

Gauge Fluctuations, Confinement, and the Pseudogap in Cuprates

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The pseudogap regime of hole-doped cuprates remains one of the most intriguing and debated features of high-temperature superconductors. In this talk, I'll discuss a unified picture of how gauge-field fluctuations and confinement processes influence the evolution of the electronic structure across this regime.

Starting from a fractionalized metallic state, I'll show how thermal gauge fluctuations can lead to Fermi-arc behavior and help connect transport and spectroscopic observations. As the temperature is lowered or a magnetic field is applied, the confinement of spinons reconstructs the system into a small but conventional Fermi surface, which naturally explains the quantum oscillations and charge-density-wave correlations seen in high fields.

Overall, this framework suggests that the pseudogap can be viewed as a fluctuating, partially deconfined state that evolves smoothly into more conventional metallic and superconducting phases. I'll emphasize how confinement dynamics bridge these regimes and what this might tell us about the broader cuprate phase diagram.