Fluktuazioak multzo makrokanonikoan: (ii) energia

$$\overline{(\Delta E)^2} \equiv \overline{E^2} - \overline{E}^2 = -\left(\frac{\partial \overline{E}}{\partial \beta}\right)_{z,V} = k_{\mathrm{B}} T^2 \left(\frac{\partial U}{\partial T}\right)_{z,V}$$

$$\left(\frac{\partial U}{\partial T}\right)_{z,V} = \left(\frac{\partial U}{\partial T}\right)_{N,V} + \left(\frac{\partial U}{\partial N}\right)_{T,V} \left(\frac{\partial N}{\partial T}\right)_{z,V}$$

$$N = -\left(\frac{\partial}{\partial \alpha} \ln \mathcal{Q}\right)_{\beta,V}, \qquad U = -\left(\frac{\partial}{\partial \beta} \ln \mathcal{Q}\right)_{\alpha,V}$$

$$\left(\frac{\partial N}{\partial \beta}\right)_{\alpha,V} = \left(\frac{\partial U}{\partial \alpha}\right)_{\beta,V}$$

$$\left(\frac{\partial N}{\partial T}\right)_{z,V} = \frac{1}{T}\left(\frac{\partial U}{\partial \mu}\right)_{T,V}$$

$$\overline{(\Delta E)^2} = k_{\mathrm{B}} T^2 C_V + k_{\mathrm{B}} T \left(\frac{\partial U}{\partial N}\right)_{T,V} \left(\frac{\partial U}{\partial \mu}\right)_{T,V}$$

$$\overline{(\Delta E)^2} = \langle (\Delta E)^2 \rangle_{\text{kanoniko}} + \left\{\left(\frac{\partial U}{\partial N}\right)_{T,V}\right\}^2 \overline{(\Delta N)^2}$$