

## 统计力学及应用作业 6

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## 1

以  $P$  和  $S$  为自变量, 证明  $\langle \Delta S \Delta P \rangle = 0$ ,  $\langle (\Delta S)^2 \rangle = C_P$ ,  $\langle (\Delta P)^2 \rangle = -T \left( \frac{\partial P}{\partial V} \right)_S$ .

根据书上 P300 有

$$w \propto \exp \left[ \frac{1}{2T} \left( \frac{\partial V}{\partial P} \right)_S (\Delta P)^2 - \frac{1}{2C_P} (\Delta S)^2 \right], \quad (1.1)$$

这个式子分解成两个因子, 各自只与  $\Delta P$  或  $\Delta S$  有关. 换句话说, 压强和熵是的涨落是统计独立的, 因而

$$\langle \Delta S \Delta P \rangle = 0, \quad (1.2)$$

$$\langle (\Delta S)^2 \rangle = -\frac{1}{2} \frac{1}{-\frac{1}{2C_P}} = C_P, \quad (1.3)$$

$$\langle (\Delta P)^2 \rangle = -\frac{1}{2} \frac{1}{\frac{1}{2T \left( \frac{\partial P}{\partial V} \right)_S}} = -T \left( \frac{\partial P}{\partial V} \right)_S. \quad (1.4)$$