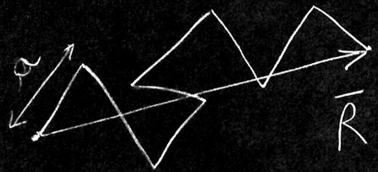

$$\bar{R} = \sum_i \bar{a}_i$$

$$Var(\bar{R}) = \langle \bar{R}^2 \rangle - \langle \bar{R} \rangle^2$$

$$= \left\langle \left(\sum_i \bar{a}_i\right)\left(\sum_j \bar{a}_j\right) \right\rangle$$

$$= \left\langle \left(\sum_{i,j} \bar{a}_i \bar{a}_j\right) \right\rangle$$

$$= \left\langle \left(\underbrace{\sum_i \bar{a}_i \bar{a}_i}_{Na^2} + \sum_{i \neq j} \bar{a}_i \bar{a}_j\right) \right\rangle$$

$$= Na^2$$

$$P(R) = \left(\frac{3}{2\pi\langle \bar{R}^2\rangle}\right)^{3/2} e^{\frac{-3R^2}{2\langle \bar{R}^2\rangle}}$$

$$S(R) = k_B \ln \Omega(R)$$

$$\Omega(R) = Cste' \cdot \exp\left(\frac{-3R^2}{2\langle \bar{R}^2\rangle}\right)$$

$$\hookrightarrow S(R) = \underbrace{k_B \ln(Cste')}_{\equiv S(0)} - k_B \frac{3R^2}{2\langle \bar{R}^2\rangle}$$

$$dF = f \cdot dR = -T dS$$

$$\hookrightarrow dF = 3 \frac{k_B T R}{\langle \bar{R}^2\rangle} dR$$

$$P(R) = \frac{\Omega(R)}{\underbrace{\int \Omega(R) dR}_{Cste}} \rightarrow \Omega(R) = Cste \; P(R)$$

$$\rightarrow f = \underbrace{\frac{3 k_B T}{\langle \bar{R}^2\rangle}}_{k(T) = \frac{3 k_B T}{Na^2}} \cdot R$$