Variational wave functions for Mott insulators

Abstract:

We give a review of recent developments on the possibility to have a faithful representation of strongly correlated systems by using improved variational wave functions. In particular, we focus the attention on the bosonic Hubbard model, where the numerically exact solution is known by Monte Carlo simulations, which allow us to assess the variational accuracy. We show how it is possible to describe the superfluid-insulator transition by using the Gutzwiller wave function supplemented with a long-range Jastrow factor. An appealing interpretation in terms of the binding-unbinding Kosterlitz-Thouless transition is obtained through the mapping onto a classical model. Finally, the case with long-range interactions will be also briefly discussed.