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Bosonic self energy spectrum of high temperature superconductors from optical spectroscopy[1]

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We address the problem of extracting the bosonic spectral function in high temperature superconductors using optical spectroscopy. Last year, we succeeded in inverting the optical spectra of the cuprates and extract the quantity, analogous to the electron-phonon spectral density $\alpha^2F(\Omega)$ in the conventional superconductors, for YBCO Ortho II system. We used the highly ordered crystals grown by Hardy, Bonn and Liang and compared our results with magnetic neutron spectra on samples from the same source measured by Stock *et al.* There was excellent agreement between the results of the two sets of spectroscopies. Since then we have refined our inversion technique and have been able to make a similar comparison for the LSCO system with new neutron scattering data from Vignolle *et al.* This magnetic spectrum, together with our Eliashberg inversion, accounts in a straightforward way for the lower T_c of LSCO as compared to other cuprates. We also offer a detailed prediction of the evolution of the magnetic excitation spectrum with temperature and doping for the highly studied system Bi-2212, a material were neutron scattering data are very hard to get. Our data show that the bosonic self energy function evolves continuously from the broad background.

[1]Work done in collaboration with Jungseek Hwang, Jules Carbotte and Ewald Schachinger