

- Integral - Path
 - Nos Ph. Stat
 - & les autres

Phy Stat $\mu \rightarrow macro$

Th centrale: $S = \sum_{N \rightarrow \infty}^N x_n \rightarrow$ loi gaussienne Ergodicité: $\lim_{t \rightarrow \infty} \overline{E^2} = \langle E \rangle^2$

Fonction génératrice: $Z(\beta) = \langle e^{-\beta X} \rangle$ $F = -\ln(Z)$ $\mu_n = \langle X^n \rangle = \frac{1}{Z} \frac{\partial^n Z}{\partial \beta^n} \propto \frac{1}{N} \rightarrow 0$

Micro état: Γ espace des phases (q,p) Macro état: $\langle A \rangle = \int d^6 \Gamma e(\Gamma) A(\Gamma)$
 Ψ espace de Hilbert

Densité d'état: $\Phi(E) = \frac{V_{sph}(R=E)}{V_{maille}}$ $\Phi(E) dE = \Phi(k) dk$ $\langle A \rangle = \sum_i p_i A_i$

$\Phi(E) = \frac{g_s}{(2\pi\hbar)^d} \int d^d r_i d^d p_i \Theta_H(E - H(\vec{r}_i, \vec{p}_i))$ $\frac{g_s}{N!} \frac{V^N}{(\frac{dN}{2} + 1)} \left(\frac{mE}{2\pi\hbar^2} \right)^{\frac{dN}{2}}$ $e(E) = \frac{d\Phi(E)}{dE}$

Entropie: $S = -k_B \sum_i p_i \ln(p_i)$

μ canonique: $E, V, N, \dots$ $\Omega(E, V, N, \dots)$ $P_i^* = \frac{1}{\Omega}$ $S^* = k_B \ln(\Omega)$ $dS = \frac{dE}{T} + \frac{P}{T} dV - \frac{\mu}{T} dN$

Canonique: $T, V, N, \dots$ $Z = \sum_i e^{-\beta E_i}$ $P_i^c = \frac{1}{Z} e^{-\beta E_i}$ $F = -k_B T \ln(Z)$ $F = E - TS$

Grand Canonique: $T, V, \mu, \dots$ $\Xi = \sum_i e^{-\beta(E_i - \mu N_i)}$ $P_i^g = \frac{1}{\Xi} e^{-\beta(E_i - \mu N_i)}$ $\Omega = -k_B T \ln(\Xi)$ $S = F - \mu N$

isot P: $T, P, N, \dots$ $\Upsilon = \sum_i e^{-\beta(E_i + p V_i)}$ $P_i^{ii} = \frac{1}{\Upsilon} e^{-\beta(E_i + p V_i)}$ $G = -k_B T \ln(\Upsilon)$ $G = F + pV$

Boz classique: C_{op} Hecht & Hübner & Hübner $\lambda_d = \frac{h}{\sqrt{2\pi m k_B T}}$ $PV = k_B T N$

Statistique Q: $\frac{0}{N} \rightarrow \frac{Q}{N} \rightarrow \frac{T^*}{T} \rightarrow \frac{T}{0}$ $\Lambda_T = \left(\frac{2\pi\hbar^2}{m k_B T} \right)^{1/2}$ $\Lambda_T^3 \leq 1$ TBS $\Lambda_T^3 \geq 1$ F&D

Distribution de Bose-Einstein: $\bar{n}_i^B = \frac{1}{e^{\beta(E_i - \mu)} - 1}$

Boson ($\mu < E_0$)

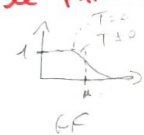


$n \in \mathbb{Z}$
 2 Cas pour Bose-Einstein: $\mu < E_0$ & $\mu = E_0$
 o P

T l
 o $F_n = \ln$
 o $L \rightarrow S$

Statistique de Fermi-Dirac: $\bar{n}_i^F = \frac{1}{e^{\beta(E_i - \mu)} + 1}$

Fermions
 $n \in \{0, 1\}$
 o TF o P o F



$$X = \frac{\partial F}{\partial x}$$

$$N = \frac{1}{\beta} \ln(Z)$$