MAR05-2004-003104

Abstract for an Invited Paper
for the MAR05 Meeting of
the American Physical Society

Dielectric Anomalies in Cuprates and Nickelates[1]

TUSON PARK, Los Alamos National Laboratory

Low frequency measurements of the dielectric response of hole-doped insulators $La_2Cu_{1-x}Li_xO_4$ and $La_{2-x}Sr_xNiO_4$ find a two order of magnitude decrease in the real part of the dielectric constant ε' as these crystals are cooled below a material- and frequency-dependent temperature T_f. The real and imaginary parts of ε exhibit universal scaling in Cole-Cole plots, which are used commonly to analyze classical structural glasses. The relaxation rate τ, obtained from the frequency dependence of T_f, is best described by $\tau(T) = a(T\text{-}T_0)^{-n}$, where T_0 is the zero-frequency limit of T_f. This power-law form, consistent with critical scaling, is followed over four decades in frequency. Together, these observations are consistent with glassy charge dynamics arising from collective behavior of doped holes in both the cuprate and nickelate. Intrinsic non-uniformities (stripes in the nickelate and stripes/potential non-stripe patterns in the cuprate) are common to both systems and drive the glassy dielectric behaviors observed. The temperature scale on which charge glassiness develops correlates with the onset of glassy spin dynamics found in NMR, μSR and susceptibility measurements, which suggests their interrelationship.

[1]In collaboration with Z. Nussinov, K. R. A. Hazzard, V. A. Sidorov, A. V. Balatsky, J. L. Sarrao, S.-W. Cheong and J. D. Thompson