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Evidence for a Pseudogap in *ab*-plane Optical Conductivity Measurements and its Applications

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The pseudogap is more difficult to identify in the *ab*-plane transport. While it was clear early on that the *ab*-plane absorption showed an unmistakable decrease at energies below Δ_{pg}, a clear interpretation in terms of a pseudogap was problematic since it is difficult to separate the effects of a pseudogap (a partial gap in the density of states) and a sharp peak in the spectrum of inelastic excitations (a magnetic resonance mode) since both give a similar feature near pseudogap energy scale. Further, studies of the real part of the conductivity did not show the expected reduction in optical spectral weight below the pseudogap energy. This remains unexplained.

The real part of the in-plane optical self-energy spectra in underdoped $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi-2212) and ortho II $YBa_2Cu_3O_{6.50}$ contains new and important information on the pseudogap. Using a theoretical model approach, a major new finding is that states lost below the pseudogap Δ_{pg} are accompanied by a pileup of states just above this energy. The pileup along with a sharp mode in the bosonic spectral function leads to an unusually rapid increase in the optical scattering rate as a function of frequency and a characteristically sloped peak in the real part of the optical self-energy. These features are not found in optimally doped and overdoped samples and represent the clearest signature so far in the in-plane optical conductivity of the opening of a pseudogap.

In this talk I will introduce the new pseudogap model and its applications on underdoped curates systems.

References:

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