

# 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

$$\begin{aligned} \sqrt{s} &= m_K + m_\Lambda \\ &= 0.497611\text{GeV} + 1.115683\text{GeV} \\ &= 1.613294\text{GeV} \\ s &= 2.602718\text{GeV}^2 \end{aligned}$$

To move to the fixed target frame;

$$\begin{aligned} s &= (p_\pi^\mu)^2 - (p_P^\mu)^2 \\ &= (E_\pi + m_P)^2 - \end{aligned}$$

**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