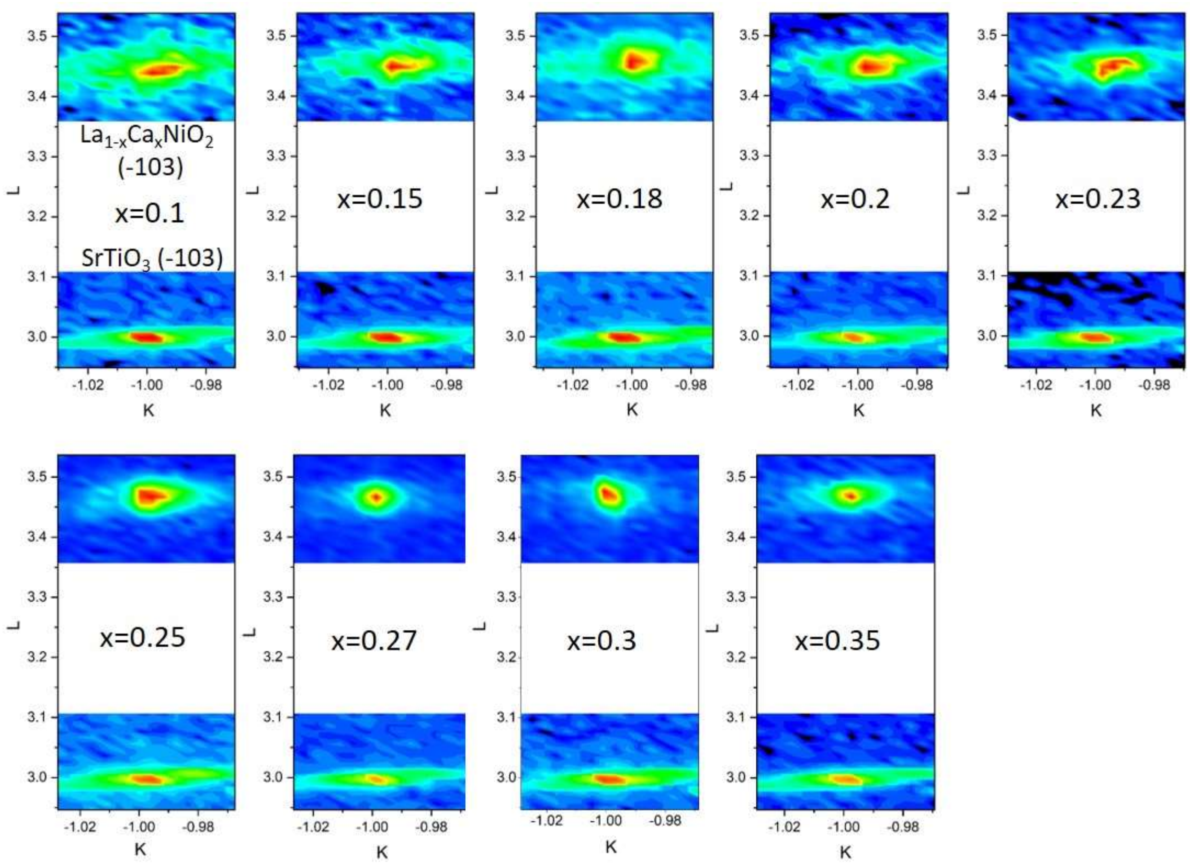
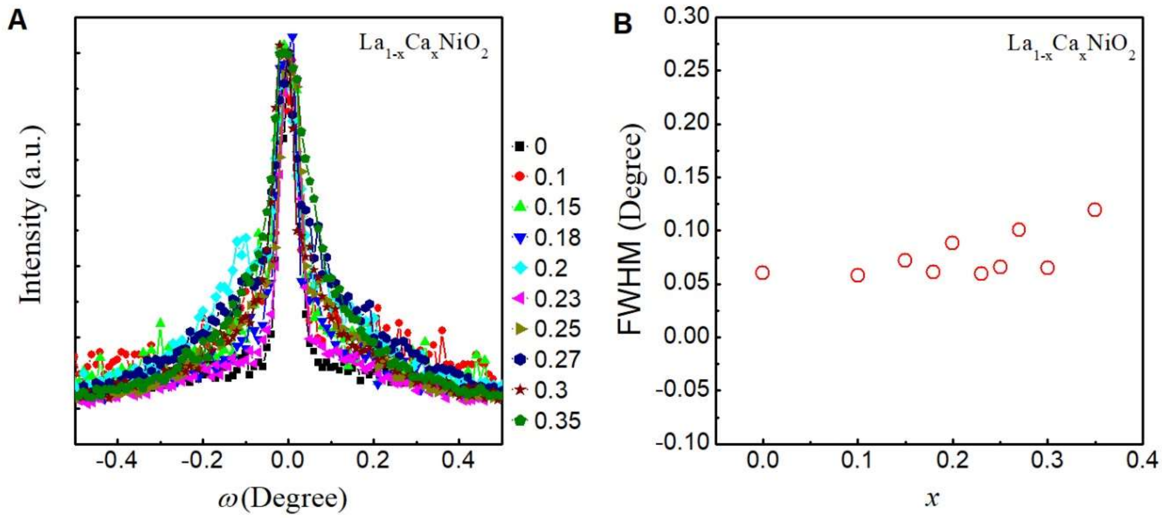
Figs. S1 to S6



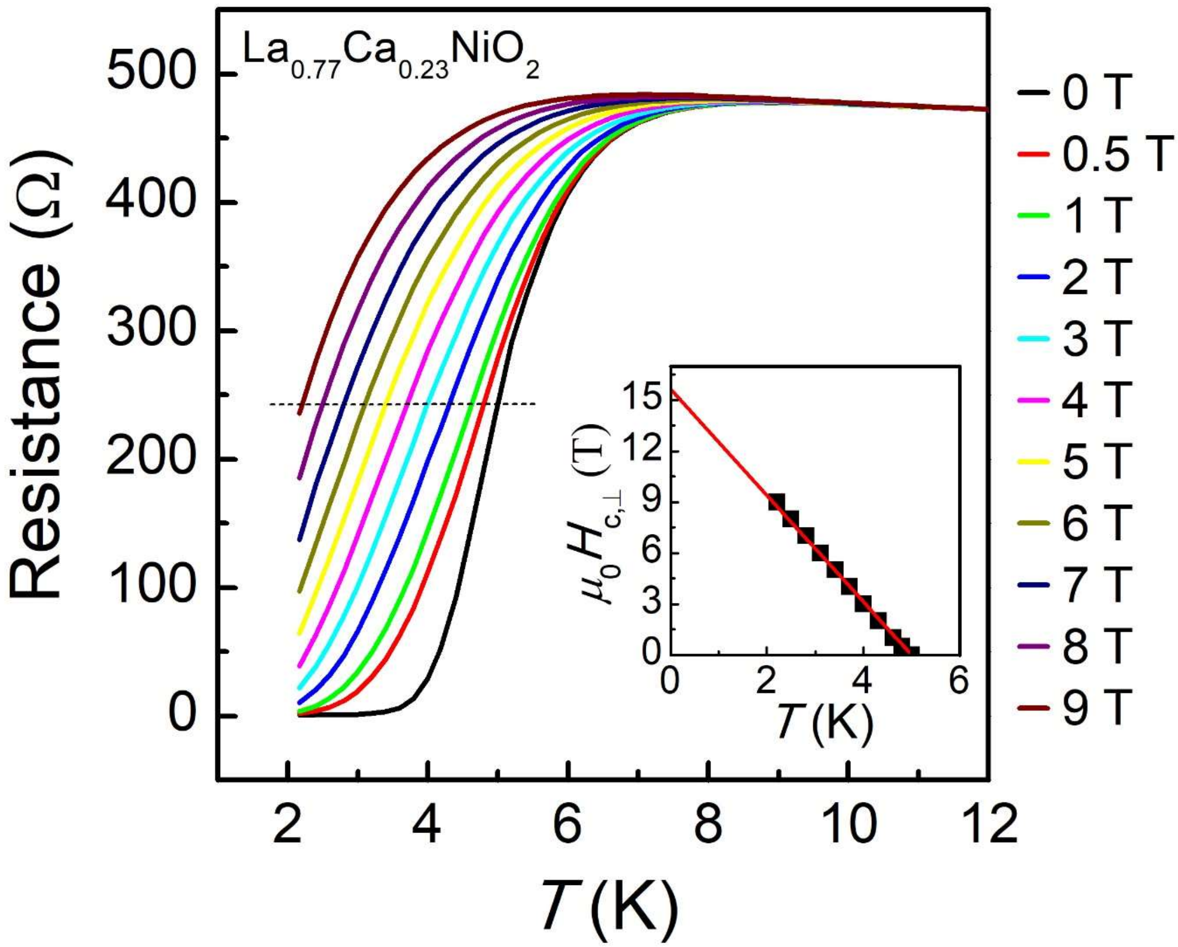
Supplementary Data - Figure S1| The XRD $\theta - 2\theta$ scan of infinite-layer $La_{1-x}Ca_xNiO_2$ thin films. (**A**) The XRD $\theta - 2\theta$ scan patterns of the as-grown perovskite $La_{1-x}Ca_xNiO_3$ thin films with different Ca doping levels x from 0 to 0.35. The intensity is vertically displaced for clarity. Only the $(00l)$ perovskite peaks are observed, where l is an integer, confirming the c-axis oriented epitaxial growth. (**B**) The zoomed-in XRD $\theta – 2\theta$ scan patterns at angles from 40 to 55 degrees. The clear thickness oscillations in the vicinity of the (002) peak indicate the single-phase and high quality of the perovskite films. The thickness of around 17 nm is obtained by calculating the period of thickness oscillations in the vicinity of the (002) peak. The (002) peak positions shift towards a higher angle as the Ca doping level increase, indicating a shrinking of the *c*-axis lattice, in agreement with the empirical expectation when replacing the cation with an atom having a smaller ionic radius.



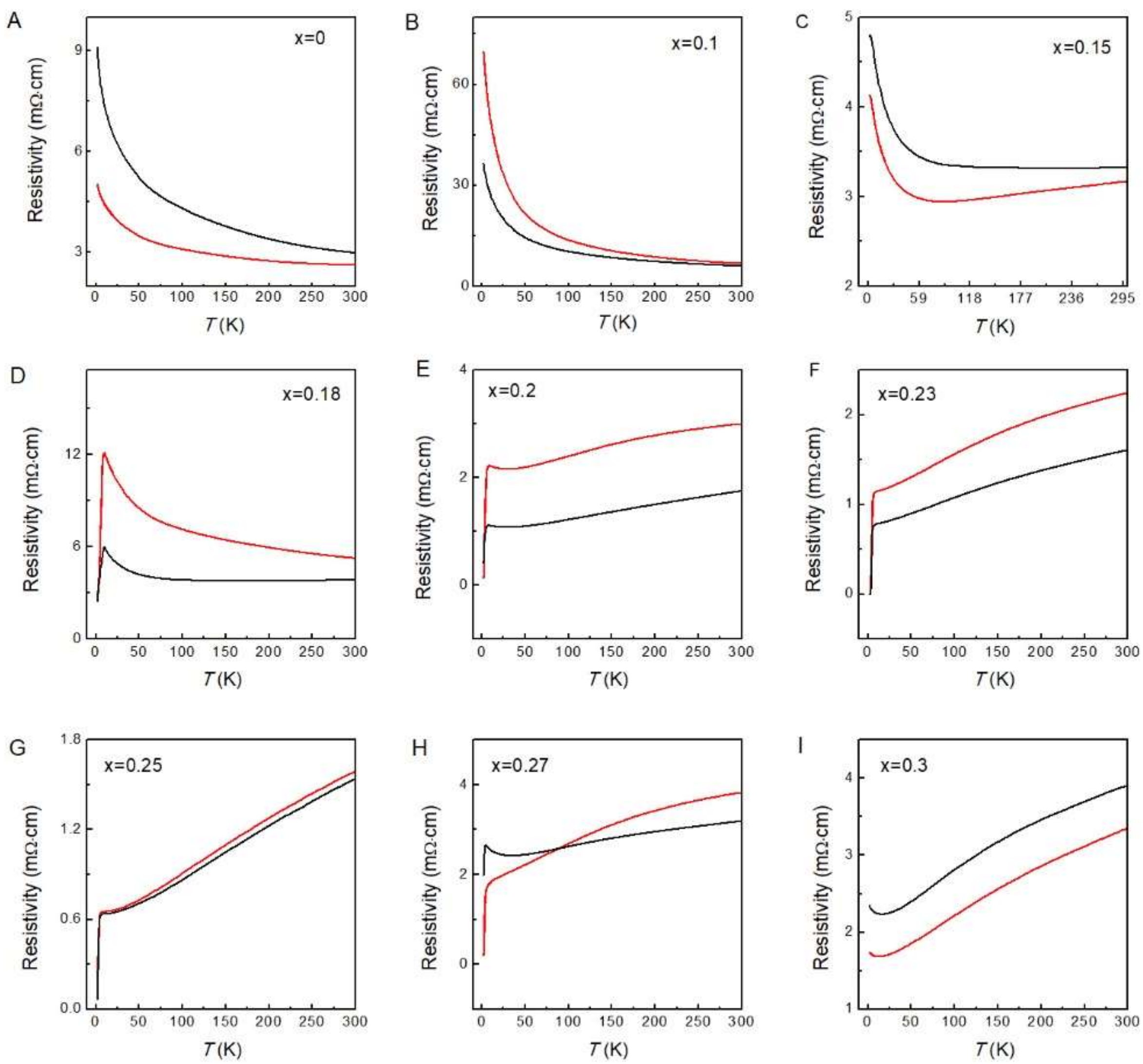
Supplementary Data - Figure S2| The reciprocal space mapping scan of infinite-layer $La_{1-x}Ca_xNiO_2$ thin films. The reciprocal space mapping scan is taken around $(\bar{1}03)$ diffraction peak for $La_{1-x}Ca_xNiO_2$ thin films with Ca doping level x from 0.1 to 0.35.



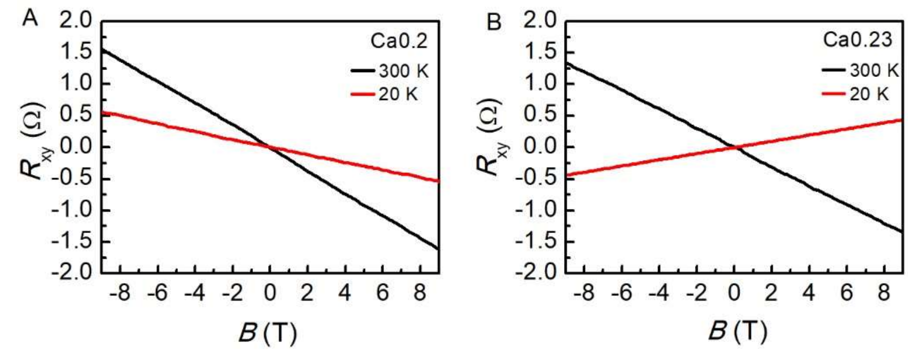
Supplementary Data – Figure S3| The rocking curves of infinite-layer $La_{1-x}Ca_xNiO_2$ thin films. (**A**) The rocking curves for the (002) peaks of the infinite-layer $La_{1-x}Ca_xNiO_2$ thin films with different Ca doping level x. (**B**) The full width at half-maximum (FWHM) of the (002) rocking curves as a function of x. The value of FWHM is between 0.06° and 0.12°.



Supplementary Data – Figure S4| Magnetic field dependence of the transition temperature. The resistance-temperature (*R*-*T*) curves for a sample with Ca doping level of 0.23 under various magnetic fields applied perpendicularly to the *a*-*b* plane. The inset shows the relationship between the upper critical field $\mu_0 H_{c,\perp}$ and T_C (extracted by the midpoint of the resistive transition) with a linear Ginzburg-Landau fitting. The red line is the fitting curve. The fitting gives a zero-temperature in-plane Ginzburg-Landau coherence length of 4.59 nm.



Supplementary Data – Figure S5| Reproducibility of the transition temperature. The resistivity-temperature (ρ-*T*) curves for two set of samples with Ca doping level varies from x=0 to x=0.3.



Supplementary Data – Figure S6| Linear Hall resistance. Hall resistance measured as a function of magnetic field at 300K vs 20K for (A) 0.2 Ca doping, and (B) 0.23 Ca doping.