The role of magnetism in forming the c-axis spectral peak at 400 cm^{-1} in high temperature superconductors.

T. Timusk and C.C. Homes

We discuss the peak at 400 cm^{-1}, which is seen in c-axis conductivity spectra of underdoped high temperature superconductors. The model of van der Marel and Munzar, where the peak is the result of a transverse plasmon arising from a low frequency conductivity mode between the closely spaced planes, fits our data well. Within the model we find that the temperature dependence of the peak amplitude is controlled by in-plane scattering processes. The temperature range where the mode can be seen coincides with T_s, the spin gap temperature, which is lower than T^*, the pseudogap temperature. As a function of temperature, the amplitude of the mode tracks the amplitude of the 41 meV neutron resonance and the spin lattice relaxation time, suggesting to us that the mode is controlled by magnetic processes and not by superconducting fluctuations which have temperature scale much closer to T_c, the superconducting transition temperature.