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Critical Exponents of Strongly Correlated Fermion Systems from Diagrammatic Multi-Scale Methods ANDREY ANTIPOV, University of Michigan, Ann Arbor, STEFAN KIRCHNER, Max Planck Institute for the Physics of Complex Systems, Dresden, EMANUEL GULL, University of Michigan, Ann Arbor — 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 neglects spatial correlations. To describe e.g. antiferromagnetism, 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 model [1] by constructing a systematic diagrammatic extension on top of DMFT. Near the critical point of the Falicov-Kimball model 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. [1] A. Antipov, S. Kirchner, E. Gull, arXiv:1309.5976 (2013).

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