Saturday, 28 November 2020 16:13

$$f(\rho) = |\rho| + 2\cos(\arg(\rho))$$

$$\rho = \frac{(s - m_1^2) + i m_1 \Gamma}{(s - m_2^2) + i m_2 \Gamma}$$

$$\lim_{\Gamma \to 0} \rho = \frac{s - m_1^2}{s - m_2^2} = \begin{cases} < 0 & \text{when } m_1 < \sqrt{s} < m_2 \\ > 0 & \text{otherwise} \end{cases}$$

$$\lim_{\Gamma \to 0} f(\rho) = \left| \frac{s - m_1^2}{s - m_2^2} \right| + 2\cos\begin{pmatrix} \pi & \text{when } m_1 < \sqrt{s} < m_2 \\ 0 & \text{otherwise} \end{pmatrix}$$

$$= \left| \frac{s - m_1^2}{s - m_2^2} \right| + \begin{cases} -2 & \text{when } m_1 < \sqrt{s} < m_2 \\ +2 & \text{otherwise} \end{cases}$$

so when $!(m_1 < \sqrt{s} < m_2)$ then $\sigma_{\circ\circ} > \sigma_\circ$

And when $m_1 < \sqrt{s} < m_2$, $\sigma_{\circ\circ} < \sigma_\circ$ when $\left| \frac{s - m_1^2}{s - m_2^2} \right| - 2 < 0$

Cross section in universe with two Bogus bosons

Cross section in universe with one Bogus boson

$$\iff \frac{s - m_1^2}{m_2^2 - s} < 2$$

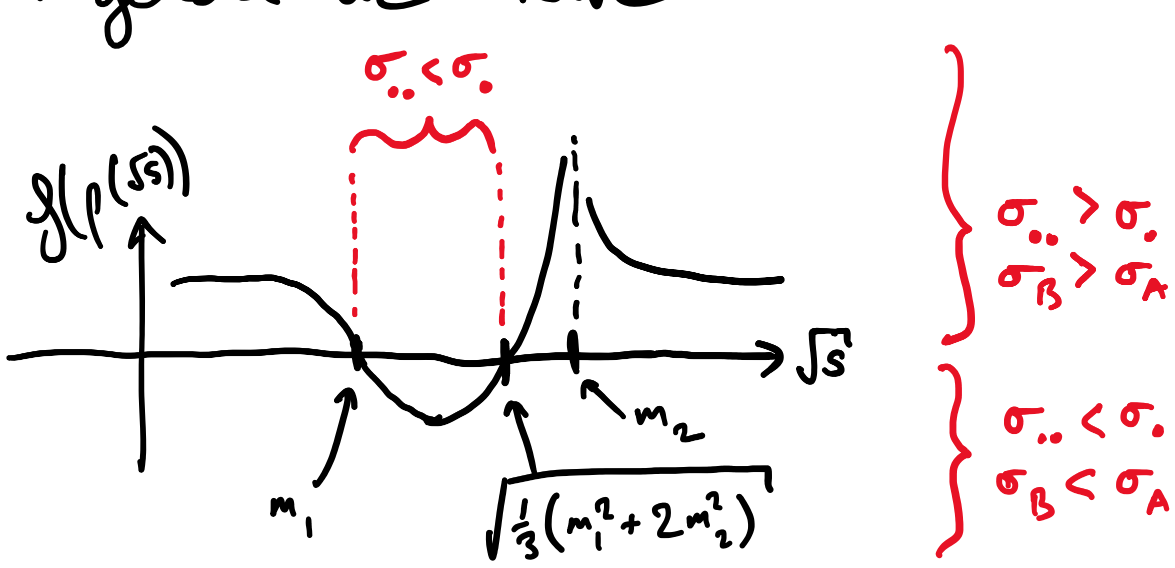
$$\iff s - m_1^2 < 2m_2^2 - 2s$$

$$\iff 3s < 2m_2^2 + m_1^2$$

$$\iff s < \tfrac{1}{3}(m_1^2 + 2m_2^2)$$

$$\iff \sqrt{s} < \sqrt{\tfrac{1}{3}(m_1^2 + 2m_2^2)}$$

$\therefore$ in general we have



which in the case $m_1 = M$, $m_2 = 2M$ gives