2 ebatze-modoa
Multzo makrokanonikoan dagoen sistema

$$\sum_{r,s} n_{r,s} = \mathcal{N}$$

$$\sum_{r,s} n_{r,s} N_r = \mathcal{N}\overline{N}$$

$$\sum_{r,s} n_{r,s} E_s = \mathcal{N}\overline{E}$$

$$W\{n_{r,s}\} = \frac{\mathcal{N}!}{\prod_{r,s}(n_{r,s}!)}$$

edozein banaketarekin lotutako kop

max!!

(i)
$$\frac{n^*_{r,s}}{\mathcal{N}} = \frac{\exp\left(-\alpha N_r - \beta E_s\right)}{\sum_{r,s} \exp\left(-\alpha N_r - \beta E_s\right)}$$

(ii)
$$\langle n_{r,s} \rangle = \frac{\sum_{\{n_{r,s}\}}{}' n_{r,s} W\{n_{r,s}\}}{\sum_{\{n_{r,s}\}}{}' W\{n_{r,s}\}}$$

$$\lim_{\mathcal{N}\to\infty} \frac{\langle n_{r,s} \rangle}{\mathcal{N}} \simeq \frac{n^*_{r,s}}{\mathcal{N}} = \frac{\exp\left(-\alpha N_r - \beta E_s\right)}{\sum_{r,s} \exp\left(-\alpha N_r - \beta E_s\right)}$$

PROBABILITATEA

TERMODINAMIKA

$$\rightarrow \quad \overline{N} = \frac{\sum_{r,s} N_r \exp\left(-\alpha N_r - \beta E_s\right)}{\sum_{r,s} \exp\left(-\alpha N_r - \beta E_s\right)} \equiv -\frac{\partial}{\partial \alpha}\left\{\ln \sum_{r,s} \exp\left(-\alpha N_r - \beta E_s\right)\right\}$$

$$\rightarrow \quad \overline{E} = \frac{\sum_{r,s} E_s \exp\left(-\alpha N_r - \beta E_s\right)}{\sum_{r,s} \exp\left(-\alpha N_r - \beta E_s\right)} \equiv -\frac{\partial}{\partial \beta}\left\{\ln \sum_{r,s} \exp\left(-\alpha N_r - \beta E_s\right)\right\}$$

SISTEMAREKIN LOTUTAKO FISIKA