(1.) for a heavy nucleus

$$E_{e^+} + E_{e^-} \cong 4mc^2$$

$V_{e^+} = V_{e^-}$ so

$$E_{e^+} = E_{e^-} = 2mc^2$$

$$\gamma = 2$$

using $E^2 = (pc)^2 + (mc^2)^2$

for individual particles gives

$$p = \sqrt{3}\, mc$$

$$(mc^2)^2 = E^2 - (pc)^2$$

↑ Invariant rest energy for the system

$$= (4mc^2)^2 - (2\sqrt{3}\, mc\, c)^2$$

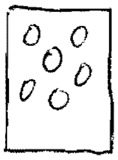
$$= 4m^2c^4$$

$$mc^2 = 2mc^2$$

↑ system ↑ m_{e^+}, m_{e^-}

(2.)

$$f = \pi b^2 n t$$



scattering cross section should not overlap

$$\pi b^2 n t << 1$$

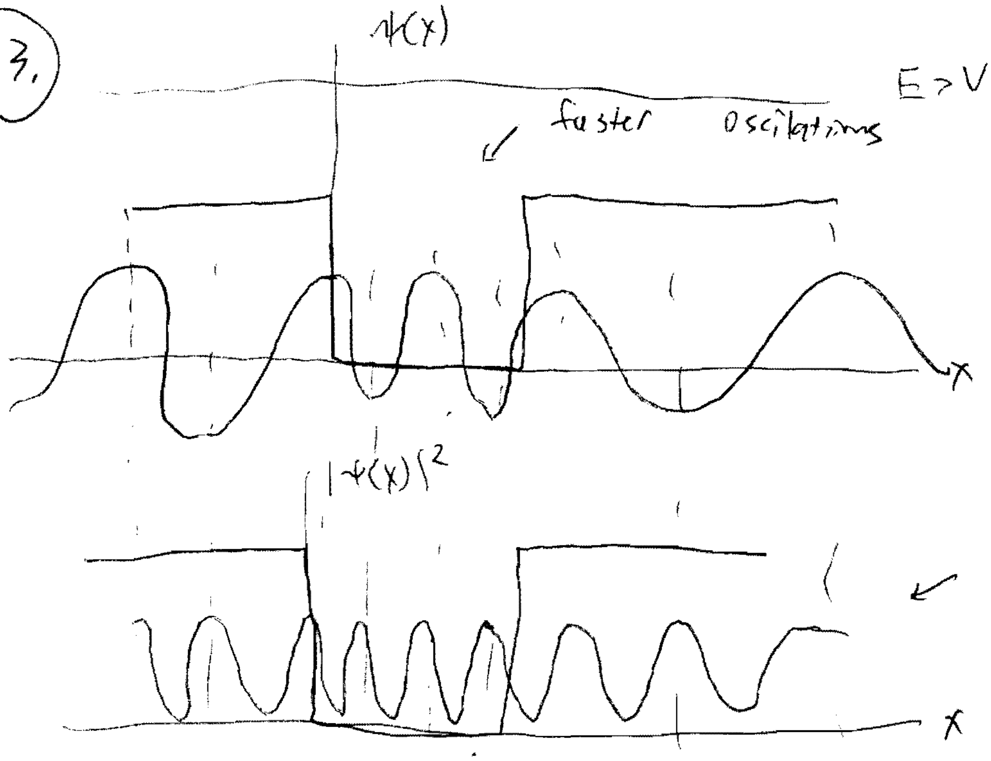
$$b = \frac{K q_\alpha Q}{m_\alpha v^2} \cot\left(\frac{\theta}{2}\right)$$

need to set an arbitrary cut-off for θ.

θ = ~~π/2~~ seems reasonable

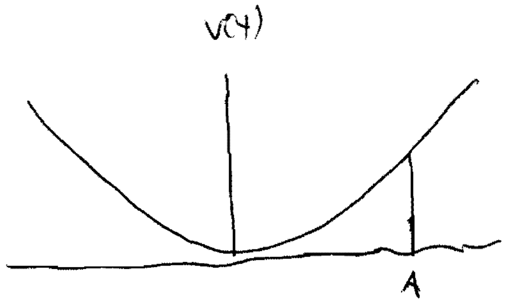
1 degree

(3.)



↙ always positive

(4.)



At top $E = V = \frac{1}{2} k x^2 = \frac{1}{2} m\omega^2 A^2$

$$P = 2 \int_A^\infty |\psi(x)|^2 \, dx$$

$$\psi(x) = A_0 e^{-\frac{m\omega^2 x^2}{2\hbar}}$$

$$|\psi(x)|^2 = A_0^2 e^{-\frac{m\omega^2 x^2}{\hbar}}$$