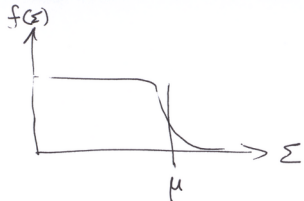


6-1

Reitna

$$-\frac{\partial f}{\partial \Sigma} \Big|_{\Sigma=\mu}$$



1

$$f(\Sigma) = \frac{1}{e^{\frac{\Sigma-\mu}{2\tau}} + 1}$$

$$-\frac{\partial f}{\partial \Sigma} = \frac{e^{\frac{\Sigma-\mu}{2\tau}} \cdot \frac{1}{2\tau}}{(e^{\frac{\Sigma-\mu}{2\tau}} + 1)^2}$$

$$-\frac{\partial f}{\partial \Sigma} \Big|_{\Sigma=\mu} = \frac{1 \cdot \frac{1}{2}}{(1+1)^2} = \frac{1}{4\tau}$$

$$\rightarrow -\frac{\partial f}{\partial \Sigma} \Big|_{\Sigma=\mu} \xrightarrow{\tau \rightarrow 0} \infty$$

$f(\Sigma)$  nagast perafall  $\Theta(\mu - \Sigma)$  fur  $\tau = 0$

6-2

Samkvæfna  $f(\Sigma)$  um  $\Sigma = \mu$

2

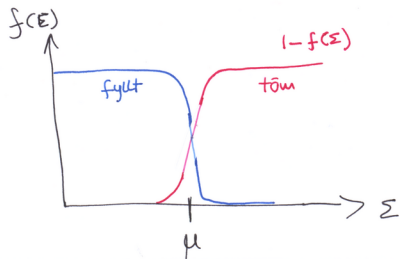
Setjum  $\Sigma = \mu + \delta$

$$f(\mu + \delta) = \frac{1}{e^{\frac{\delta}{\tau}} + 1}$$

$$f(\mu - \delta) = \frac{1}{e^{-\frac{\delta}{\tau}} + 1}$$

$$= \frac{e^{\frac{\delta}{\tau}}}{1 + e^{\frac{\delta}{\tau}}} = 1 - f(\mu + \delta)$$

$$\rightarrow f(\mu + \delta) = 1 - f(\mu - \delta)$$



$$\frac{1 + e^{\frac{\delta}{\tau}}}{1 + e^{\frac{\delta}{\tau}}} - \frac{1}{1 + e^{\frac{\delta}{\tau}}}$$

$$= \frac{e^{\frac{\delta}{\tau}}}{1 + e^{\frac{\delta}{\tau}}}$$

6-3

3

Svigræma setni 0, 1, 2 með orku 0,  $\Sigma$ ,  $2\Sigma$

a) Finna  $\langle N \rangle$  fyrir kerfið  $\bar{z}$  jafnvegi við einda og varma-  
með  $\tau$  og  $\mu$

atlungum ástand

(0,0)

(0,1)

(1,0)

(1,1)

orka

$$\rightarrow \mathcal{Z} = 1 + 2\lambda e^{-\frac{\Sigma}{\tau}} + \lambda^2 e^{-\frac{2\Sigma}{\tau}}$$

The diagram shows four energy levels labeled 0,  $\Sigma$ ,  $\Sigma$ , and  $2\Sigma$  under the heading 'orka'. Blue arrows point from each level to a term in the partition function  $\mathcal{Z} = 1 + 2\lambda e^{-\frac{\Sigma}{\tau}} + \lambda^2 e^{-\frac{2\Sigma}{\tau}}$ . The arrow from 0 points to the constant term 1. The arrow from the first  $\Sigma$  points to  $2\lambda e^{-\frac{\Sigma}{\tau}}$ . The arrow from the second  $\Sigma$  points to  $\lambda^2 e^{-\frac{2\Sigma}{\tau}}$ . The arrow from  $2\Sigma$  points to the same  $\lambda^2 e^{-\frac{2\Sigma}{\tau}}$  term.

$$\langle N \rangle = \frac{0 \cdot 1 + 1 \cdot 2\lambda e^{-\frac{\Sigma}{\tau}} + 2 \cdot \lambda^2 e^{-\frac{2\Sigma}{\tau}}}{\mathcal{Z}} = \frac{2\left\{ \lambda e^{-\frac{\Sigma}{\tau}} + \lambda^2 e^{-\frac{2\Sigma}{\tau}} \right\}}{1 + 2\lambda e^{-\frac{\Sigma}{\tau}} + \lambda^2 e^{-\frac{2\Sigma}{\tau}}}$$

$$\rightarrow \langle N \rangle = \frac{2\lambda e^{-\frac{\Sigma}{\epsilon}} \{1 + \lambda e^{-\frac{\Sigma}{\epsilon}}\}}{\{1 + \lambda e^{-\frac{\Sigma}{\epsilon}}\}^2} = \frac{2\lambda e^{-\frac{\Sigma}{\epsilon}}}{\{1 + \lambda e^{-\frac{\Sigma}{\epsilon}}\}} \quad (4)$$

$$= \frac{2}{\lambda e^{\frac{\Sigma}{\epsilon}} + 1} = \frac{2}{\exp\left\{\frac{\Sigma - \mu}{\epsilon}\right\} + 1}$$

b) orkustig  $\Sigma$  ertvöfaldit  
er nákvæmlega a-líður

66

N-A og N-B í línulaga jafnvægi,  $\tau, V$  sama

5



full komín blöndun

$$\hookrightarrow \Delta T = 2N \ln 2$$

Sýna að ef  $A=B \rightarrow \Delta T = 0$  (Gibbs paradox)

Fjöldaföllin  $g_A$  og  $g_B$

$$g = g_A g_B$$

↓

$$T = T_A + T_B$$

fyrir og eftir  
blöndun

En við höfum

$$T = N \left\{ \ln \left( \frac{n_0}{n} \right) + \frac{S}{2} \right\}$$

Fyrir

$$T_i = N \left\{ \ln \left( \frac{n_0^A}{n_i} \right) + \ln \left( \frac{n_0^B}{n_i} \right) + S \right\}$$

↑ því  $N$  er það sama

Eftir  $n_f = \frac{N}{2V} = \frac{n_i}{2}$

$$\nabla_f = N \left\{ \ln\left(\frac{n_0^A}{n_f}\right) + \ln\left(\frac{n_0^B}{n_f}\right) + S \right\}$$

$$= N \left\{ \ln\left(2 \frac{n_0^A}{n_i}\right) + \ln\left(2 \frac{n_0^B}{n_i}\right) + S \right\}$$

$= \nabla_i + 2N \ln 2$  klöndur öreida

Ef eindirnar þeltjast ekki í sundur þá gildir

$$n_f = \frac{2N}{2V} = n_i$$

$$\nabla_f = 2N \left\{ \ln\left(\frac{n_0}{n_i}\right) + \frac{S}{2} \right\}$$

Engin munur á  $n_0^A$  og  $n_0^B$

sama fyrir og eftir