SFB 608

Einladung zum Kolloquium

Ort: Universität zu Köln
II. Physikalisches Institut, Seminarraum 201

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Thema: Phenomenological self-energy for strongly correlated electrons in metals

Momentum resolved single particle excitations of electrons in a metal are described by the complex self-energy function $\Sigma(k,\omega)$, eventually generalised to a matrix-block of finite size, when orbital degrees of freedom are involved. Continued theoretical interest in $\Sigma(k,\omega)$ for strongly correlated electrons is justified by the fact that it is indirectly related to higher correlation functions, determining the thermodynamical, optical and transport properties of a material. Any deviations from Fermi liquid behaviour first show up in the self-energy. Exact solutions exist only for some models that are of little quantitative interest for real materials. A direct experimental access to $\Sigma(k,\omega)$ is possible through angle resolved photo-emission and inverse photo-emission spectra.

The low energy sector of the self-energy is either a strongly renormalized Fermi liquid or may have non-Fermi liquid features, e.g. power-law behaviour. Starting from a model Hamiltonian, approximations to this sector can be obtained by microscopic methods : e.g. Gutzwiller, renormalisation group or bosonisation. Using the same Hamiltonian, the high energy sector can also be obtained, e.g. by the moment method.

Our phenomenology consists of a parameter free, analytical interpolation formula with respect to the ⌉-dependence that covers also the spectral features at intermediate energy scales. We first present the general properties of this approximate but non-perturbative solution to the full correlation problem and critically discuss its advantages and drawbacks. Then, we review some models with the Hubbard interaction U as highest energy scale : Intermediate spectral features within the reach of this approximation include the charge transfer gap and the Zhang-Rice singlet-triplet gap in an Anderson lattice model, bi-layer splitting in coupled 2D Hubbard planes, as well as crystal field splitting in Heavy Fermion models.

Reference : Special Issue: Strongly Correlated Systems (Ed. M. Grioni). Journal of Electron Spectroscopy and Related Phenomena, VOLS 117-118, 13 – 30, 2001.

Gez. Prof. E. Müller-Hartmann