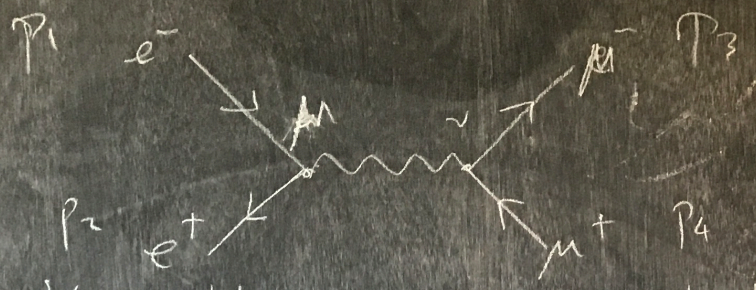


$$q^\mu = p_1^\mu + p_2^\mu$$

Heavy photon $\dfrac{g_{\mu\nu}}{q^2 - m_i^2 + i m_i \Gamma}$ $\quad ie\gamma^\mu$

$$M_i \propto \bar{v}(e^+)\gamma^\mu u(e^-)\, \frac{g_{\mu\nu}}{q^2 - m_i^2 + i m_i \Gamma}\, \bar{u}(\mu^-)\gamma^\nu v(\mu^+)$$

$$\therefore M_{TOT} = j_e \cdot j_\mu \left(\frac{1}{q^2 - m_1^2 + i m_1 \Gamma} + \frac{1}{q^2 - m_2^2 + i m_2 \Gamma} \right)$$

$$= \frac{q^2 - m_1^2 - i m_1 \Gamma}{\underbrace{(q^2 - m_1^2)^2 + m_1^2 \Gamma^2}_{A}} + \frac{q^2 - m_2^2 - i m_2 \Gamma}{\underbrace{(q^2 - m_2)^2 + m_2^2 \Gamma^2}_{B}}$$

$$= Z + W$$

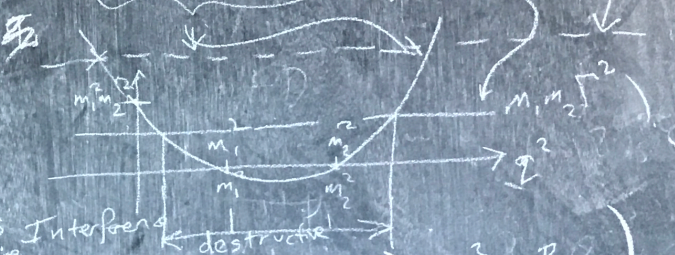
$$\Rightarrow |M_{TOT}|^2 = |Z|^2 + |W|^2 + 2\,\mathrm{Re}(Z\bar{W})$$

$$\mathrm{Re}(Z\bar{W}) = \frac{(q^2 - m_1^2)(q^2 - m_2^2) - m_1 m_2 \Gamma^2}{(\quad A \quad)(\quad B \quad)}$$

Where is this +ve or −ve?

$A > 0$, $B > 0$, so ~~sing~~ sign $\mathrm{Re}(Z\bar{W})$ is given by numerator

$\mathrm{Re}(Z\bar{W}) < 0 \Leftrightarrow (q^2 - m_1^2)(q^2 - m_2^2) < m_1 m_2 \Gamma^2$



Possibilities Interference

So get destructive interference ~~from~~ when $\max(0, R_1) < q^2 < R_2$

$R_1 < m_1^2$ $\qquad R_2 > m_2^2$