Abstract for the Eurasia-Pacific Summer School and Conference 2012 (Invited talk)

Antiferromagnetic Spin Fluctuations Do Not Mediate Pairing for Cuprate Superconductors

Han-Yong Choi and Seung Hwan Hong
Department of Physics, SungKyunKwan University, Suwon 440-746, Korea.
Asia Pacific Center for Theoretical Physics, Pohang 790-784, Korea.

There is no consensus yet on the interaction underlying the cuprate high T_C superconductivity. Leading ideas consistent with the *d*-wave pairing are the resonating valence bond, loop current order, and antiferromagnetic spin fluctuations (SF). Among them we put the SF idea under scrutiny by comparing consequences of the SF spectrum from inelastic neutron scattering (INS) with angle resolved photoemission spectroscopy (ARPES) measurements. We compute the angle (the momentum direction in the Brillouine zone) and frequency dependence of the self-energy of quasiparticles using the Eliashberg formalism. The effective interaction between quasiparticles, i.e., the Eliashberg function, was modeled in terms of the SF spectrum from the INS on the optimally doped LSCO superconductors reported by Vignolle et al. The resulting Eliashberg equation was solved iteratively using tight-binding dispersion. The self-energy may also be deduced from ARPES intensity analysis. Both above and below T_C, the angle and frequency dependence of the self-energy from ARPES and INS SF spectrum are not consistent. This observation casts some doubt on the SF idea for the cuprate superconductors. In order is a comment on Dahm et al's report that INS and ARPES are consistent for cuprates.