Key points of 03/23 lecture

- Bosons: integer spin

$$\psi(\vec{q}_1, \vec{q}_2, \ldots, \vec{q}_i, \ldots, \vec{q}_j, \ldots, \vec{q}_N) = +\psi(\vec{q}_1, \ldots, \vec{q}_j, \ldots, \vec{q}_i \ldots \vec{q}_N)$$

exchange of particles i and j

plus sign!

ψ: many-body wave fct.

$\vec{q}_i$: coordinate of i^{th} particle (position vector, spin quantum numbers, ...)

- Fermions: half-integer spin

$$\psi(\vec{q}_1, \ldots, \vec{q}_i, \ldots, \vec{q}_j, \ldots) = -\psi(\vec{q}_1, \ldots, \vec{q}_j, \ldots, \vec{q}_i, \ldots \vec{q}_N)$$

exchange of particles i and j

minus sign!

- Microcanonical ensemble, ideal non-rel. gas, quantum:
  - bosons: $n_{\vec{k}} = 0, 1, 2, \ldots$
  - fermions: $n_{\vec{k}} = 0, 1$
  - boltzmann: $n_{\vec{k}} = 0, 1, 2, \ldots$ (but: $\frac{N!}{\prod_{\vec{k}} (n_{\vec{k}}!)}$ states for the N-particle system)

$n_{\vec{k}}$: occupation number
($n_{\vec{k}}$ particles have momentum $\hbar\vec{k}$ in state under consideration)