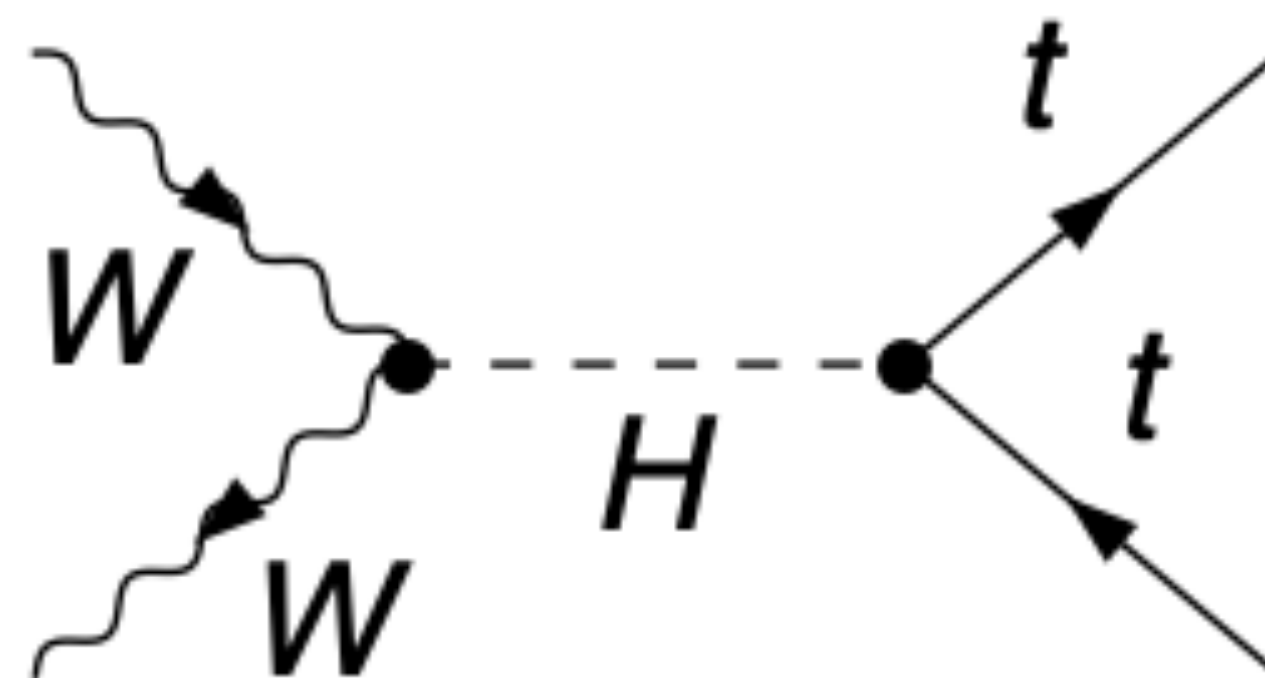
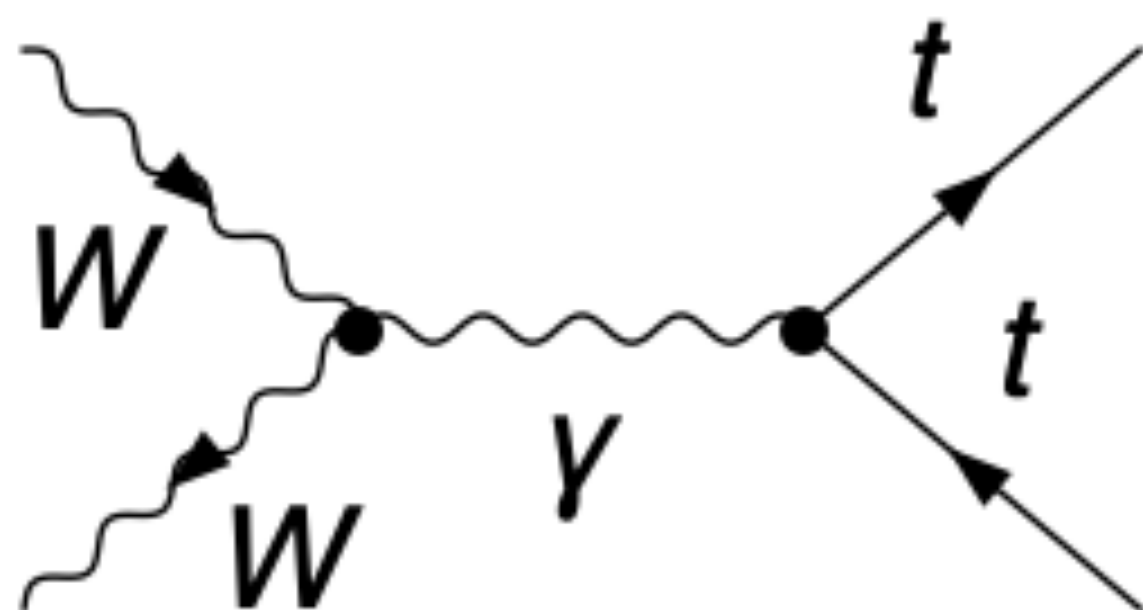
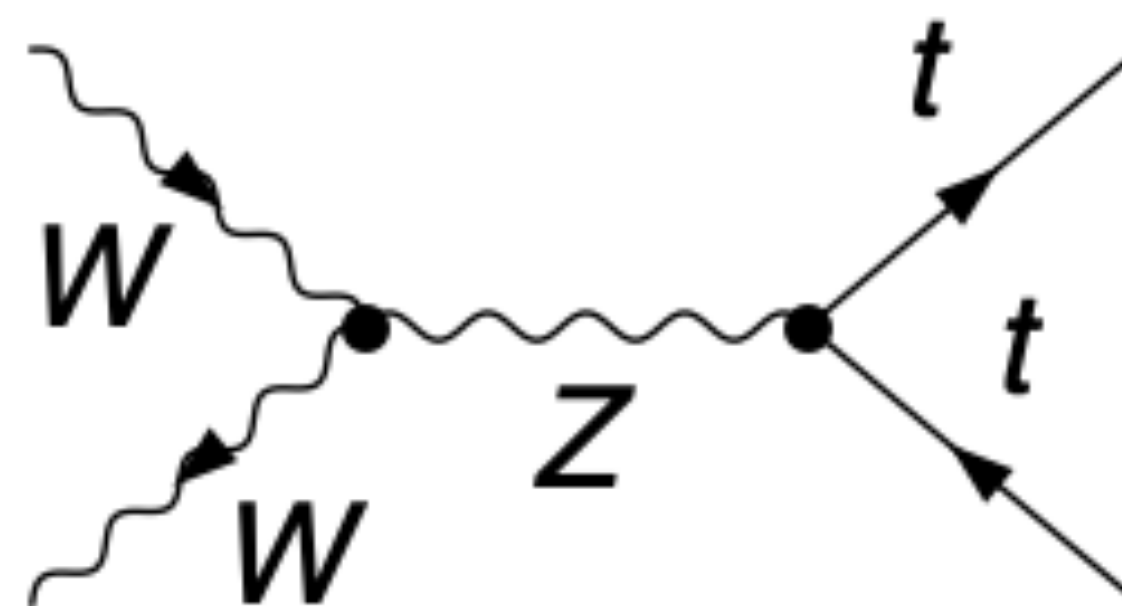
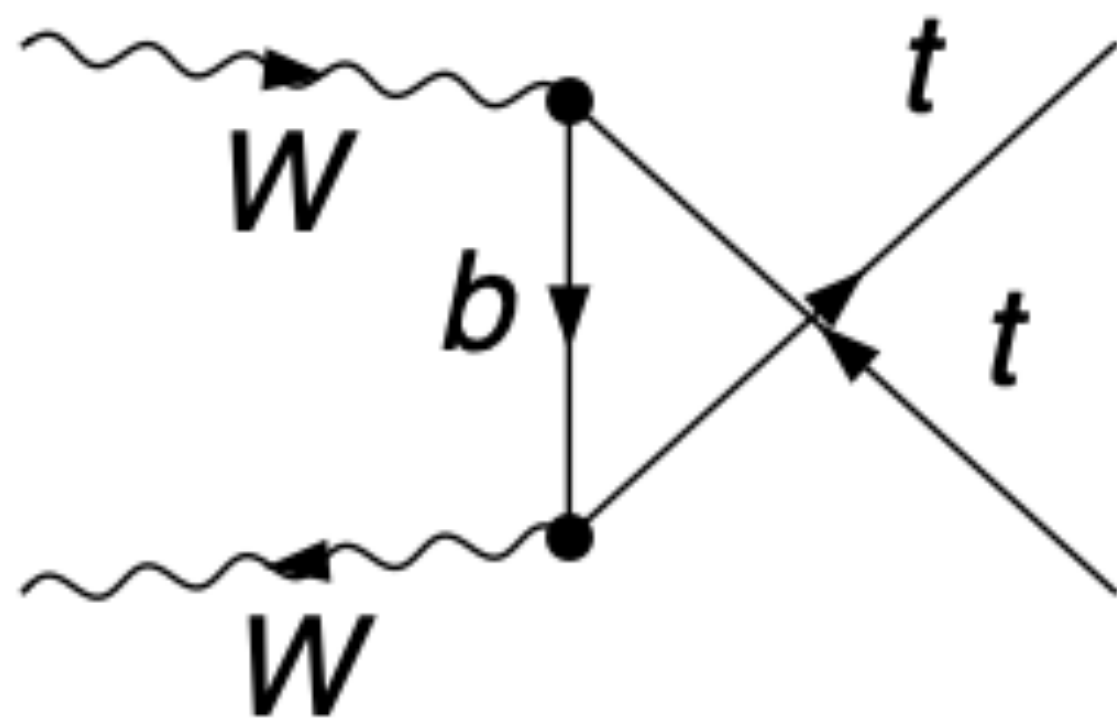
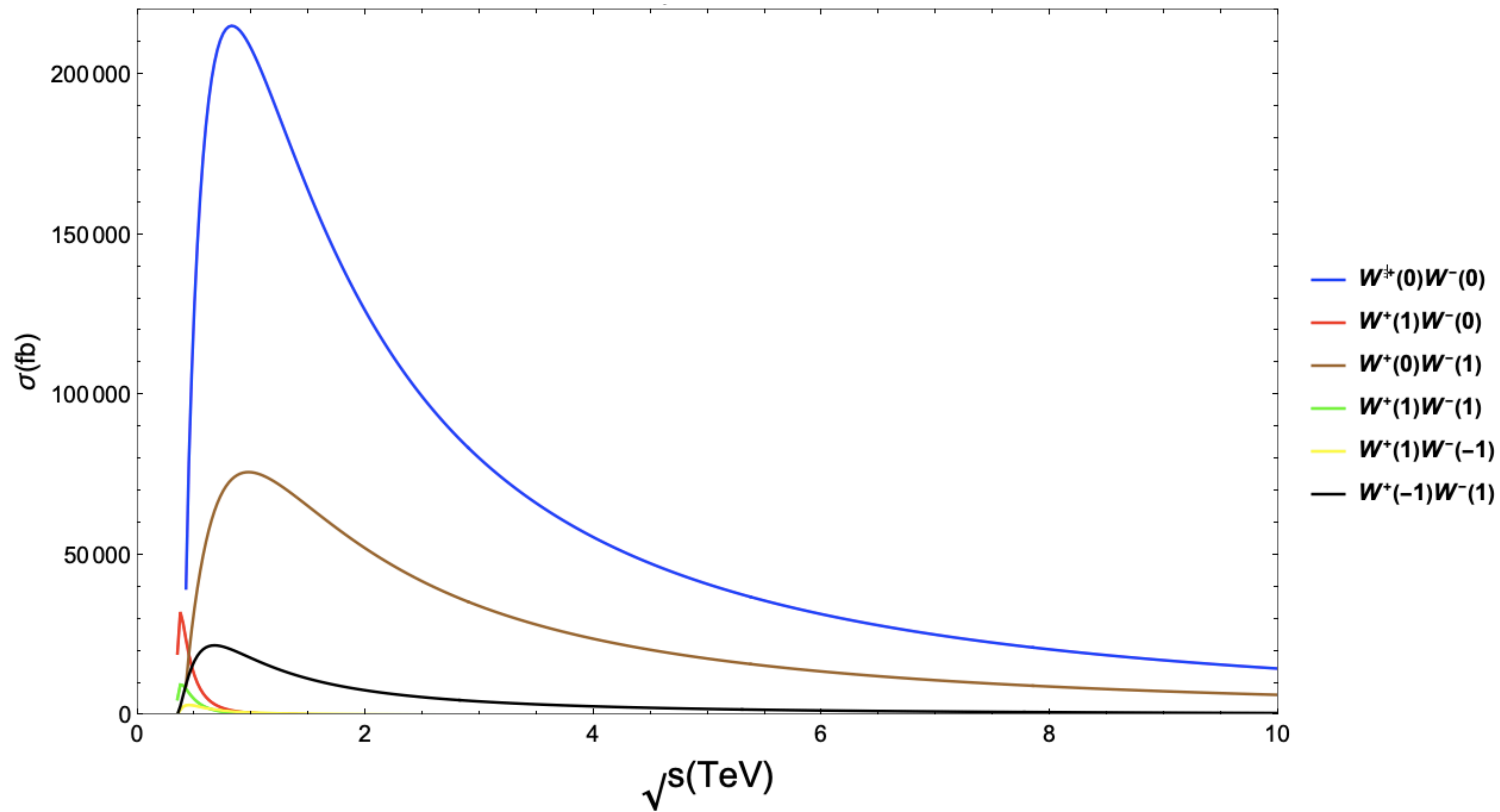


$$\mu^+\mu^- \rightarrow W^+W^- \rightarrow tt$$



# $W^+W^- \rightarrow tt$ Cross-Section



# Muon PDF

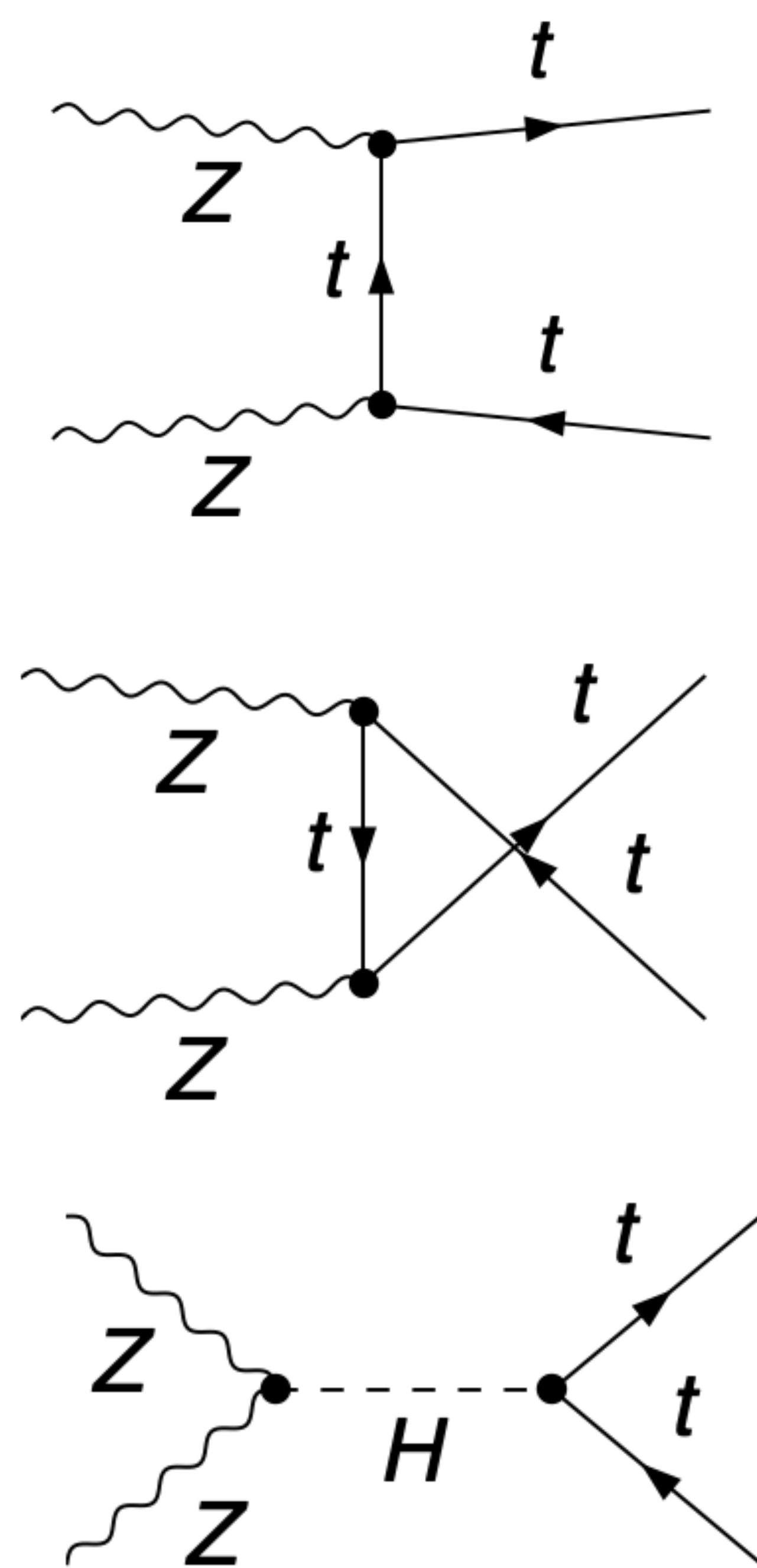
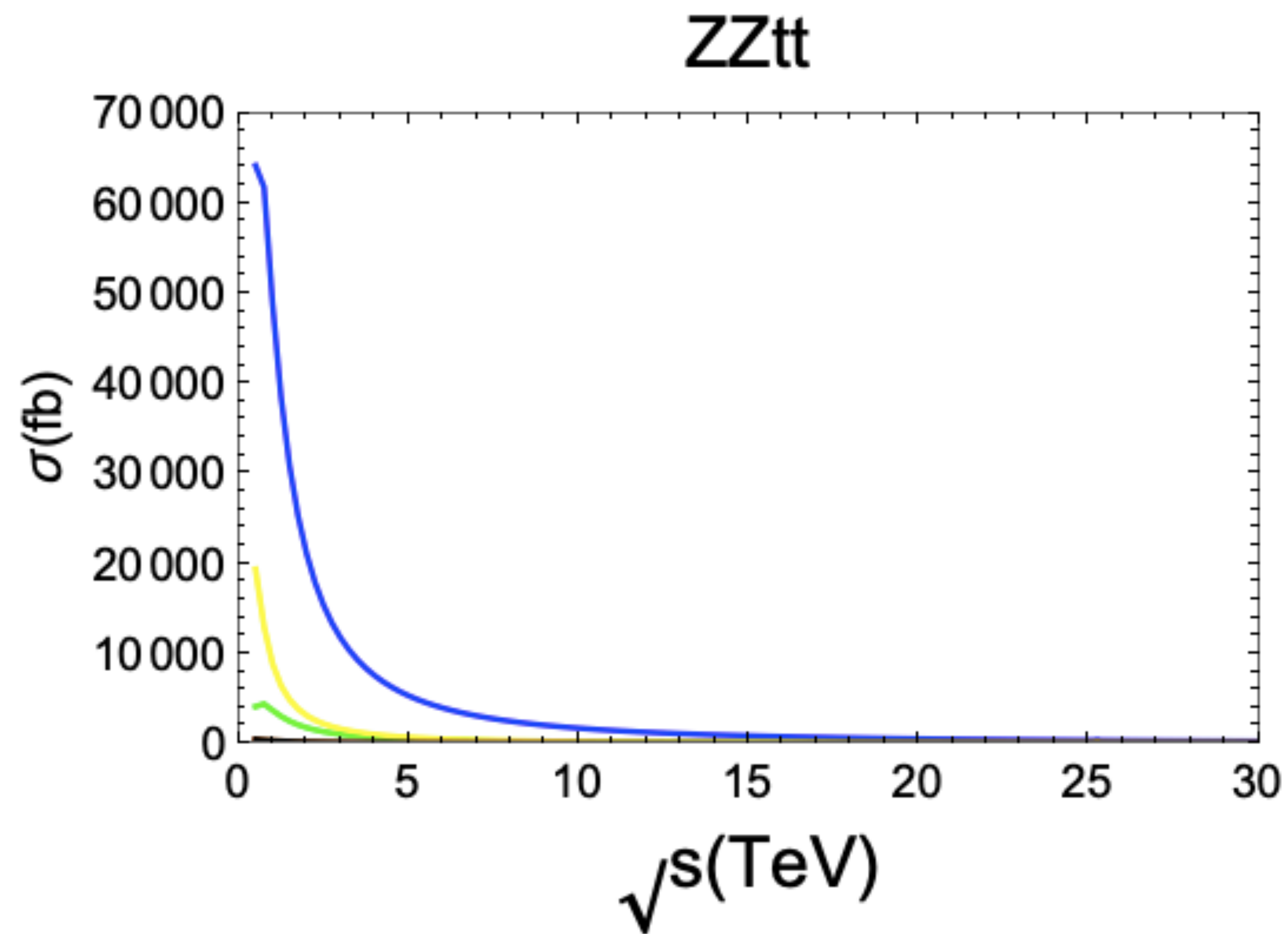
$$\mu^+\mu^- \rightarrow W^+W^- \rightarrow tt$$

$$\mu^+\mu^- \rightarrow ZZ \rightarrow tt$$

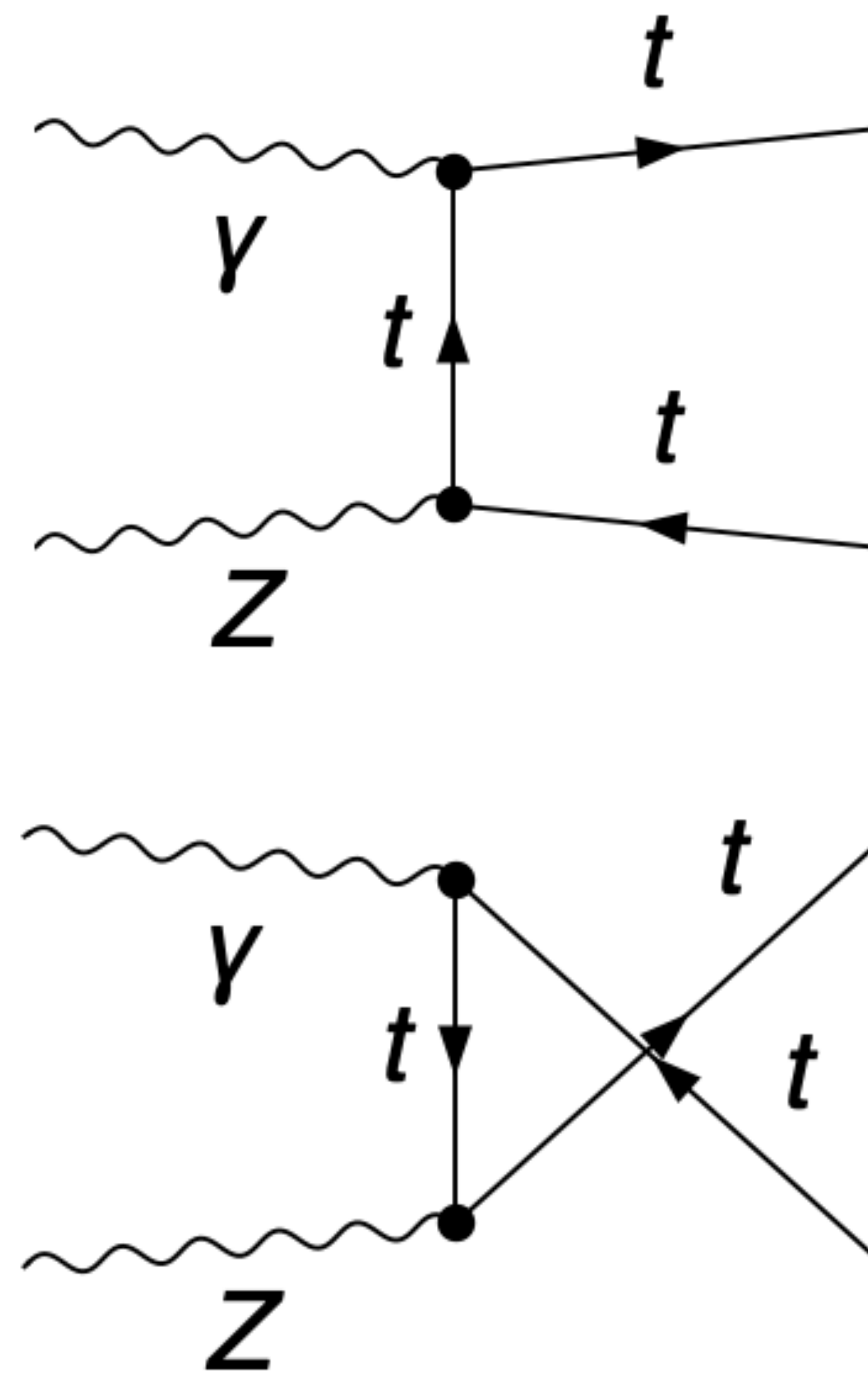
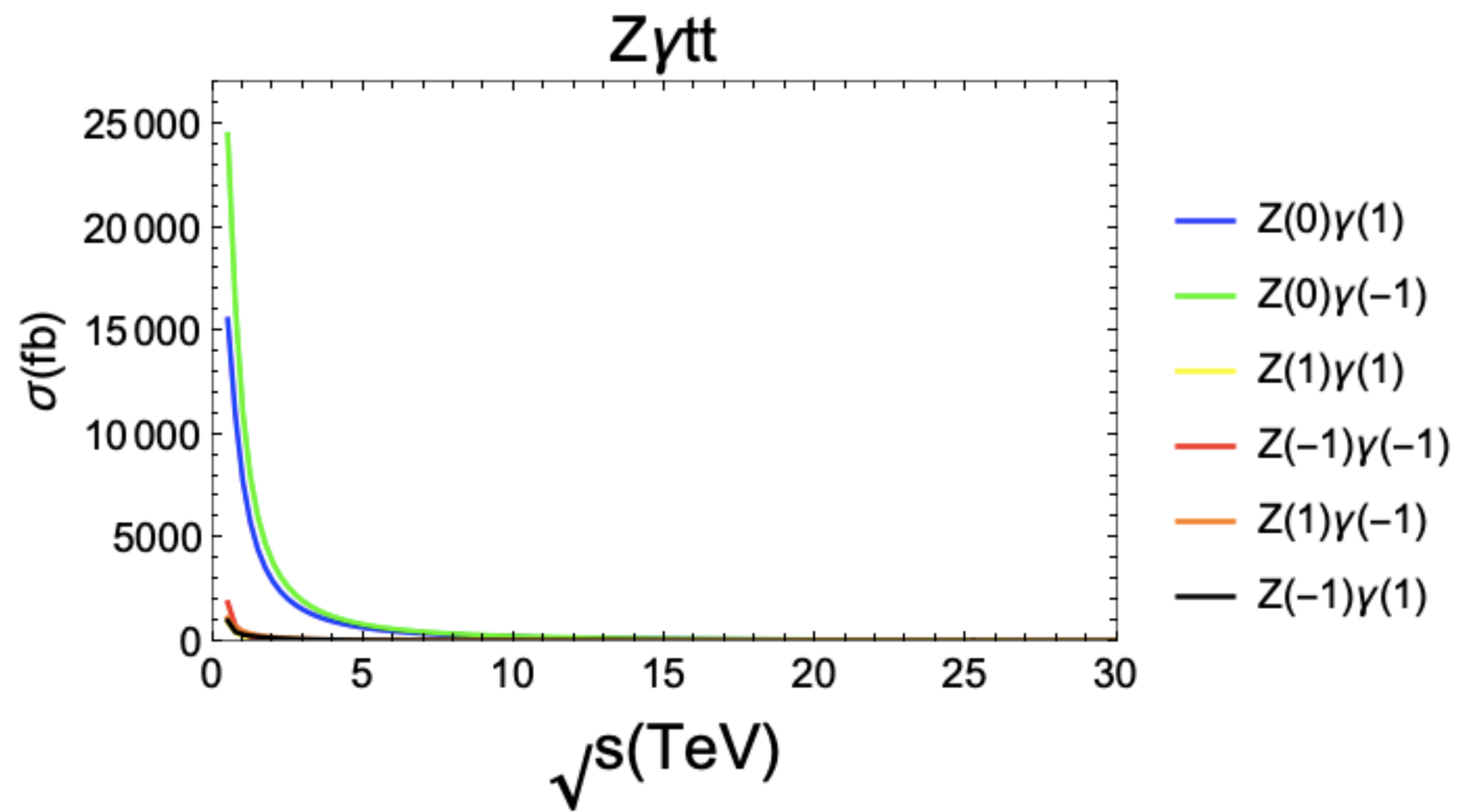
$$\mu^+\mu^- \rightarrow \gamma\gamma \rightarrow tt$$

$$\mu^+\mu^- \rightarrow \gamma Z \rightarrow tt$$

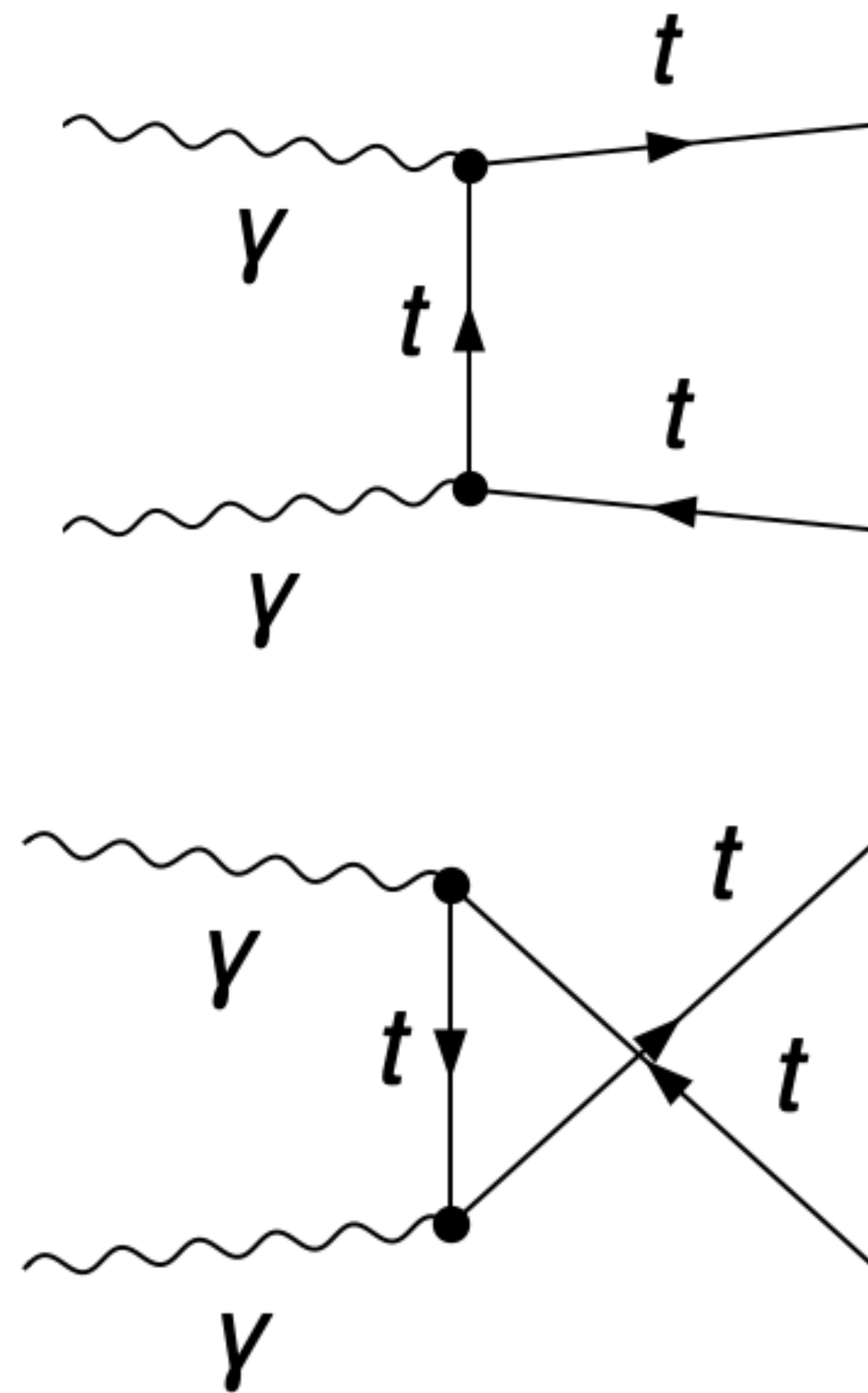
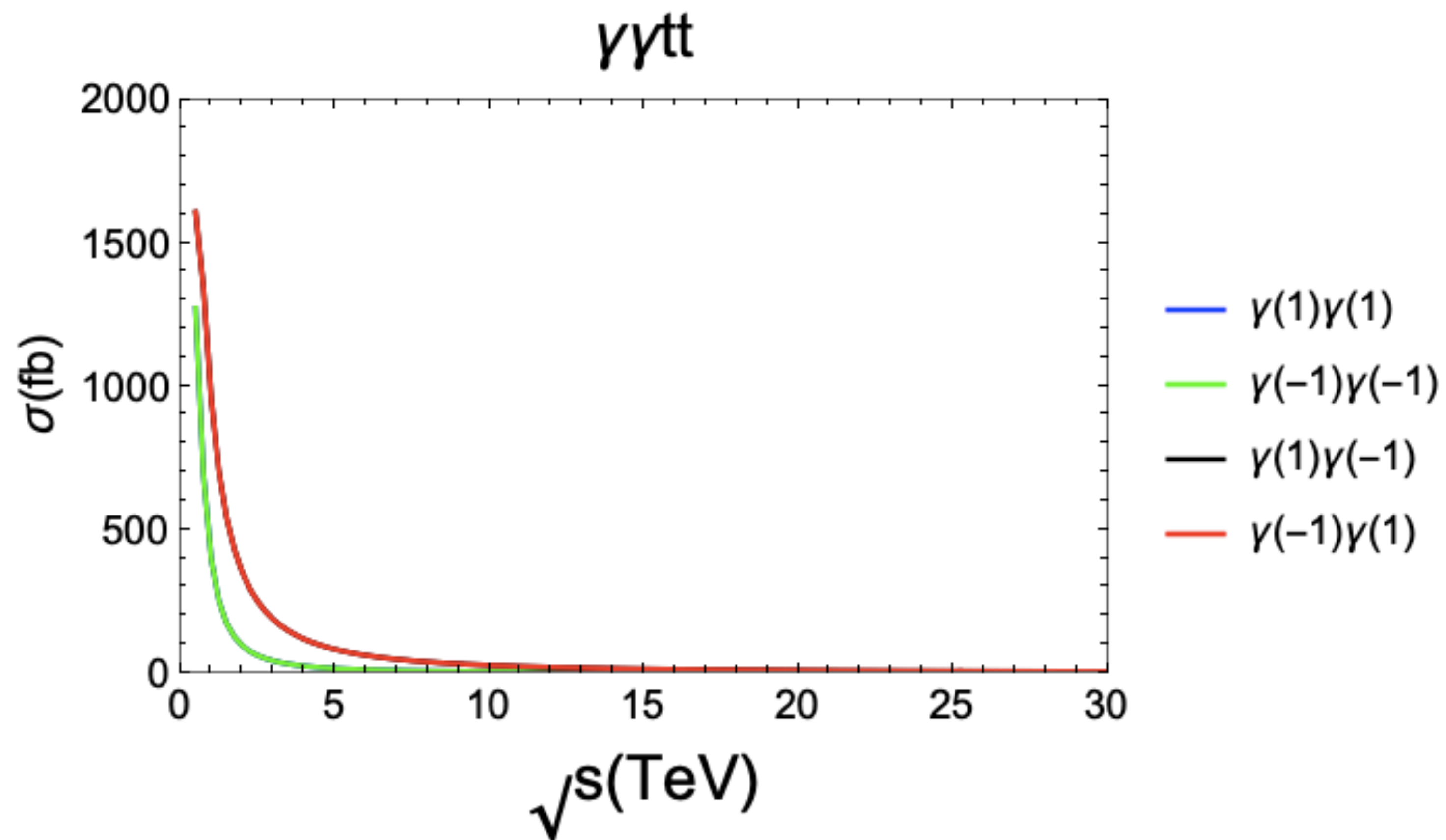
$$ZZ \rightarrow tt$$



$$\gamma Z \rightarrow t\bar{t}$$

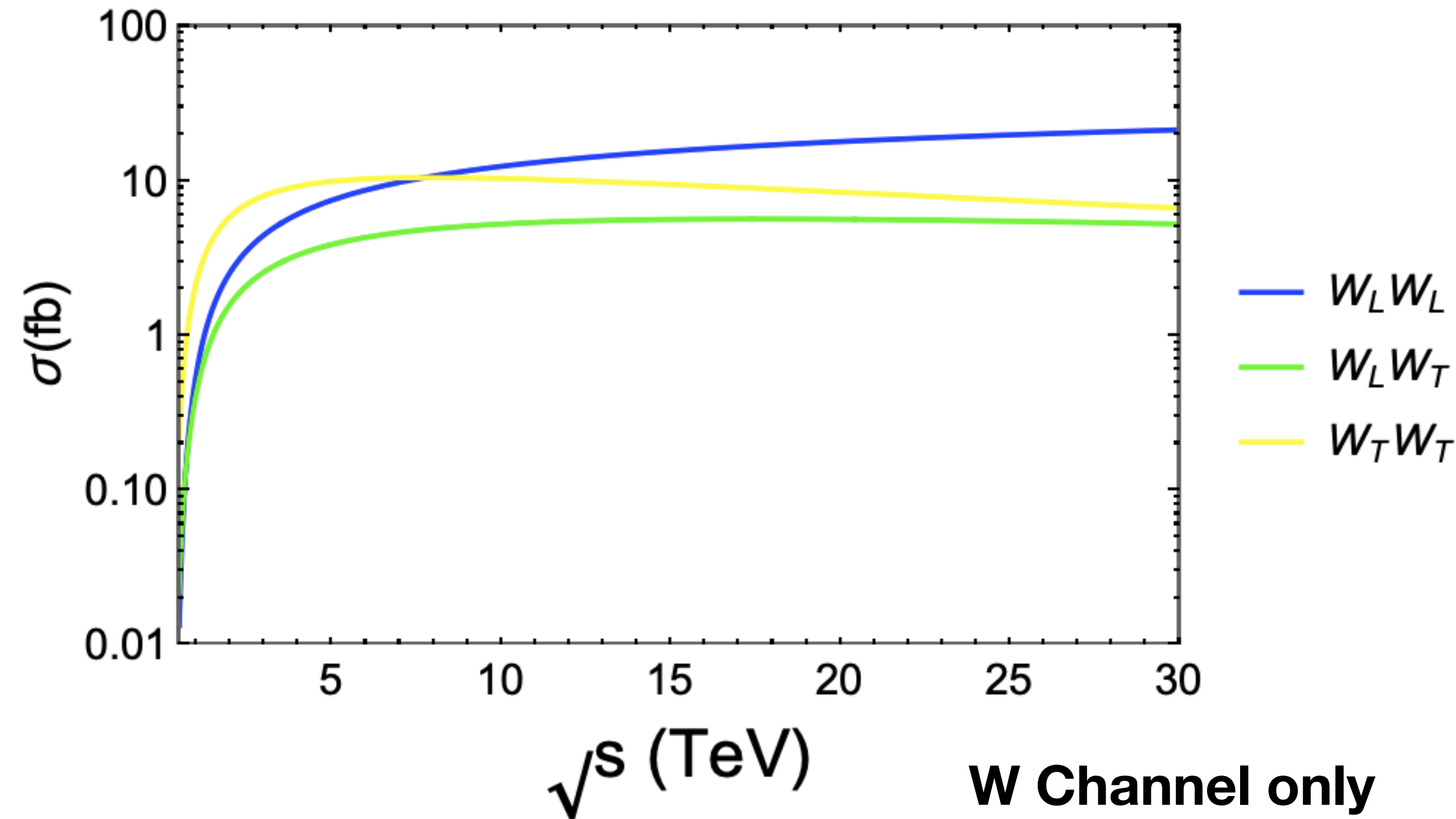
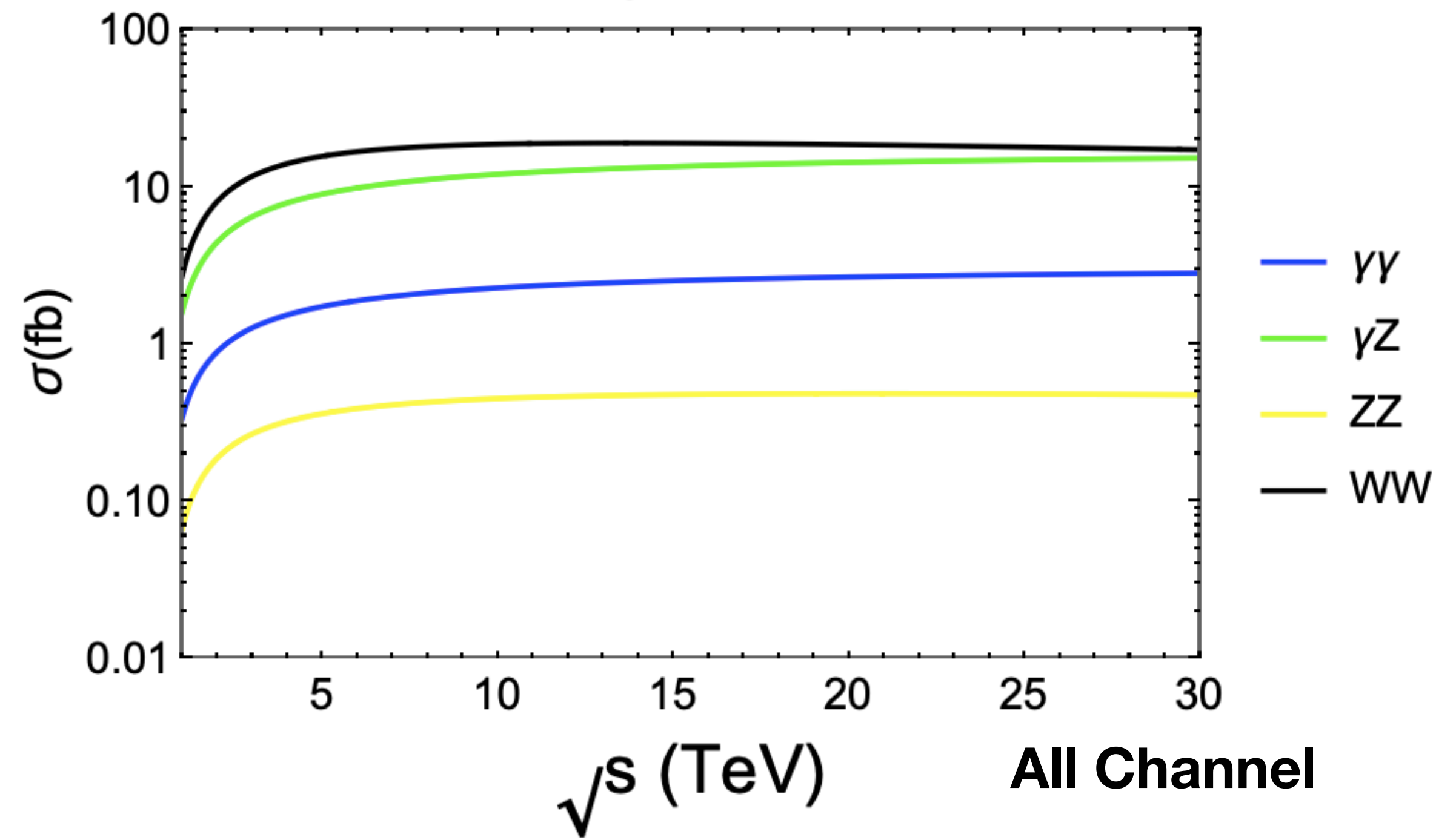
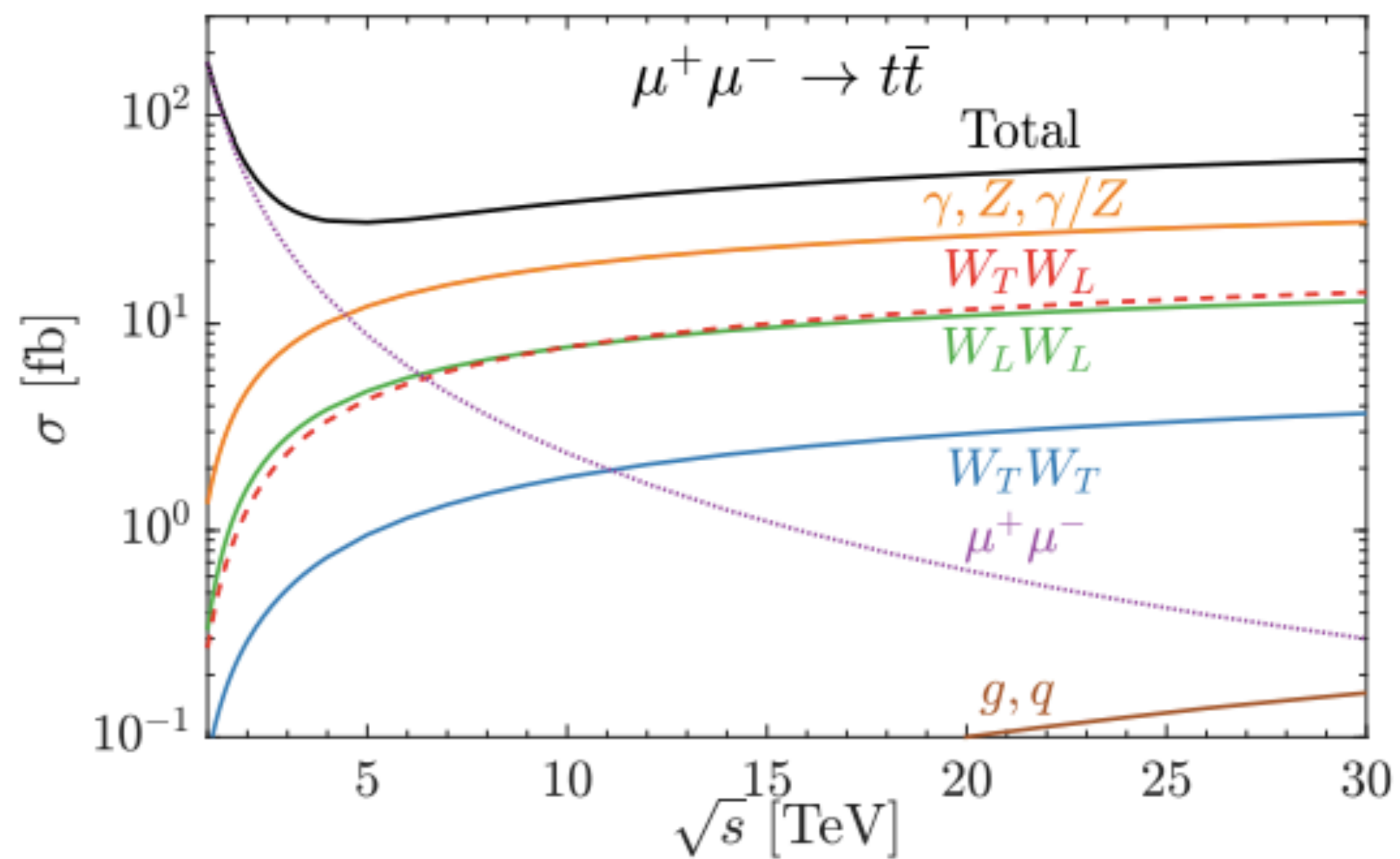


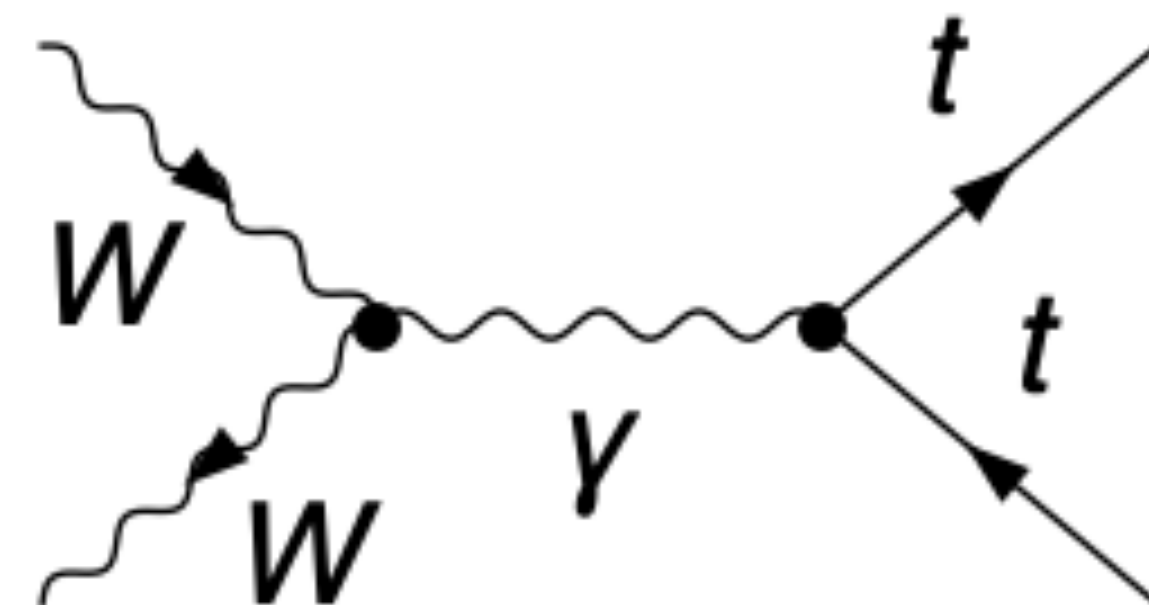
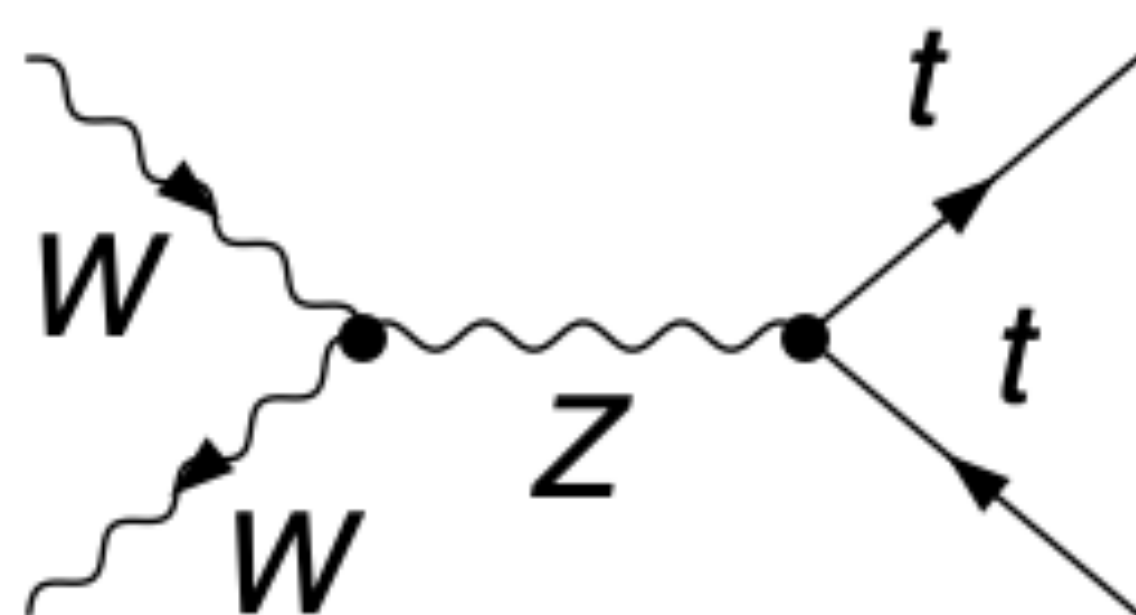
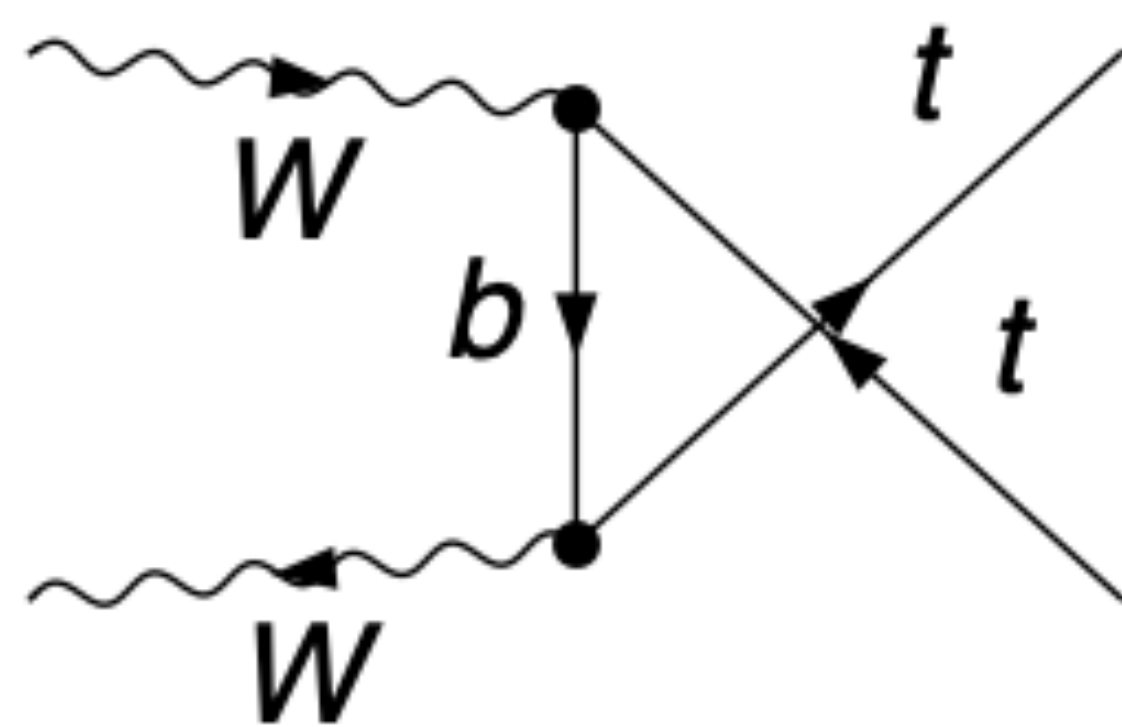
$$\gamma\gamma \rightarrow tt$$





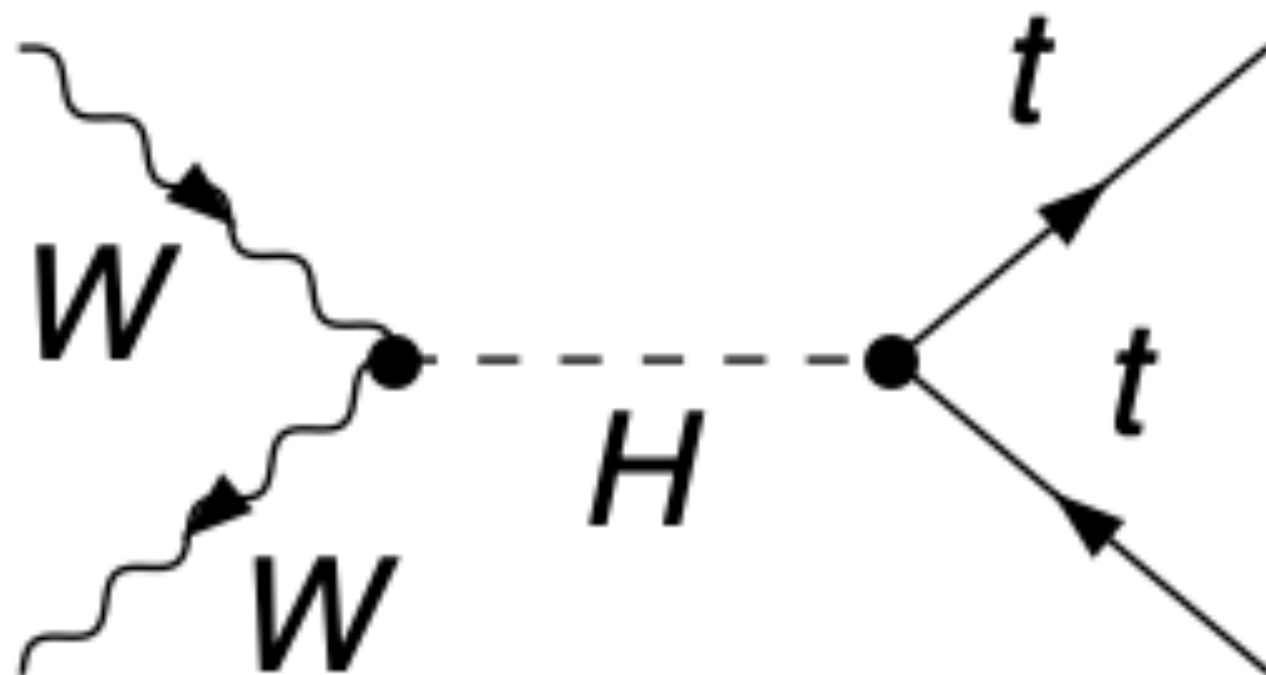
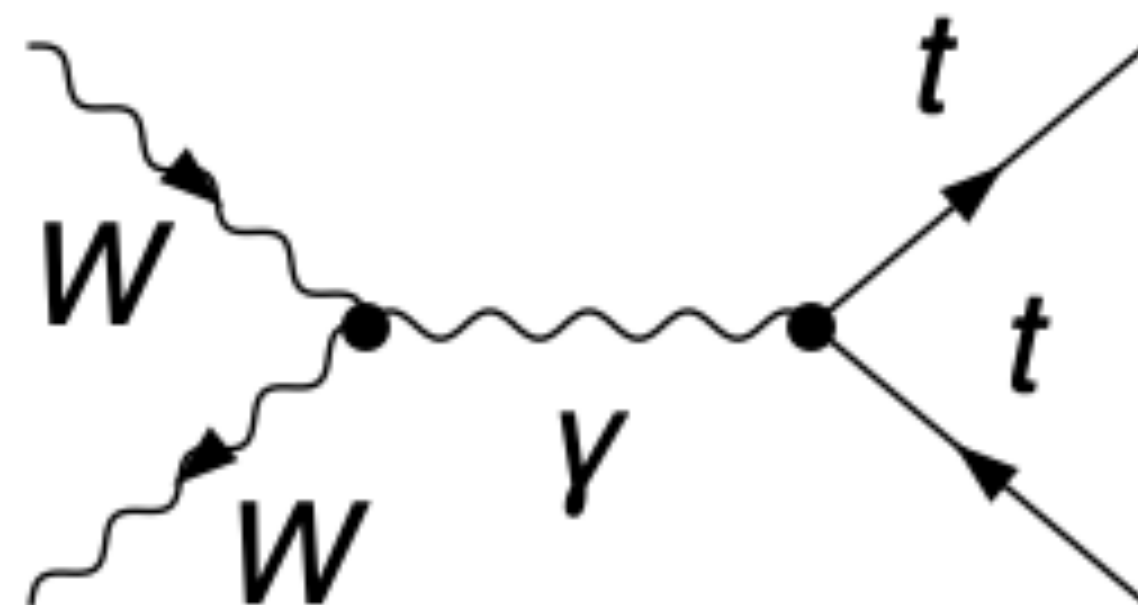
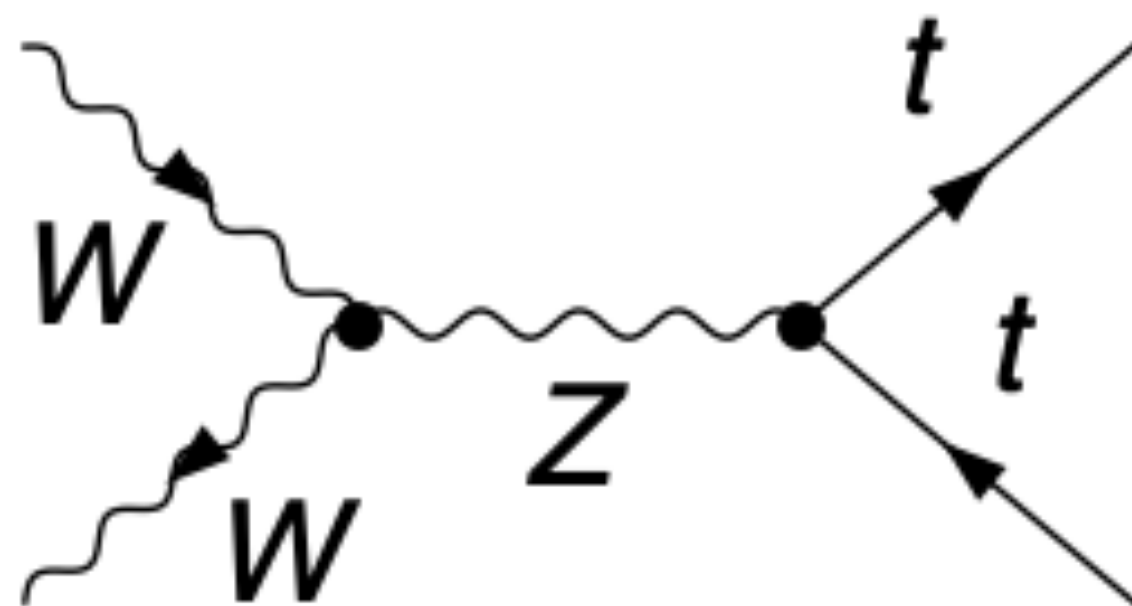
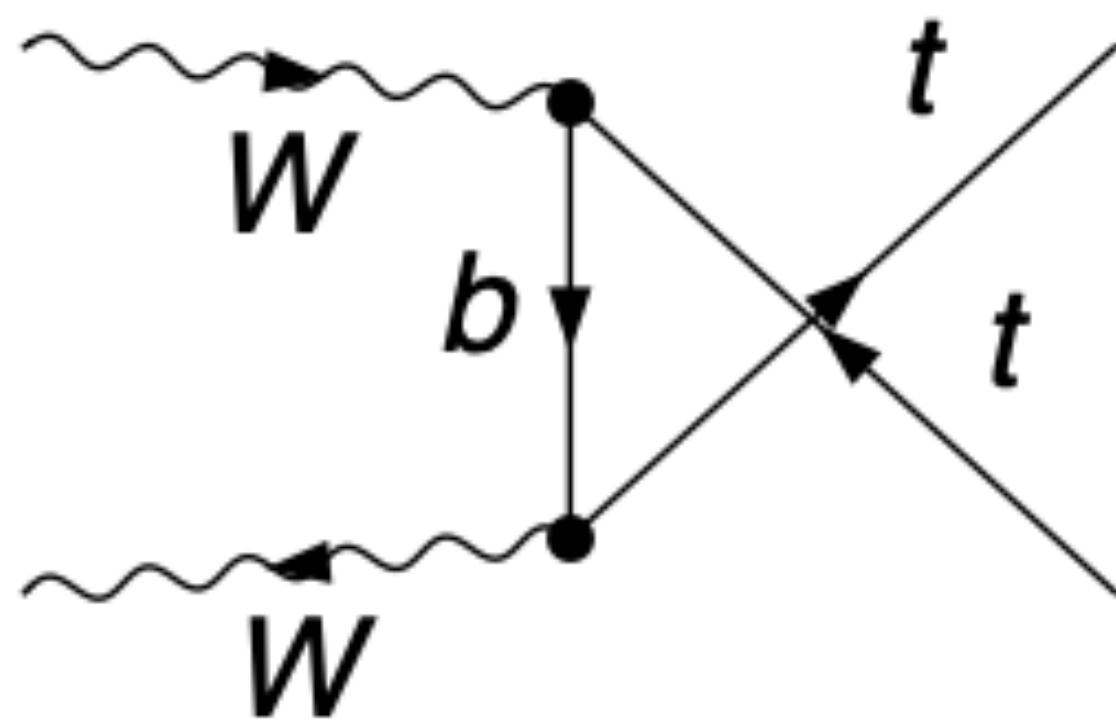
# Convolute All Processes





$$\boxed{\mathcal{M}_{++}^{\gamma+Z+b} = \sqrt{2}G_F m_t \sqrt{s} = \frac{m_t}{v^2} \sqrt{s}} \quad \sqrt{s} \gg m_t, M_Z, M_W$$

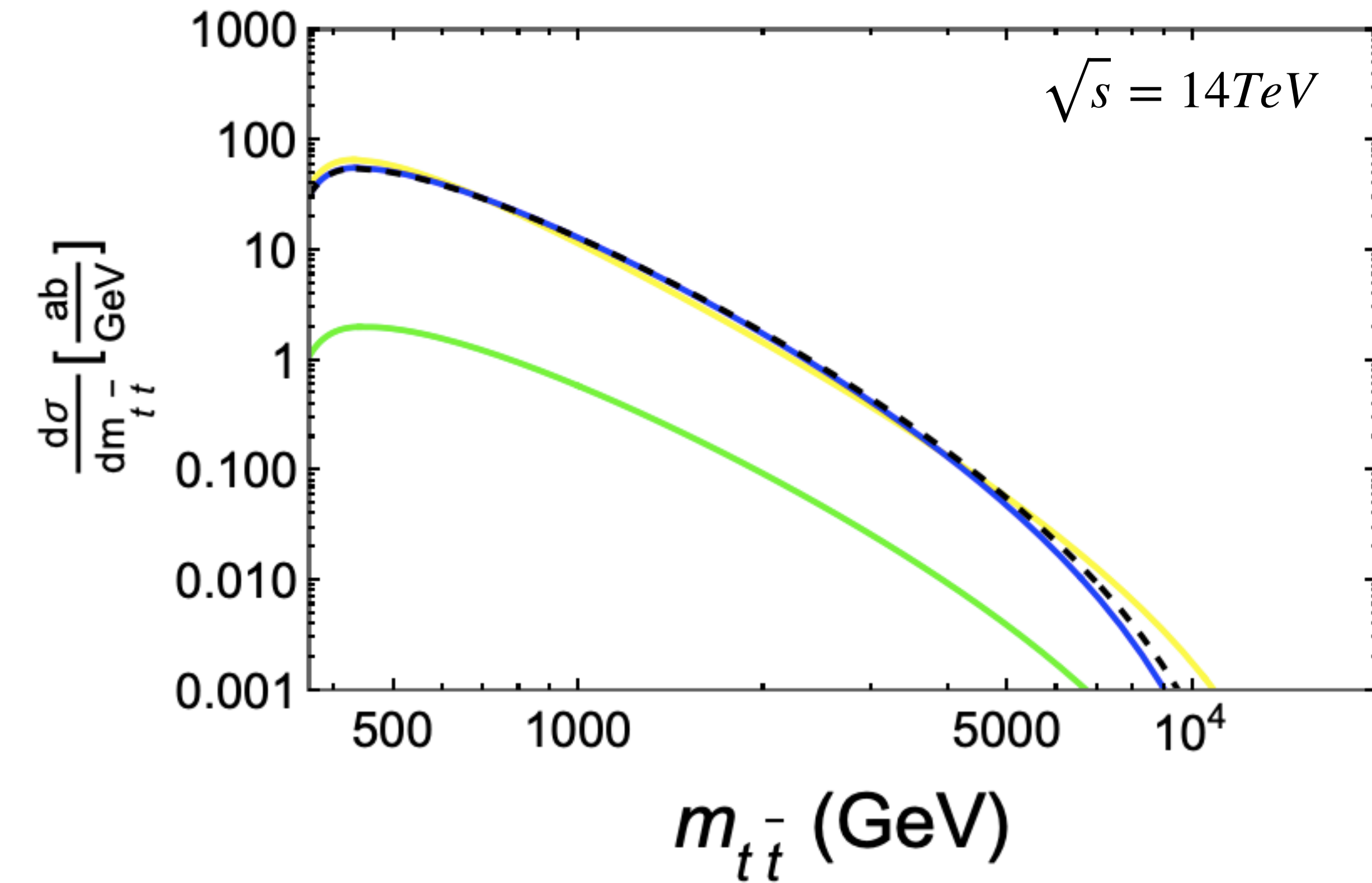




$$yt \rightarrow yt(1 + \delta_{yt})$$

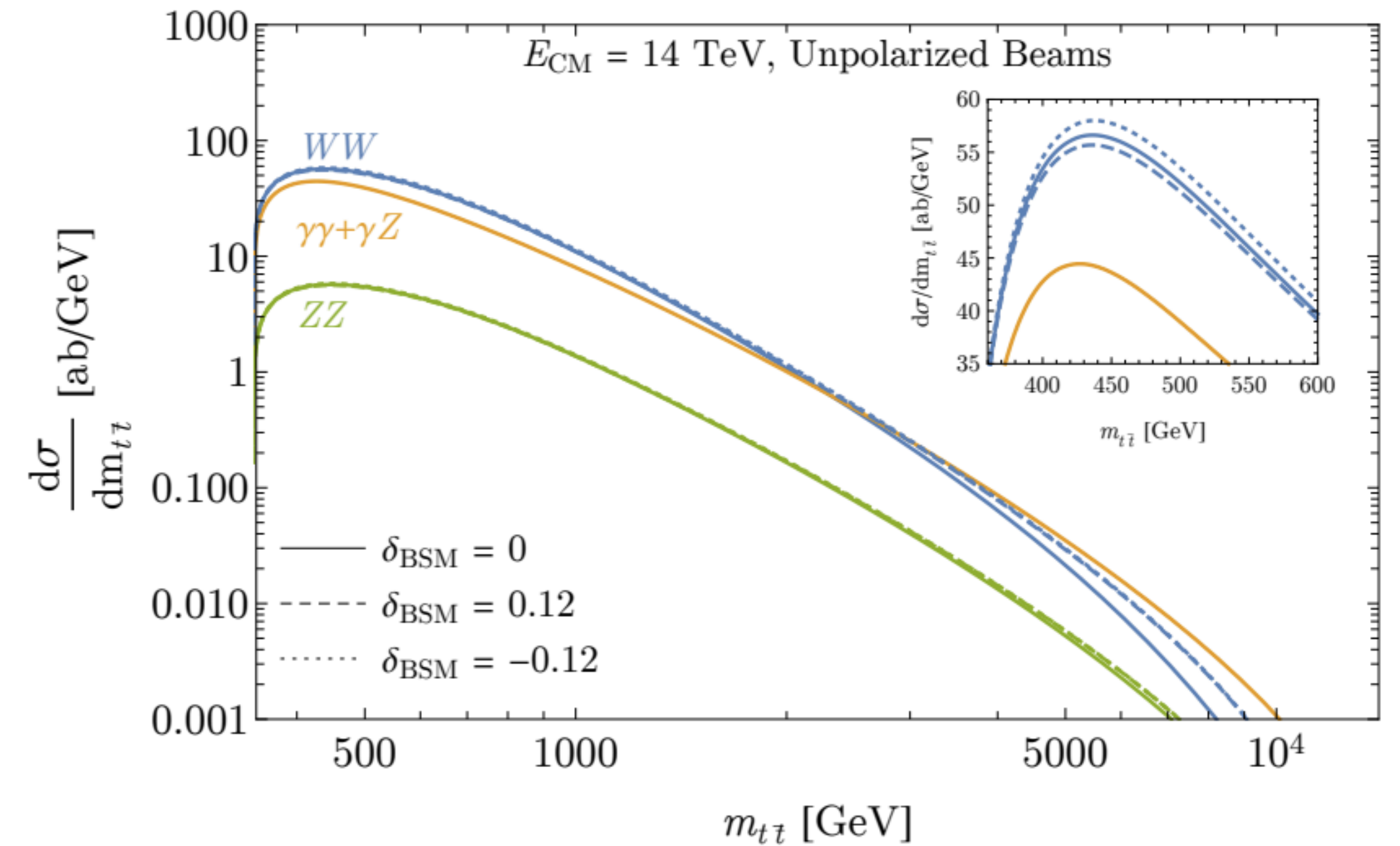
$$\mathcal{M}(W_L^+ W_L^- \rightarrow t\bar{t}) = \frac{m_t}{\nu^2} \delta_{yt} \sqrt{s}$$

$$\mu^+\mu^- \rightarrow t\bar{t} + X \text{ from } WW \rightarrow t\bar{t}$$

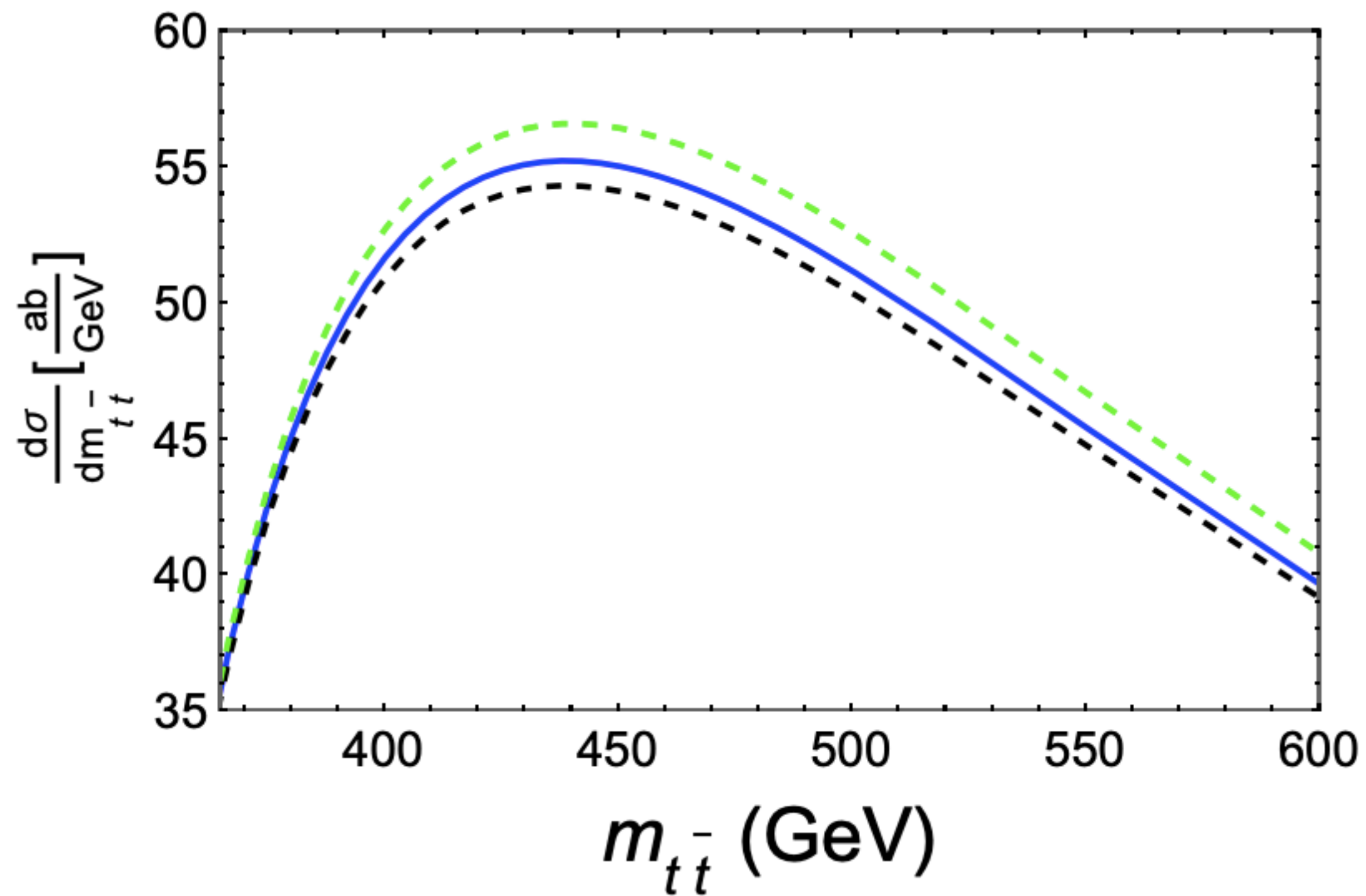


**Quark Helicity Summed  
W Polarisations Summed**

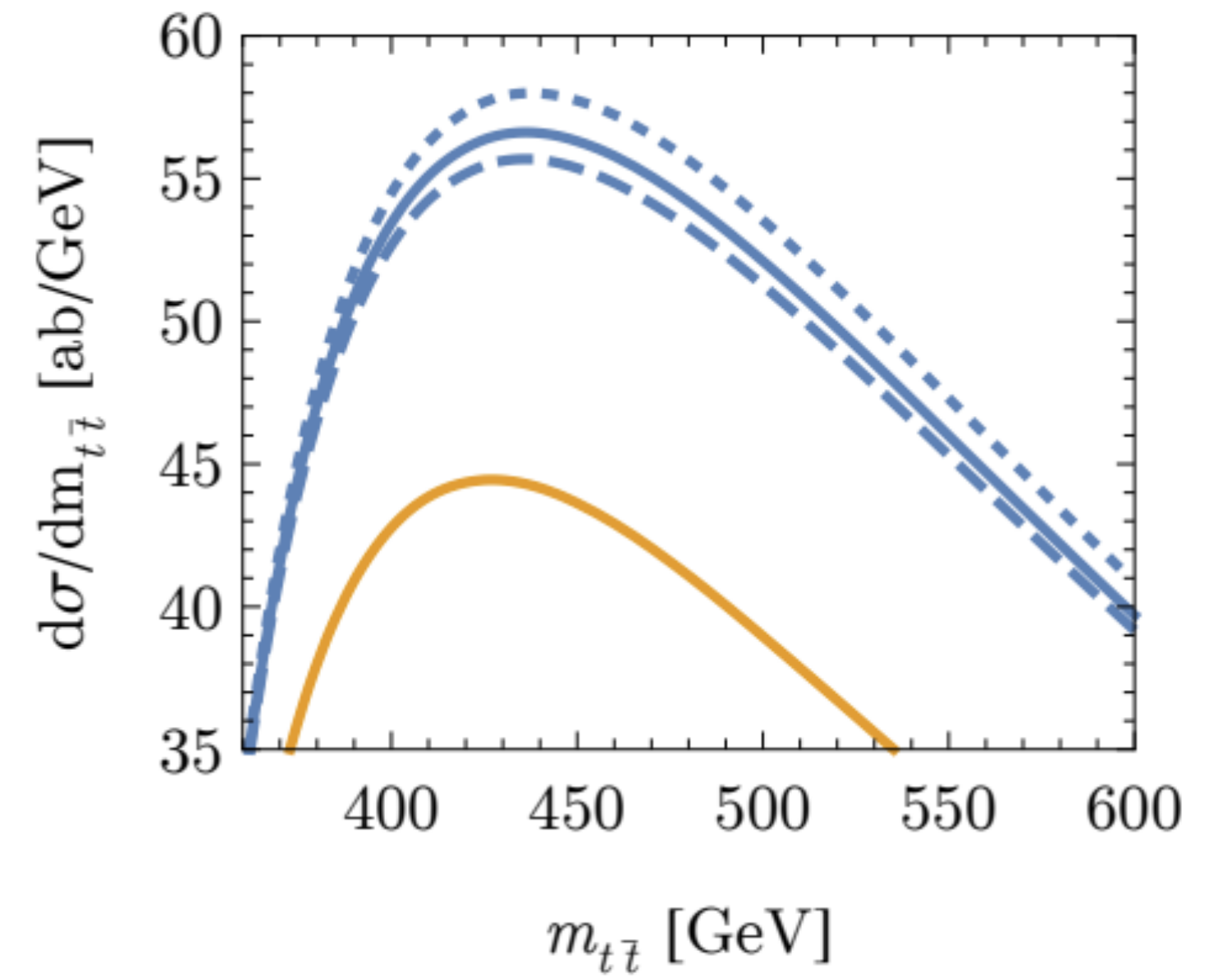
- $Z\gamma+\gamma\gamma$
- $WW(\delta_{yt} = 0)$
- $ZZ(\delta_{yt} = 0)$
- $WW(\delta_{yt} = 0.12)$



$$\mu^+\mu^- \rightarrow t\bar{t} + X \text{ from } WW \rightarrow t\bar{t}$$

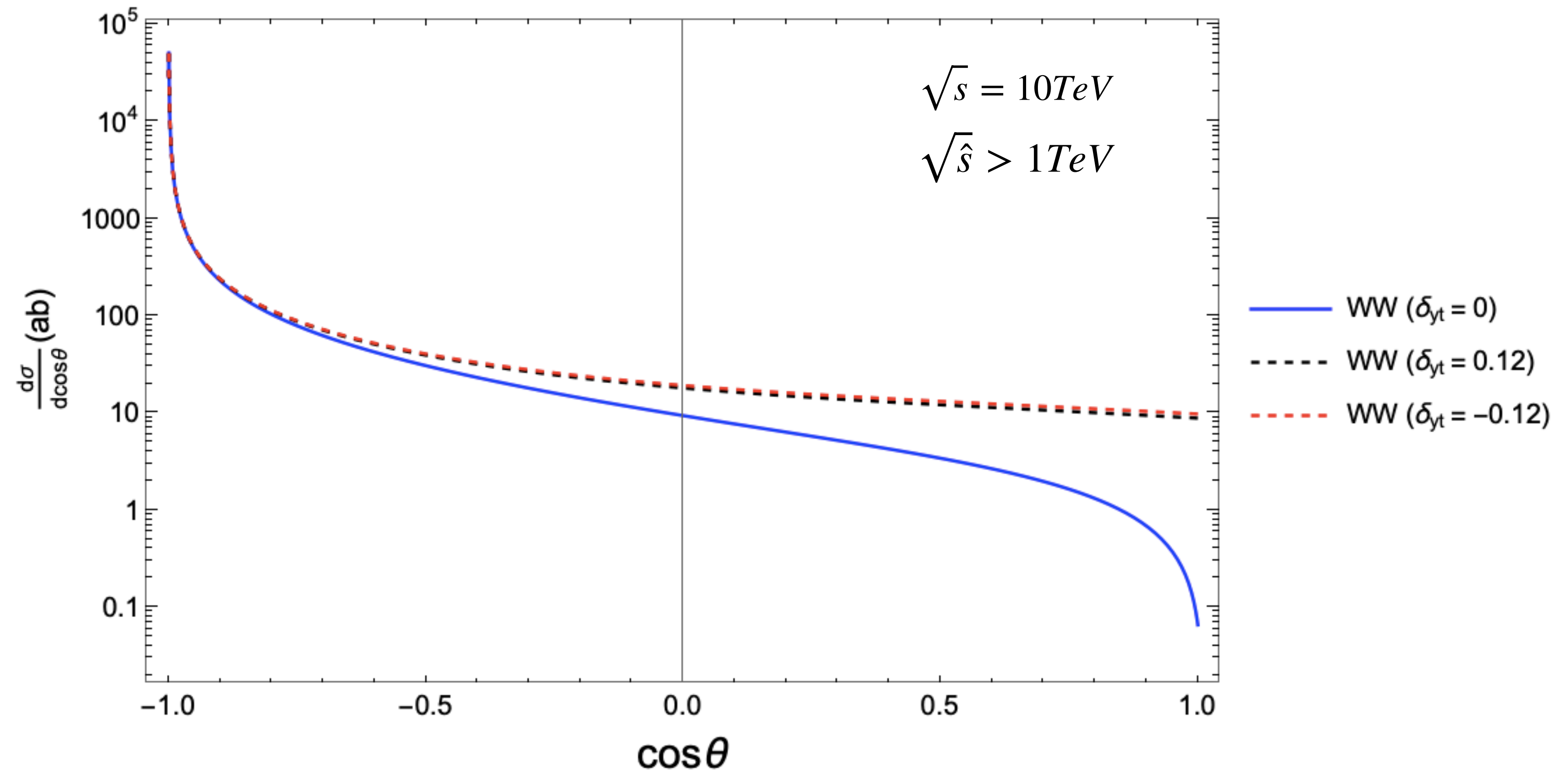


$WW(\delta_{yt} = 0)$   
 $WW(\delta_{yt} = 0.12)$   
 $WW(\delta_{yt} = -0.12)$

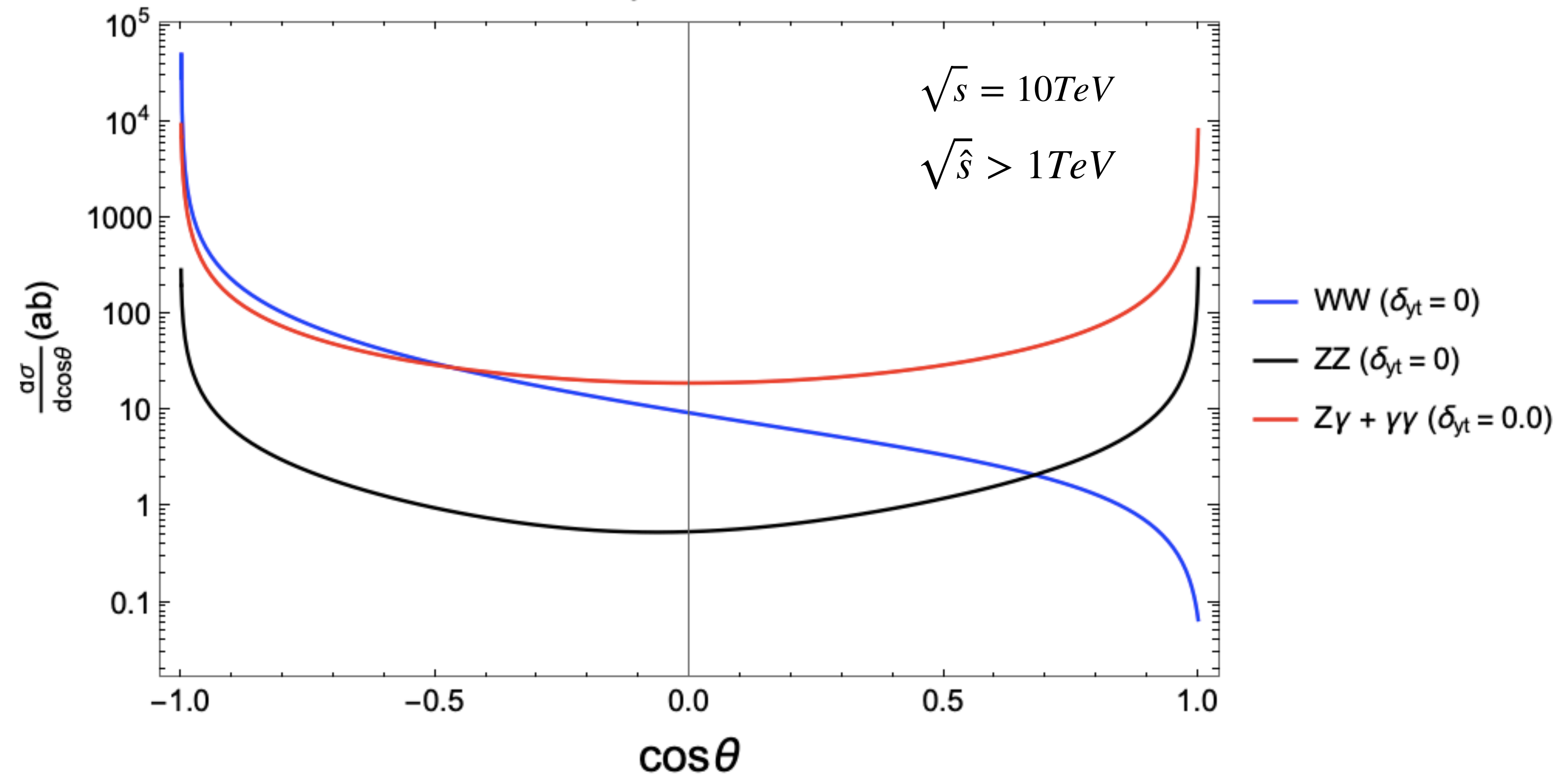


*H. Al Ali et al. , "The Muon Smasher's Guide,"  
arXiv:2103.14043 [hep-ph]*

$$\mu^+\mu^- \rightarrow t\bar{t} + X \text{ from } WW \rightarrow t\bar{t}$$



# $\mu^+\mu^- \rightarrow t\bar{t} + X$ from different processes



All Channels with varied  $\delta_{yt}$

