LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

LEHRSTUHL FÜR THEORETISCHE NANOPHYSIK
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Condensed Matter Theory Seminar

Wednesday, 18 November, 2015
2.00 pm c.t.

Room H 107, Schellingstr. 4, I

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Thermodynamics of the Bose-Hubbard model in a Bogoliubov+U theory

The Bogoliubov+U formalism (B+U) is introduced and applied to the thermodynamics of the Bose-Hubbard model. The framework can be viewed as the zero-frequency limit of bosonic dynamical mean-field theory (B-DMFT), but equally well as an extension of the mean-field decoupling approximation in which pair creation and annihilation of depleted particles is taken into account. The self-energy on the impurity is treated variationally, minimizing the grand potential. For a single-site impurity the theory containing just three parameters that are determined self-consistently reproduces the T= 0 phase diagrams of the three-dimensional and two-dimensional Bose-Hubbard model with an accuracy of 1% or better. The superfluid to normal transition at finite temperature is also reproduced well and only slightly less accurately than in B-DMFT. Finally, an outlook on current work on the extension of B+U to impurities with more than one site within a dynamical cluster approximation (DCA) is presented by applying it to the one-dimensional Bose-Hubbard model.