Mott-insulator and superfluid phases of correlated bosons in the bosonic dynamical mean-field theory with the strong coupling impurity solver

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We investigate the phase diagram of correlated lattice bosons using the bosonic dynamical mean field theory (BDMFT). The BDMFT, formulated by Byczuk and Vollhardt (Phys. Rev. B 77, 235106 (2008)), is a comprehensive and thermodynamically consistent approximation in which the normal and condensed bosons are treated on equal footing. Within BDMFT the lattice bosonic problem is replaced by a single impurity coupled to two bosonic baths (corresponding to normal and condensed bosons, respectively). The resulting set of equations, the so-called "impurity problem", has to be solved self-consistently. Our approach is the strong coupling expansion within which the phase transition between Mott-insulating and superfluid phases can be described. Different thermodynamical quantities (particle density, compressibility, order parameter) as well as the bosonic density of states are investigated across the transition lines.