LP 16 Facteur de Boltzmann

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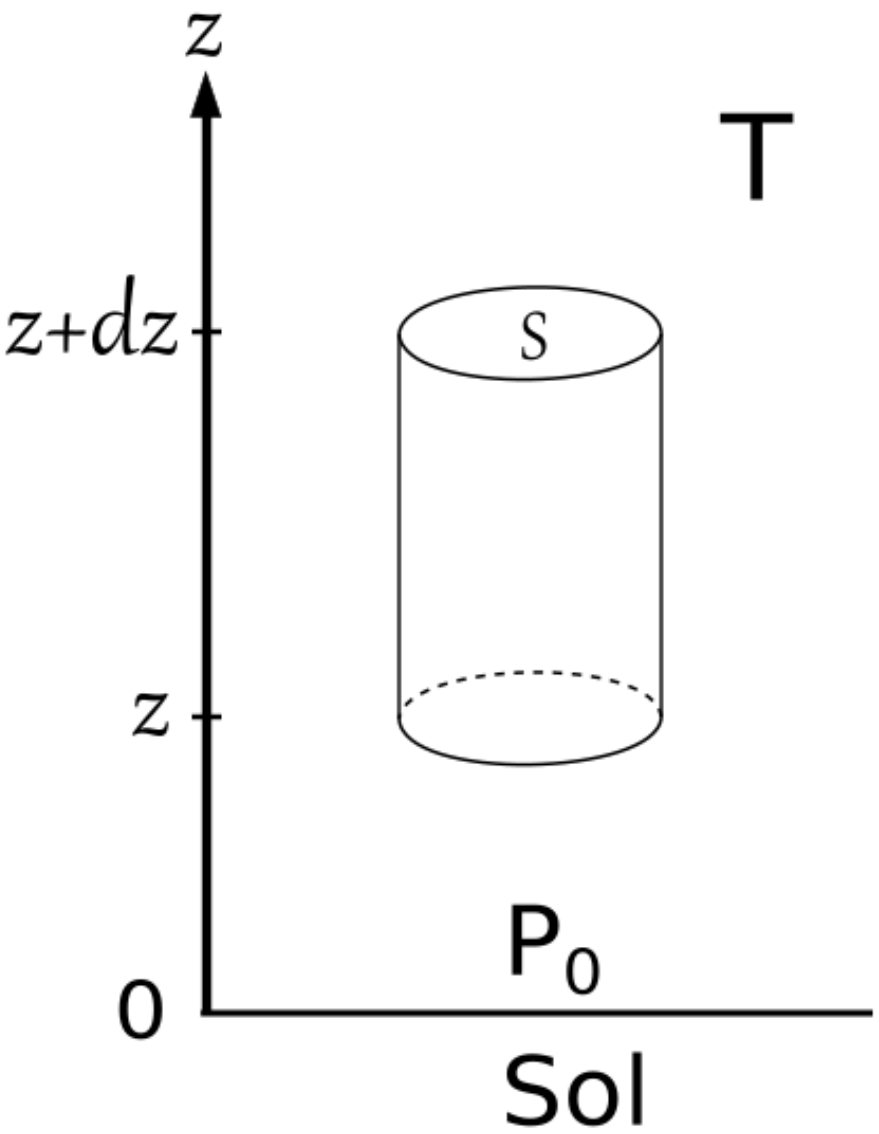
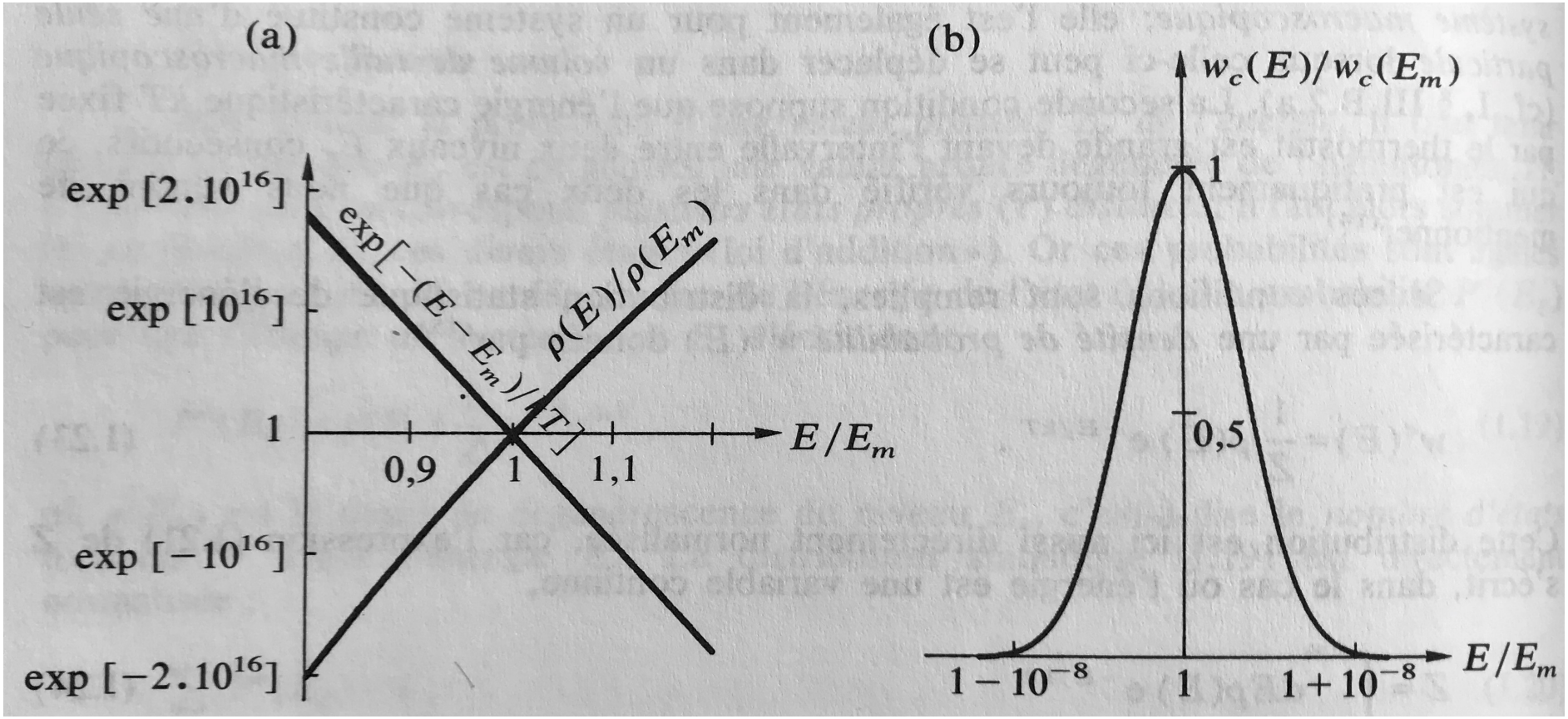
Atmosphère isotherme



Compétition entre densité d'état et facteur de Boltzmann



Capacité calorifique, formulaire

Pour le calcul de $\bar{E}$, on a

$$\frac{\partial}{\partial\beta}\ln(\sinh\alpha\beta) = \alpha\frac{\cosh\alpha\beta}{\sinh\alpha\beta} = \alpha\coth\alpha\beta \tag{1}$$

Pour le calcul de C_V, on a

$$\frac{\partial}{\partial\beta}\coth\alpha\beta = \frac{\partial}{\partial\beta}\frac{\cosh\alpha\beta}{\sinh\alpha\beta} = \alpha\frac{\sinh^2\alpha\beta - \cosh^2\alpha\beta}{\mathrm{sh}^2\alpha\beta} \tag{2}$$

or on sait que $\cosh^2\alpha\beta - \sinh^2\alpha\beta = 1$

$$\Longrightarrow \frac{\partial}{\partial\beta}\coth\alpha\beta = -\alpha\frac{1}{\sinh^2\alpha\beta} \tag{3}$$

Finalement

$$\frac{\partial}{\partial T}\coth\alpha\beta = \frac{\partial\beta}{\partial T}\frac{\partial}{\partial\beta}\coth\alpha\beta = \frac{1}{k_B T^2}\alpha\frac{1}{\sinh^2\alpha/k_B T} \tag{4}$$

Capacité calorifique