Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

March 27th 2014 – 16:00

CFEL Seminar room V, 01.109 (Bldg. 99)

Andrey Antipov

University of Michigan, Ann Arbor

Critical Exponents of Strongly Correlated Fermion Systems from Diagrammatic Multi-Scale Methods

The dynamical mean field theory (DMFT) has become the standard tool in describing strongly correlated electron materials. While it captures the quantum dynamics of local fields, it eglects spatial correlations. To describe e.g. anti-ferromagnetism, unconventional superconductivity or frustration a proper treatment of non-local correlations is necessary. Diagrammatic multi-scale approaches offer an elegant option to accomplish this: the difficult correlated part of the system is solved using a non-perturbative many-body method, whereas 'easier', 'weakly correlated' parts of the problem are tackled using a secondary perturbative scheme. Here we employ such a method, the dual fermion approach, to problems of charge ordering in Falicov-Kimball [1] and Hubbard models by constructing a systematic diagrammatic extension on top of DMFT. Near the critical points of both models we study the interplay between charge excitations and long-range fluctuations. We show that such multi-scale approach is indeed capable of capturing the non mean-field nature of the critical point of the lattice model and correctly describes the transition to mean-field like behavior as the number of spatial dimensions increases. We demonstrate that such consideration allows to capture the nature of the critical fixed point of the classical phase transition in an RPA-like approach, and does not require a simultaneous resummation over several divergent channels as typically done in RG.

[1] A. Antipov, S. Kirchner, E. Gull, arXiv:1309.5976 (2013).

Host: Martin Eckstein

MAX-PLANCK-GESELLSCHAFT