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Dynamical vertex approximation — a step beyond dynamical mean field theory ALESSANDRO TOSCHI, Max Planck Institute for Solid State Research, Stuttgart, ANDREY KATANIN, Max Planck Institute for Solid State Research, Stuttgart; Institute of Metal Physics, Ekaterinburg , KARSTEN HELD, Max Planck Institute for Solid State Research, Stuttgart — We have developed a new diagrammatic approach[1], coined "Dynamical Vertex Approximation" (DΓA), with the aim of going beyond dynamical mean field theory for strongly correlated systems, by including the effects of long-range spatial correlations. Without resorting to any finite-size cluster scheme, DΓA allows us to compute momentum dependent self-energies (and spectra), whose expressions are diagrammatically constructed starting from the two-particle irreducible local vertex. Therefore, DΓA naturally applies for studying effects of magnetic fluctuations with large correlation length in strongly correlated systems, such as the Hubbard model. Specifically, we analyze the interplay between antiferromagnetic fluctuations and the Mott metal-insulator transition in three dimensions and the formation of a pseudogap in two dimensions. The diagrammatic nature of DΓA, moreover, should allow for a generalization to the more realistic case of multi-band Hamiltonians.
[1] A. Toschi, A. Katanin, K. Held, cond-mat/0603100.

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