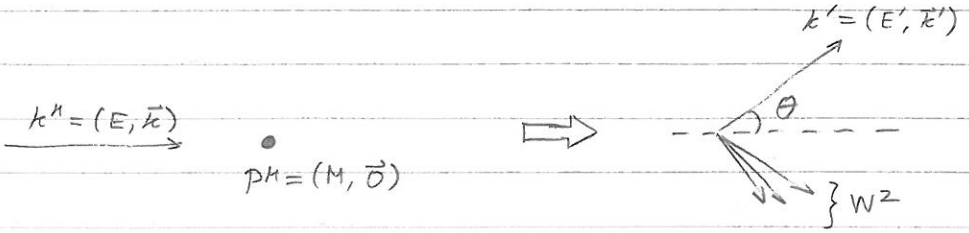
DIS kinematics in LAB frame



$$k \cdot k' = EE' - \vec{k} \cdot \vec{k}' \quad \text{--- if } m = 0$$

$$= EE' - |\vec{k}||\vec{k}'| \cos\theta \longrightarrow EE'(1 - \cos\theta)$$

$$= 2EE' \sin^2(\theta/2)$$

$$k \cdot p = EM$$

$$k' \cdot p = E'M$$

alternate forms can be obtained by using $s + t + u = 2m^2 + M^2 + W^2$

$s - Q^2 + u = (\quad " \quad " \quad)$

$$s = (k+p)^2 = k^2 + p^2 + 2k \cdot p$$

$$= m^2 + M^2 + 2EM$$

$$-t = Q^2 = -(k - k')^2 = -2m^2 + 2k \cdot k'$$

$$= -2m^2 + 2(EE' - |\vec{k}||\vec{k}'| \cos\theta)$$

if $m = 0$ simplifies:

$$= +4EE' \sin^2(\theta/2)$$

$$Q^2 = s + u - 2m^2 - M^2 - W^2$$

$$= (m^2 + M^2 + 2EM) + (m^2 + M^2 - 2E'M) - 2m^2 - M^2 - W^2$$

$$= 2M(E - E') + M^2 - W^2$$

$$u = (k' - p)^2 = (k')^2 + p^2 - 2k' \cdot p$$

$$= m^2 + M^2 - 2E'M$$

Conservation of energy:

Set two forms of Q^2 equal:

$$-2m^2 + 2(EE' - |\vec{k}||\vec{k}'| \cos\theta) = 2M(E - E') + M^2 - W^2$$

very complicated for $m \neq 0$.

Put $m = 0$

$$4EE' \sin^2(\theta/2) = 2M(E - E') + M^2 - W^2$$

$$= 2ME - 2ME' + M^2 - W^2$$

$$(4E \sin^2 \theta/2 + 2M) E' = 2ME + M^2 - W2$$

$$E' = \frac{2ME}{4E \sin^2(\theta/2) + 2M} + \frac{M^2 - W^2}{4E \sin^2(\theta/2) + 2M}$$

$$= E \frac{1}{1 + \frac{2E}{M} \sin^2 \frac{\theta}{2}} + \frac{1}{2}\left(\frac{M^2 - W^2}{2E \sin^2 \frac{\theta}{2} + M}\right)$$

recoiling factor due to non-static scattering center

contribution due to inelasticity.