

# CMS found a 750GeV spin-2 resonance ?!

CMS PAS EXO-15-004

The Randall-Sundrum (RS)  
effective coupling

$$\tilde{\kappa} = \sqrt{8\pi\kappa/m_{Pl}}$$

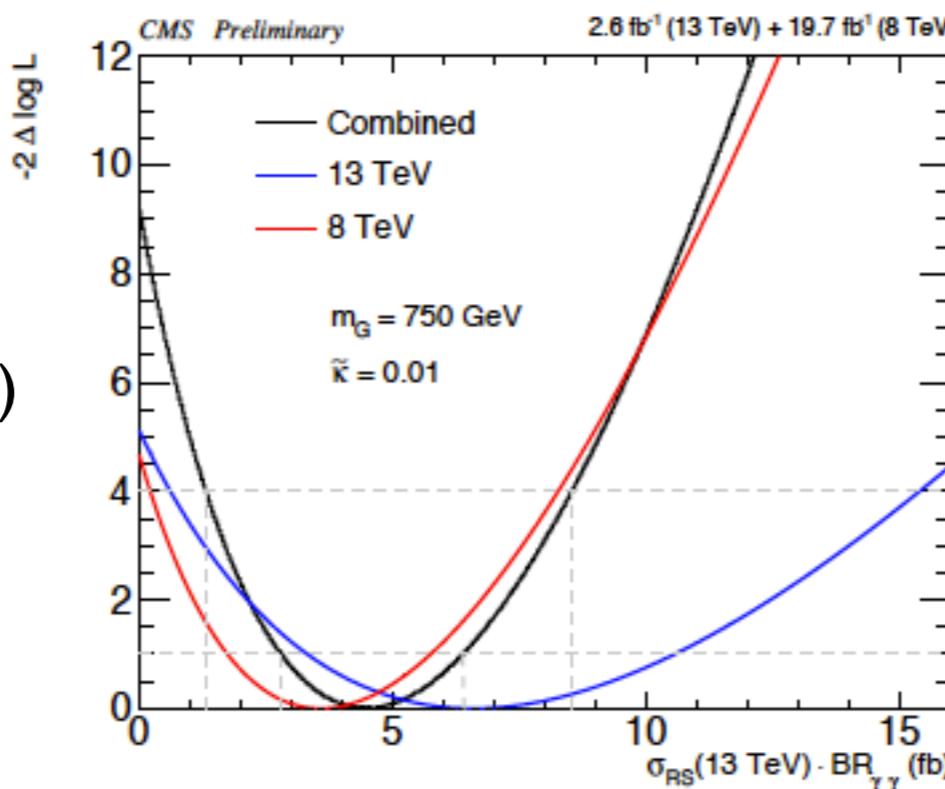


Figure 11: Likelihood scan for the cross section corresponding to the largest excess in the combined analysis of the 8 and 13 TeV datasets. The 8 TeV results are scaled by the expected ratio of cross sections predicted for an RS graviton resonance.

# Diphoton excess

## in phenomenological spin-2 resonance scenarios



Kentarou Mawatari



1601.05729 (21 Jan 2016) with A. Martini (UC Louvain) and D. Sengupta (LPSC)

$$\mathcal{L}_{\text{eff}} = -\frac{1}{\Lambda} [\kappa_\gamma T_{\mu\nu}^\gamma + \kappa_g T_{\mu\nu}^g + \kappa_q T_{\mu\nu}^q] X_2^{\mu\nu}$$

FeynRules HC model: <http://feynrules.irmp.ucl.ac.be/wiki/HiggsCharacterisation>  
MadGraph5\_aMC@NLO: <https://launchpad.net/mg5amcnlo>

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spin-2 particle  
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Diagram illustrating the components of the effective Lagrangian:

- $\kappa_\gamma T_{\mu\nu}^\gamma$ : energy-momentum tensor (green arrow)
- $\kappa_g T_{\mu\nu}^g$ : energy-momentum tensor (green arrow)
- $\kappa_q T_{\mu\nu}^q$ : energy-momentum tensor (green arrow)
- $X_2^{\mu\nu}$ : spin-2 particle (blue arrow)

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↑  
energy-momentum tensor  
↓  
spin-2 particle  
↓

theory scale parameter  
(=10TeV in this study)

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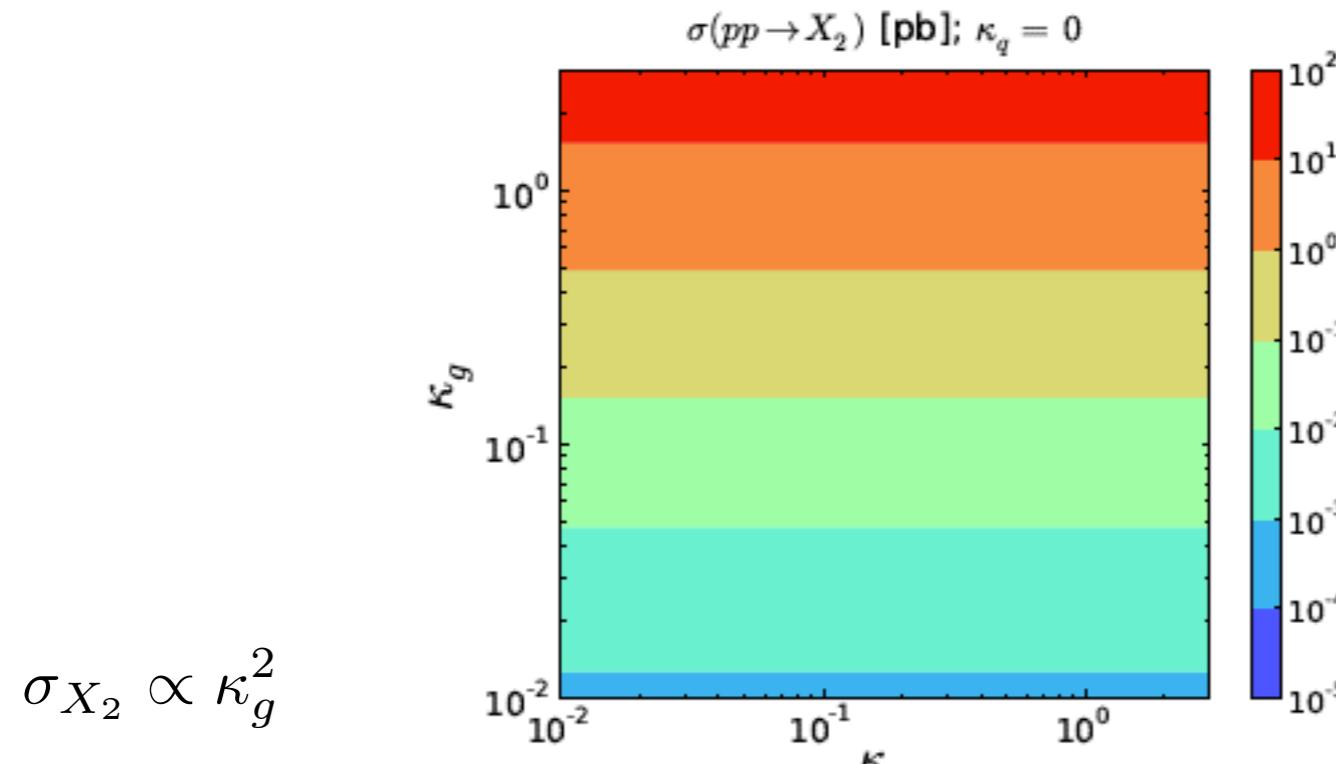
energy-momentum tensor  
non-universal coupling parameters

spin-2 particle

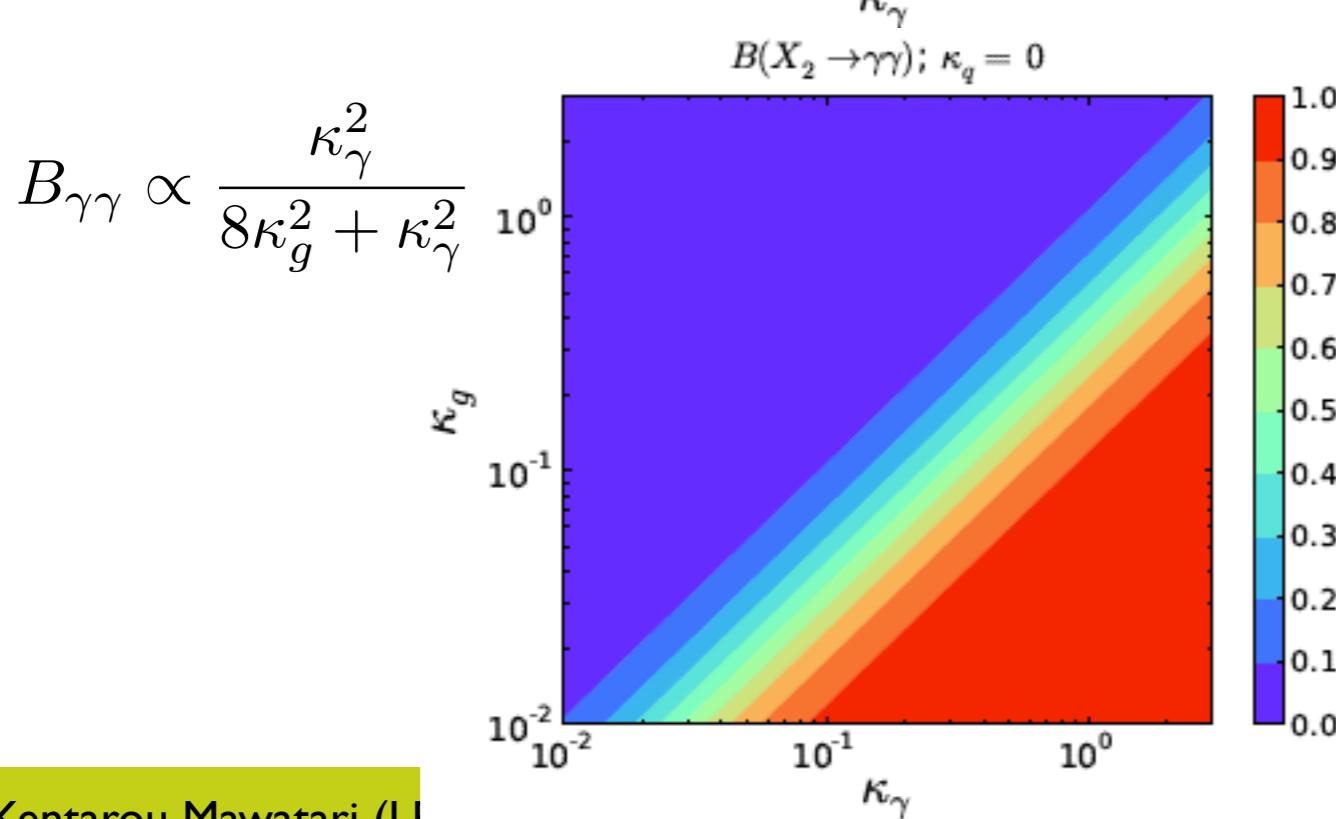
The diagram shows the effective Lagrangian  $\mathcal{L}_{\text{eff}}$  as a sum of three terms. Each term is a product of a non-universal coupling parameter ( $\kappa_\gamma$ ,  $\kappa_g$ , or  $\kappa_q$ ) and an energy-momentum tensor ( $T_{\mu\nu}^\gamma$ ,  $T_{\mu\nu}^g$ , or  $T_{\mu\nu}^q$ ). The tensors are labeled with arrows indicating they are energy-momentum tensors. The coupling parameters are circled in red. The entire expression is multiplied by a theory scale parameter  $\Lambda$ , which is circled in pink. An arrow points from the text 'theory scale parameter' to the circled  $\Lambda$ . Another arrow points from the text 'energy-momentum tensor' to the first term. A third arrow points from the text 'non-universal coupling parameters' to the second term. A final arrow points from the text 'spin-2 particle' to the third term.

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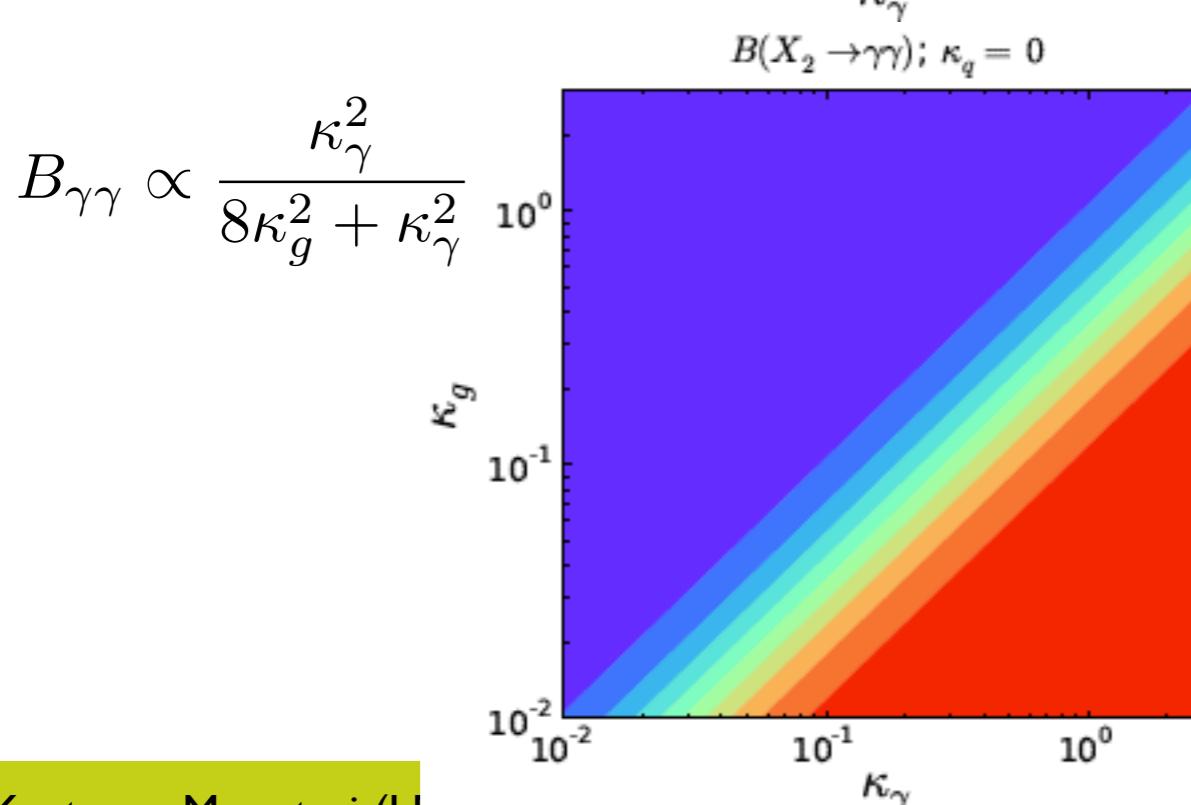
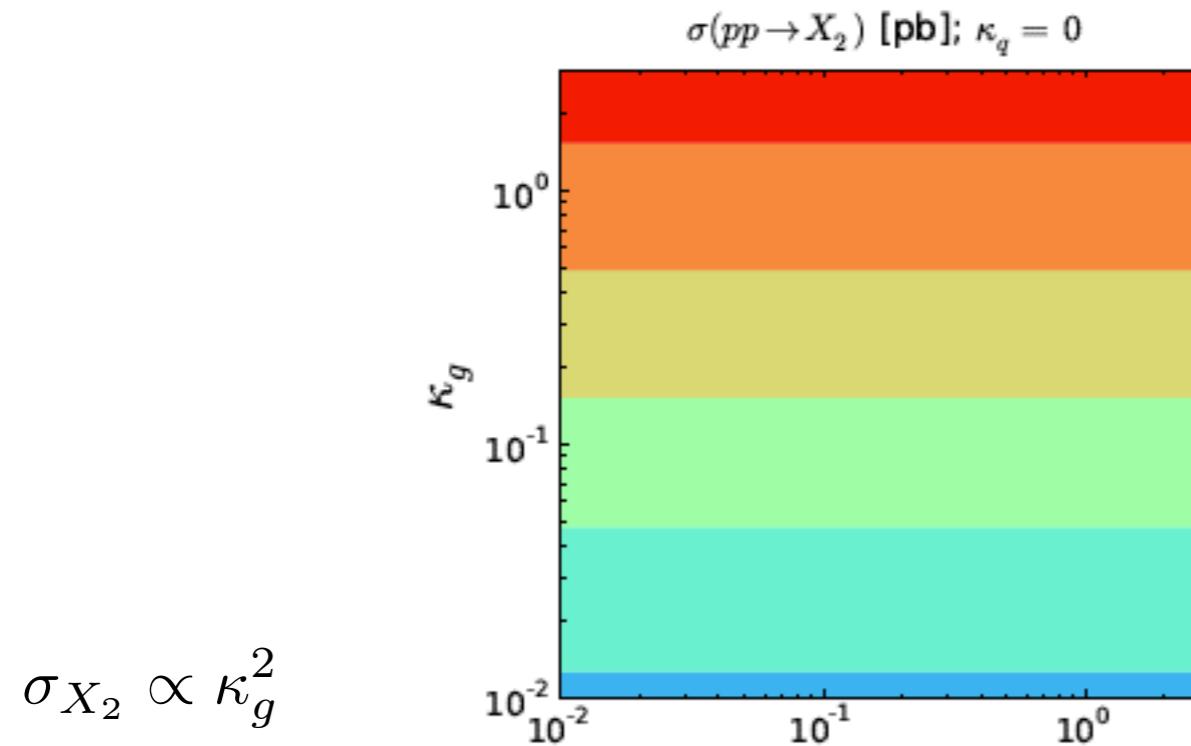
# diphoton excess vs. dijet constraint (I)



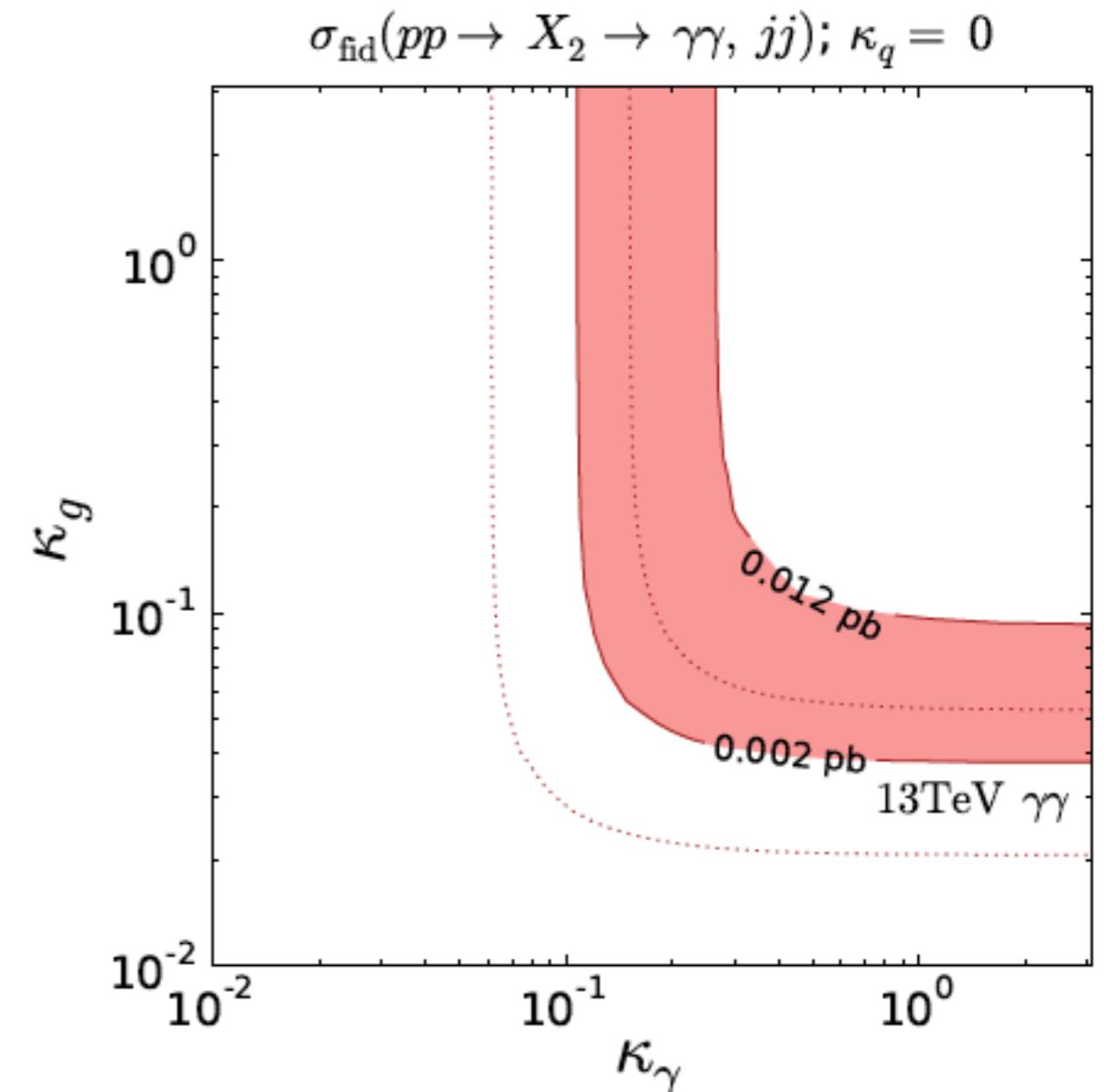
I:  $\kappa_g \neq 0, \kappa_q = 0$  (gluon dominant scenario)



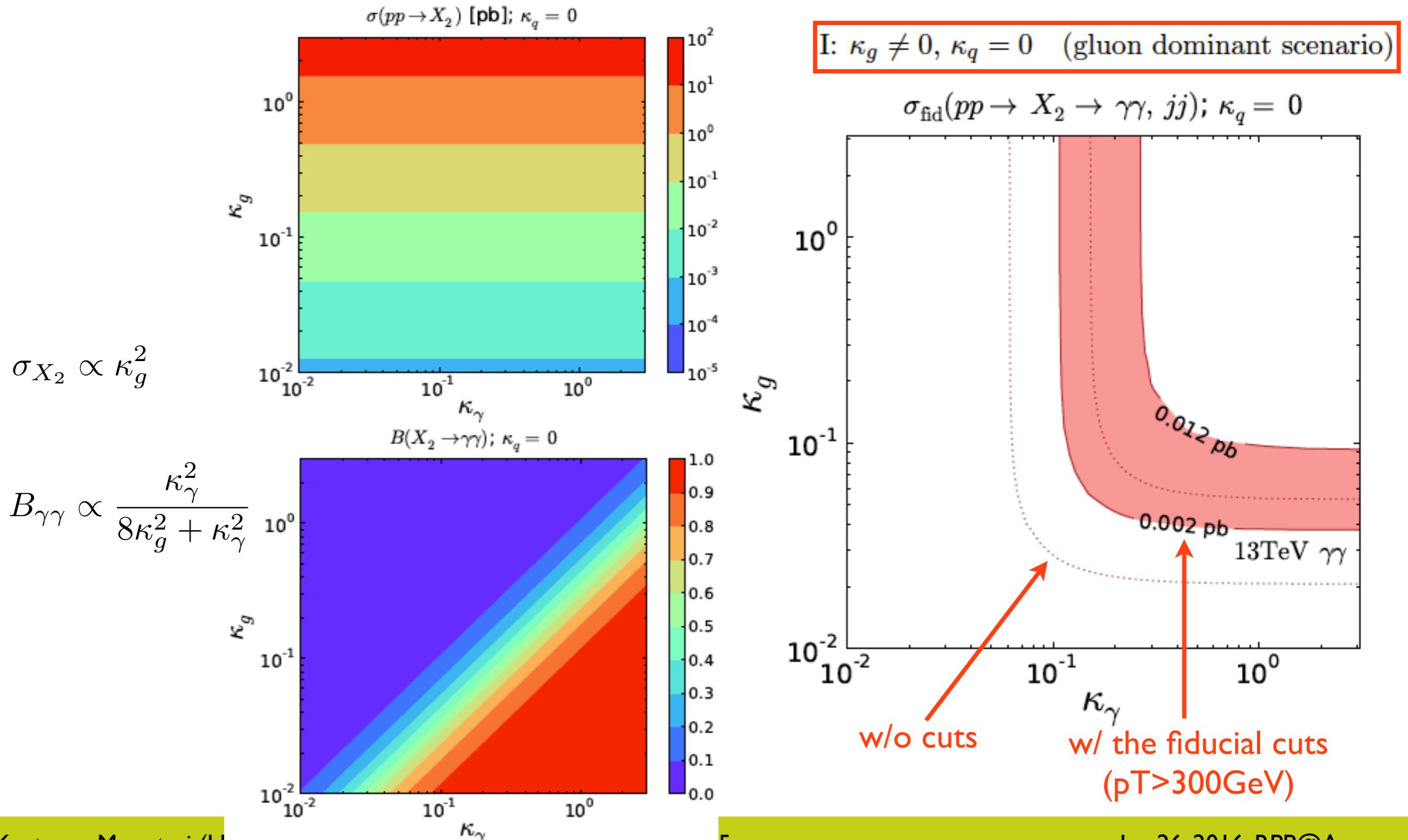
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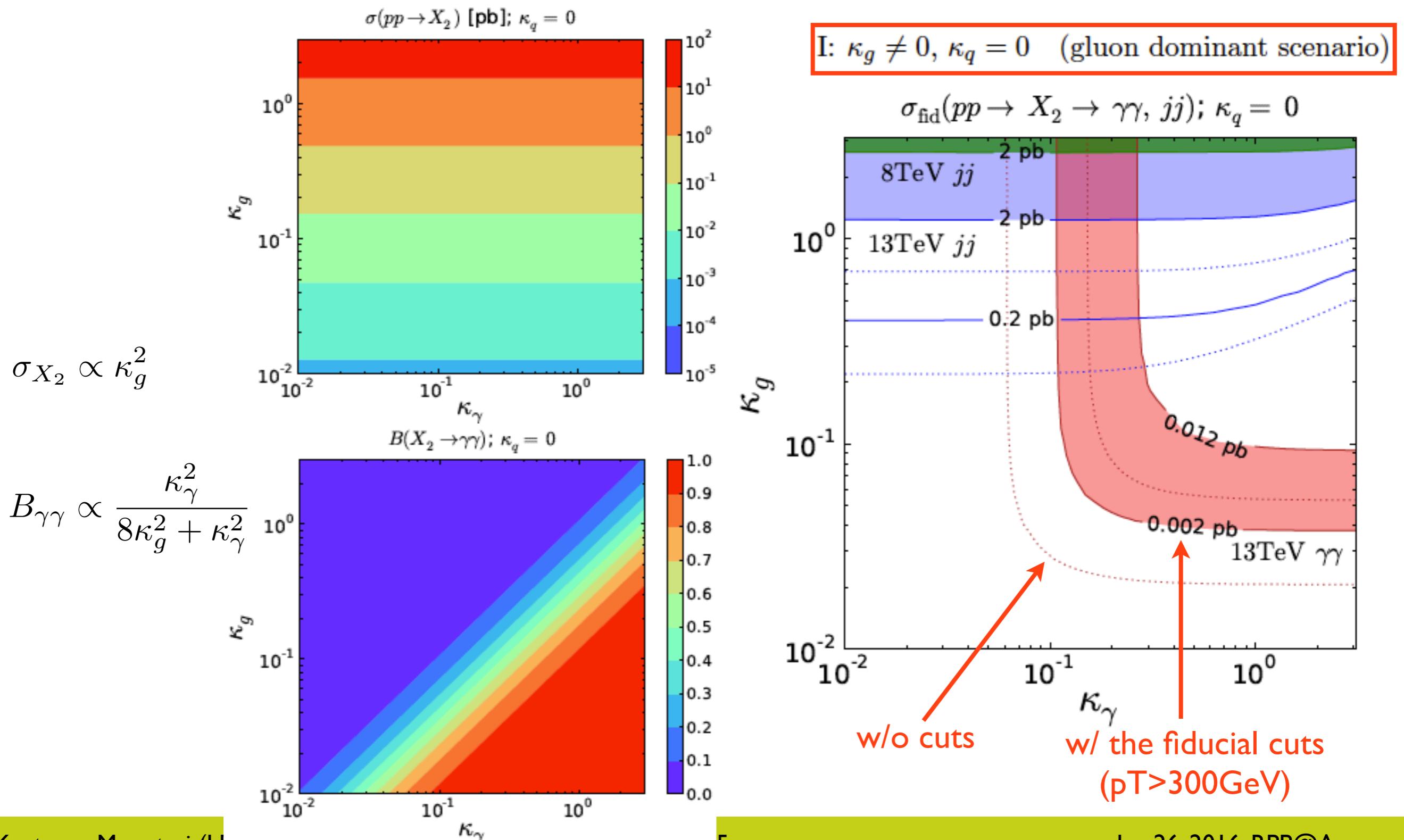
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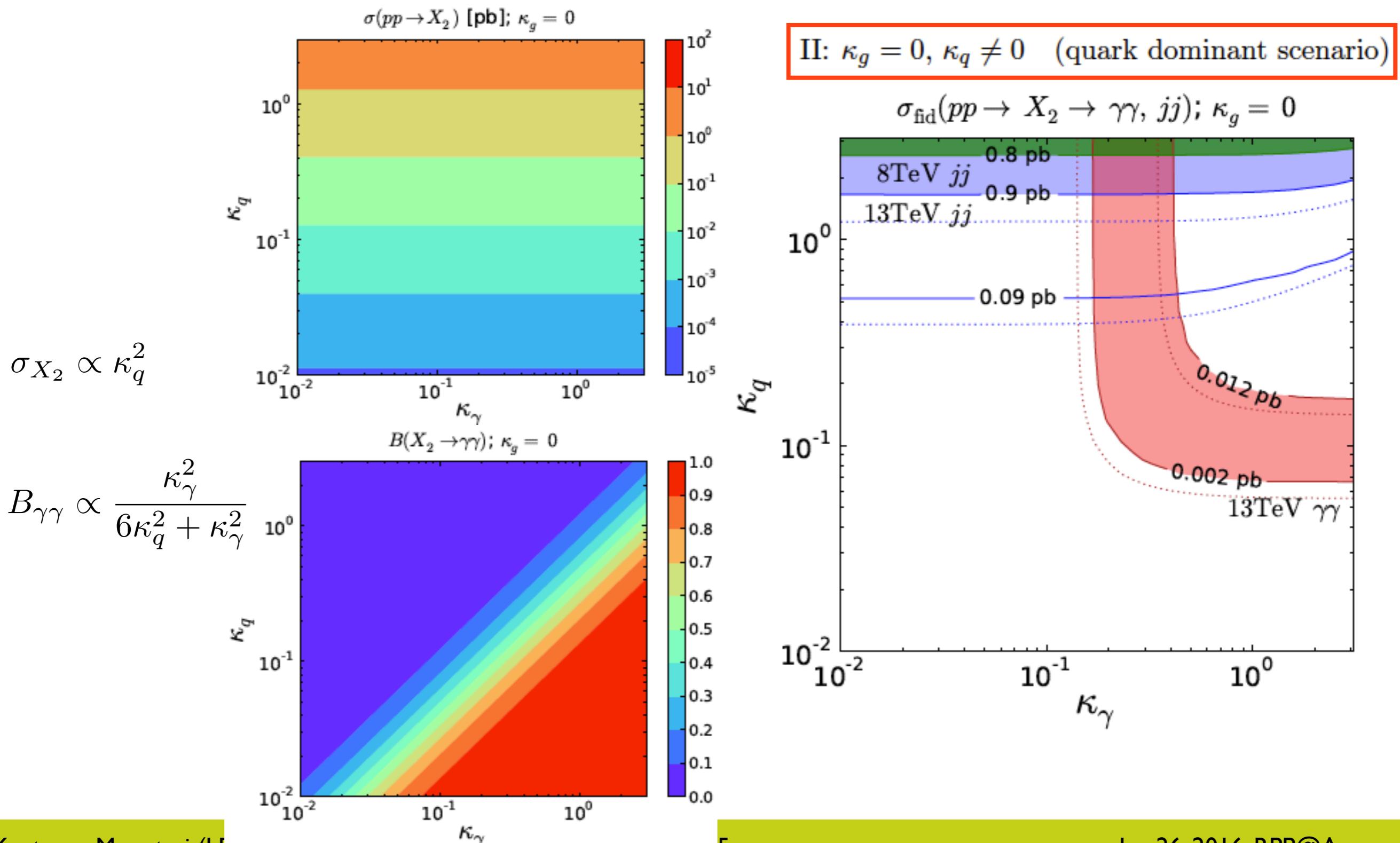
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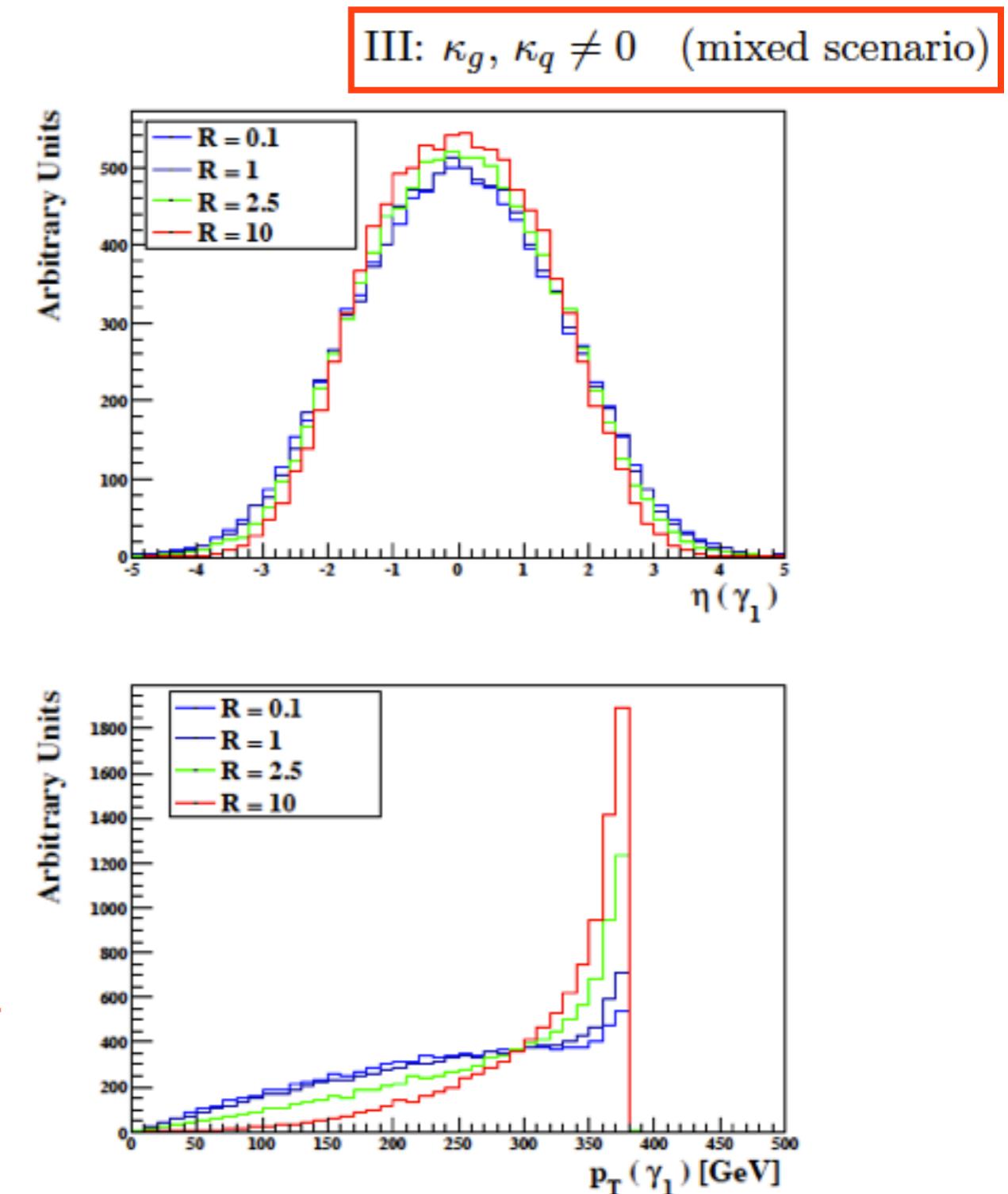
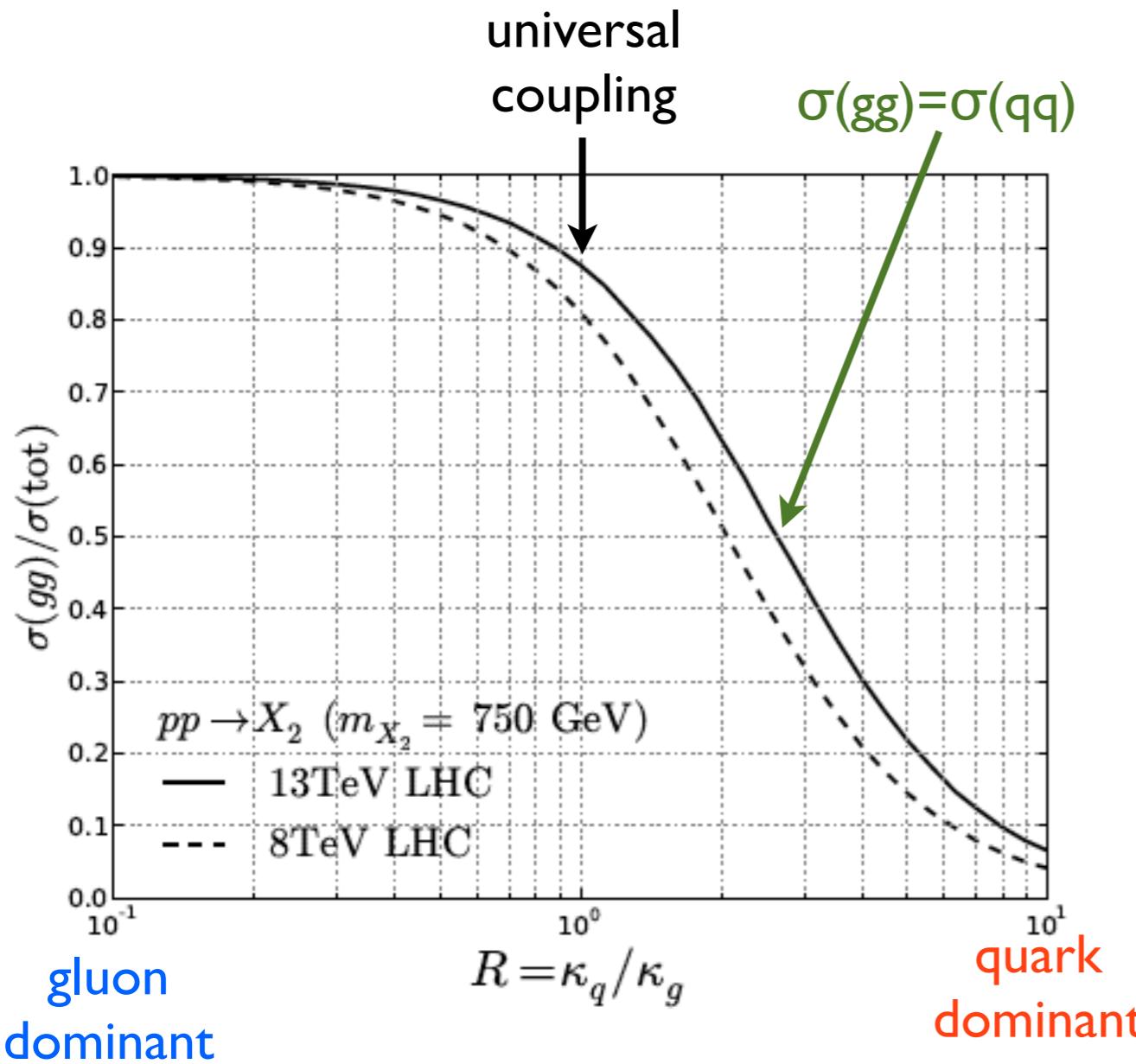
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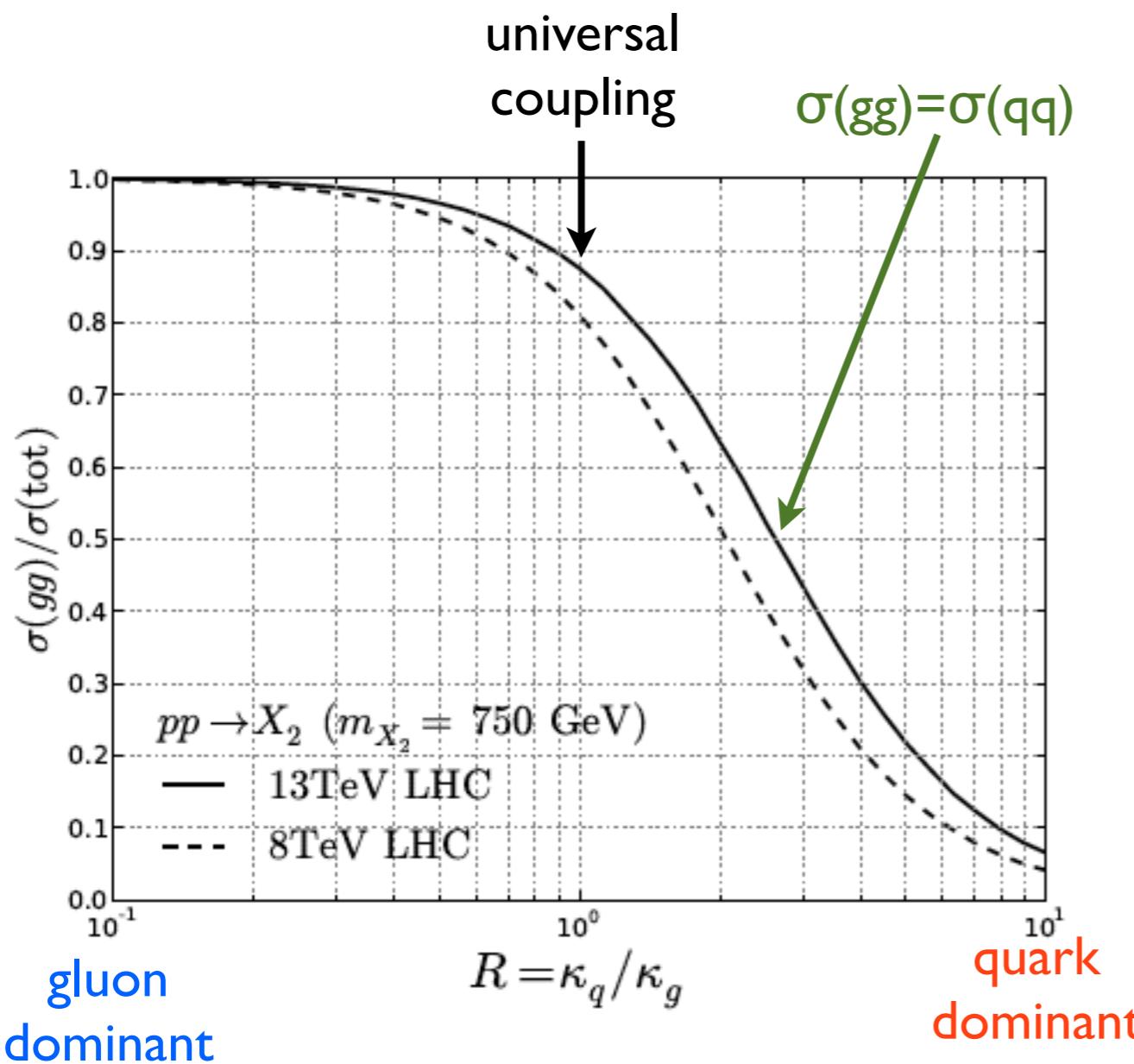
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# gg vs. qq in diphoton events



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