

Homework 1

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1)

For a differentail cross section

$$\frac{d\sigma}{dt} = \left(\frac{ak_n}{m_n} \right)^2 \frac{\pi}{|t|} \quad (1)$$

On the range $10^{-6} \leq |t| \leq 10^{-2}$ is given by;

$$\sigma = \int_{10^{-6}}^{10^{-2}} \frac{d\sigma}{dt} dt$$

2)

For the fixed-target reaction $\pi^- p \rightarrow K^0 \Lambda^0$, the pion beam is required to have a momentum of

$$\begin{aligned} \sqrt{s} &= m_K + m_\Lambda \\ &= 0.497611\text{GeV} + 1.115683\text{GeV} \\ &= 1.613294\text{GeV} \\ s &= 2.602718\text{GeV} \end{aligned}$$

To move to the fixed target frame;

$$s = (p_\pi^\mu)^2 - (p_P^\mu)^2$$

$$= (E_\pi + m_P)^2 -$$

3)

For a particle with $M \gg m_e$, the maximum kinetic energy that can be transferred to an electron is given by

4)

In proton-proton scattering, the maximum laboratory angle between the two particles will be 90 degrees. This is because the two particles are of equal mass. In the relativistic limit,

5)

For an antineutrino detection process ($\bar{\nu}_e + \rightarrow e^+ + n$) there is one parameter that determines interaction kinematics. Choosing this parameter to be the