

same with bosons

- 1) equation of motion hopping
- 2) perturbation hopping,
- 3) some things explicitly (linked cluster, symmetries, self energy up to a certain (2nd) order)
- 3) perturbation small system up to a certain order. Compare numerically
- 4) Wick's for finite temperature, Matsubara
- 5) impurity, or surface
- 6) delta potential (bruus p.400)
- 7) Kondo 3rd order self-energy

MORE IN DETAIL

- 1)
 - (a) 2-site Hubbard exact solution.
 - (b) First and second order (for self energy and for Green's function) calculation by Feynman Diagrams
Numerical (evtl. analytic: i.e. Taylor expansion of (a)) comparison (a) with
- 2)

For one person:
Check explicitly cancellation of disconnected graphs (linked-cluster theorem) up to second order in V
(In case it's too easy, some proofs related to Wick's theorem)
- 3) Calculation of local and nearest-neighbor Green's function(s) for a noninteracting infinite tight-binding fermionic chain via equations of motion. Depending on complexity and number of participants, inclusion of an on-site interaction on one site and Hartree-Fock calculation.
- 4) Free electrons interacting with a $\delta(x-x')$. First and second order calculations (or Hartree-Fock) for the Green's function.
Alternatively, calculation of effective interaction and use for Hartree-Fock (depending on complexity and number of participants).
- 5) One of 1,2,3,4 with a simple model of electron-phonon interaction or just with interacting bosons (Bose-Hubbard model)