



Contribution ID: 137 Contribution code: S06-CMPSP-111

Type: Oral presentation

Spectral functions of the Holstein polaron: exact and approximate solutions

Tuesday 30 August 2022 15:15 (15 minutes)

It is generally accepted that the dynamical mean field theory (DMFT) gives a good solution of the Holstein model [1], but only in dimensions greater than two. Here we show that the DMFT, which becomes exact in the weak coupling and in the atomic limit, provides an excellent numerically cheap approximate solution for the spectral function of the Holstein model in the whole range of parameters even in one dimension. To establish this, we made a detailed comparison with the spectral functions that we obtained using newly developed momentum-space numerically exact hierarchical equations of motion method, which yields electronic correlation functions directly in real time [2]. We crosschecked these conclusions with our path integral quantum Monte Carlo and exact diagonalization results, as well as with the available numerically exact results from the literature [3].

References:

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Session Classification: S06 Condensed Matter Physics and Statistical Physics

Track Classification: Scientific Sections: S06 Condensed Matter Physics and Statistical Physics