Non-monotonic electron interactions and charge order in the copper oxide plane.

In strongly correlated systems the strength of Coulomb interactions between electrons, relative to their kinetic energy, plays a central role in determining their emergent quantum mechanical phases. I will discuss resonant x-ray scattering experiments on Bi$_2$Sr$_2$CaCu$_2$O$_{8+\delta}$, a prototypical cuprate superconductor that probe electronic correlations within the CuO$_2$ plane. We discovered a dynamic quasi-circular pattern in the $x$-$y$ scattering plane with a radius that matches the wave vector magnitude of the well-known static charge order [1]. Along with doping- and temperature-dependent measurements, our experiments reveal a picture of charge order competing with superconductivity where short-range domains along $x$ and $y$ can dynamically rotate into any other in-plane direction. This quasi-circular spectrum, a hallmark of Brazovskii-type fluctuations, has immediate consequences to our understanding of rotational and translational symmetry breaking in the cuprates. I will discuss how the combination of (screened) short- and long-range Coulomb interactions results in an effective non-monotonic potential (see figure) that may determine the quasi-circular pattern. – I will also present experiments where we demonstrate a very modest amount of uniaxial stress (0.1GPa causing 0.04% uniaxial strain) results in a very large reduction of the onset of charge stripes ($\sim$50K) [2]. I will also discuss how to interpret these results in the context of the quasi-circular dynamic correlations.