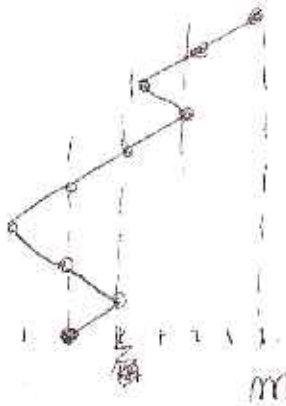
N (number of steps of size ℓ) $\quad x = m\ell$

↑

A note on Diffusion



m

↑

$\frac{N+m}{2}$ → steps

$\frac{N-m}{2}$ → steps

} sum N

N, m both even odd check for N = 1, 2, 3, ..

$$W(m,N) = \frac{N!}{\left[\frac{N+m}{2}\right]!\left[\frac{N-m}{2}\right]!}\left(\frac{1}{2}\right)^2$$

Sterling $m \ll N$

$$W(m,N) = \frac{\sqrt{2}}{\sqrt{\pi N}}\, e^{-\frac{m^2}{2N}}$$

$x = m\ell$

$D = n\frac{\ell^2}{2}$ $\left[\frac{cm^2}{s}\right]$

n = scatters per unit time

diffusion/speed

$$W(x,t) = \frac{1}{2\sqrt{\pi D t}}\, e^{-\frac{x^2}{4Dt}}$$

$m \to x$

$N \to 2Dt$

up to dim. factors

$$W(r)\,dr = \frac{1}{\sqrt{4\pi D t}}\, e^{-\frac{|r|^2}{4Dt}}$$

$$D = \frac{n\langle z^2\rangle}{6}$$

$\langle z^2\rangle$ scatt. length

Note that the diffusion coefficient

$$D \sim \nu l^2 \sim \underbrace{[\nu l]}_{\text{velocity}} l \sim cl$$

Böhm diffusion: l = gyroradius

$$D = \frac{1}{3} c \frac{E}{ZeB}$$