

Role of spin-charge coupling on antiferromagnetic universal scaling behaviors in unconventional Cu-based and Fe-based high temperature superconductors

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As well-known, the two different classes of Cu-based and Fe-based unconventional superconductors are characterized by antiferromagnetic and superconducting phases. One of the major theoretical challenges in high- T_c superconductivity is to understand physics involved universal scaling behaviors for both strongly correlated electron systems. In this study we focus our attention on the antiferromagnetic universal scaling behaviors of both systems based on our earlier proposed theory of the slave-boson founded t-J Hamiltonian of U(1) and SU(2) symmetry. This theory was successful in reproducing the observed phase diagrams of cuprate superconductors which show the monotonously decreasing pseudogap temperature T^* and the dome-shaped superconducting transition temperature T_c in the plane of temperature vs. hole concentration. The temperature and doping dependences of superfluid density and spectral function are well reproduced consistent with measurements. Besides, both charge dynamics and spin dynamics are importantly in good qualitative agreements with observed optical conductivity and spin susceptibility of

involving magnetic resonance energy E_{res} vs T_c . All of these agreeable predictions are due to the spin-charge coupling which arises from our accurate derivation of the slave-boson founded t-J Hamiltonian which is not available elsewhere in literatures. This study further showed that the universal scaling behaviors T^*/T_c and E_{res}/T_c are found in agreement with observations. Being encouraged we apply it to the Fe-based superconductors to show how well the universal scaling behaviors of the Cu-based superconductors fit 'universally' with them.

Biography

Sung-Ho S Salk has completed his Ph. D, in Physics, 1972 from the University of Texas at Austin. He was vice president of Korea Academy of Science (KAST) and Technology and is KAST permanent fellow. He has published more than 160 refereed papers in addition to book chapters, invited papers and talks and abstracts with the over 500.

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