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Evolution of the Spin Susceptibility of High-T_c Superconductors.[1]

THOMAS TIMUSK, JUNGSEEK HWANG, McMaster University, EWALD SCHACHINGER, Graz University of Technology, JULES CARBOTTE, McMaster University — We demonstrate that a new tool, a model independent numerical Eliashberg inversion of the optical self-energy, based on maximum entropy considerations can be used to extract the magnetic excitation spectra of high-transition-temperature superconductors. In $Bi_2Sr_2CaCu_2O_{8+\delta}$ we explicitly show that the magnetic mode that dominates the self-energy at low temperatures directly evolves out of a smooth transfer of spectral weight to the mode from the continuum just above it. This redistribution starts already at 200 K in optimally doped materials but is much weaker in overdoped samples. This provides evidence for the magnetic origin of the superconductivity and presents a challenge to theories of the spin susceptibility and to neutron scattering experiments in high-temperature superconductors.

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