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EINLADUNG zum IFP-SEMINAR

Thema: **Universal thermopower of bad metals**

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Ort: Institut für Festkörperphysik, TU Wien
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Host: Karsten Held
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We discuss the transport properties of strongly correlated materials, such as vanadates, cobaltates, cuprates, Kondo semiconductors and organic demiconductors, which show the non-Fermi-liquid (NFL) behavior. One common feature of these vastly different materials is that the resistivity rises linearly with temperature above the Ioffe-Regel limit. Another common feature is that they are formed by doping away from a Mott-Hubbard insulating state. Starting from this observation, and the ubiquity of NFL materials, we provide a simple explanation for the transport properties.

We derive the linear resistivity from an analytic approach, in the spirit of Mahan and Sofo's work on the best thermoelectrics, using the general properties of the transport relaxation time for a strongly correlated material. The phenomenological results are substantiated by calculating the transport coefficients of the Falicov-Kimball model which, like the Hubbard or periodic Anderson model, has a gap in the excitation spectrum but, unlike these other models, admits an exact solution at arbitrary doping and temperature.

Our analysis shows that the resistivity ρ(T) and thermopower α(T) of doped Mott-Hubbard systems exhibit simple universal features. (i) Close to the insulating phase, ρ(T) has a sharp low-T upturn and α (T) has a large peak centered at T_α, where T_α increases with doping. (ii) At moderate doping, ρ(T) becomes linear, while the peak of α(T) is reduced and shifted to lower-T; α(T) changes sign for $T>>T_\alpha$. (iii) At the highest doping, we find that $\rho(T) \sim \rho_0 + A\,T^2$, and that α(T) is a monotonic function of T: negative for electron and positive for hole doping. The universality follows from the general properties of the transport relaxation time of a doped Mott-Hubbard system. The behavior of α(T) is explained by the Kelvin formula and the fact that the chemical potential for doped Mott insulators displays similar behavior at high T.

[1] V. Zlatic, G. Boyd and J.K. Freericks, Phys. Rev. B89,55101 (2014)
[2] G. Boyd, V. Zlatic and J.K. Freericks, arXive: 1404.2859 (submitted to PRL)

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