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Strong correlation effects on the electrical permittivity of two-dimensional systems

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The cooperative properties of strongly correlated electrons have often been related to key technologies, for instance with the aim of developing high capacitance hetero-structures. In this contribution we unravel the electrical permittivity contained in the extended two-dimensional Hubbard model. Regarding static properties we consider a pair of plates hosting correlated electrons separated by a dielectric medium, that comprise a capacitor. We show that the natural tendency towards phase separation harbored in the two-dimensional Hubbard model extended by over-screened Coulomb interaction results in an increase of the capacitance. This effect competes with the electrostatic contribution and in a thermodynamically stable state we find it to be enhanced by the proximity to a van Hove singularity. The mutual influence of the interaction parameters and the distance of the van Hove singularity to half-filling are also discussed, as well as the parameters controlling the disparity of the capacitance and the compressibility. The dynamical properties will be addressed as well. It will be shown that the spectra generically consists of a continuum, a gapless collective mode with anisotropic zero-sound velocity and a correlation induced high-frequency mode dispersing at energies close to the Hubbard U. The influence of the loss of the particle-hole symmetry on these spectra will be presented too.

Biography

Raymond Frésard currently works at the Laboratoire CRISMAT, National Graduate School of Engineering and Research Center (Caen). After getting a degree of Physicien (1984) and a PhD in Physics from the University of Neuchâtel, Switzerland (1989), in the field of liquid and amorphous metals I moved to the University of Karlsruhe, Germany, where I started to work in the field of strongly correlated electrons. In 1994, I moved to Shimane University, Japan, where I accepted an Associate Professor position. I pursued research activities in the fields of strongly correlated electrons and bosons, and on the transport properties of amorphous metals. In 1996 I returned to the University of Neuchâtel, Switzerland, where I stayed until 2000. I then accepted a Professor position at the Institute des Sciences de la Matière et du Rayonnement, Caen, France, where I am pursuing research activities in the field of strongly correlated electrons, in close connection with experiment.

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