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A New Perspective on Correlated Metals: from Concealed Mott Quantum Criticality to Disorder in Heavy Fermi Liquids

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The band-structure picture of metals is very successful in many materials where the electron correlations are weak. On the other extreme, when correlations are very strong, one expects interaction-induced insulators –due to Mott localization or symmetry breaking. However, the intermediate regime where correlations are strong but the material remains gapless, harbors many open questions in our understanding of quantum materials.
In this talk, I will give an overview of three aspects of correlated metals. I will discuss the relation between quantum criticality at the Kondo breakdown and in doped charge-transfer insulators like the cuprates. These metal-to-metal transitions can be viewed as exhibiting concealed Mott criticality.
Near a Mott critical point, large effective mass enhancements are observed. The famous Landau relation between mass enhancement and specific heat requires a new sum rule for the temperature-dependence of the electron self-energy.
In such heavy Fermi liquids, the interplay between correlations and disorder cannot be ignored. Inspired by new experiments on organic compounds, we show that contrary to textbooks, the residual resistivity is affected by the mass enhancement.

email address

louk.rademaker@gmail.com

Affiliation

Université de Genève

Author: RADEMAKER, Louk (Université de Genève)

Presenter: RADEMAKER, Louk (Université de Genève)

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