

Calculations done in 2260

	Result	Exact
Rutherford $e^-p \rightarrow pe^-$	$\frac{d\sigma}{d\Omega} = \frac{\alpha^2}{16T^2 \sin^4(\frac{\theta}{2})} \sim \frac{\alpha^2 s}{t^2}$	} same
	$\sigma(\theta > \theta_0) = \frac{\pi \alpha^2}{4T^2} \cot^2(\frac{\theta_0}{2})$	

Compton $\gamma e^- \rightarrow e^- \gamma$	$\sigma = 4\pi \frac{\alpha^2}{m_e^2}$	$\frac{8\pi}{3} \frac{\alpha^2}{m_e^2} = \frac{2}{3} \text{ barn}$
		

β $X \rightarrow \gamma e^- \bar{\nu}_e$ $\mu^- \rightarrow \nu_\mu e^- \bar{\nu}_e$	$R = \frac{G_F^2 Q^5}{60\pi^3}$	$\frac{G_F^2 m^5}{192\pi^3}$
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 $W^- \text{ decay: } W^- \rightarrow e^- \nu$	$R = \frac{g^2 m_W}{8\pi} = \frac{1}{\sqrt{2}\pi} G_F m_W^3$	$R = \frac{1}{6\sqrt{2}\pi} G_F m_W^3$
		

$\nu X \rightarrow \gamma e^-$	$\sigma = \frac{G_F^2 (E-Q)^2}{\pi} = \frac{G_F^2 s}{\pi}$	$\frac{G_F^2 s}{\pi} \quad !! \text{ (Feynman PA, 23)}$
		

$e^+e^- \rightarrow \mu^+\mu^-$	$R = \frac{1}{(2\pi)^3} (2\pi) (4\pi) \int \frac{p^2 dp \delta(E_{cm} - 2p)}{\frac{1}{8} E_{cm}^2} \left(\frac{E^2}{S}\right)^2$	
	$= \frac{S}{8\pi} \cdot \left(\frac{4\pi\alpha}{S}\right)^2 = \frac{2\pi\alpha^2}{S}$	$\sigma = \frac{4\pi}{3} \frac{\alpha^2}{S} = \frac{87 \text{ nb}}{E(\text{GeV})^2}$
$\sigma = \frac{R}{F} = \frac{R}{2}$	$= \frac{S}{16\pi} \left(\frac{4\pi\alpha}{S}\right)^2 = \frac{\pi\alpha^2}{S}$	
$ v_1 - v_2 $		