Hyperbolic Extra Dimensions at the Large Hadron Collider

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Outline

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- Motivation and description of the model
- Possible signals at the LHC
- Conclusions

The paper

- Based on arXiv:0806.1841 [hep-ph]
- In collaboration with Tommy Ohlsson

The hierarchy problem

- The electroweak scale $M_{\mathrm{ew}} \sim 100 \ \mathrm{GeV}$
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- Alternative solution: Large extra dimensions

Extra dimensions — the ADD model

- The ADD model:
  - Arkani-Hamed, Dimopolous, and Dvali (1998)
  - d extra spatial dimensions
  - Compactified on a torus (a flat space)
  - SM fields confined to a 4-dimensional brane
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- The extra dimensions can be large, $\sim 10~\mu\mathrm{m}$, i.e.,
  Large extra dimensions

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- However, if $M_* = 1 \ \mathrm{TeV}$, then $L \sim 10^{31/d} \ \mathrm{TeV}^{-1} \gg M_*^{-1}$
- New hierarchy between M_* and L^{-1}

Hyperbolic extra dimensions

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- Our model: two extra dimensions with the geometry of a hyperbolic disc

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- The main SM background, from $p + p \to \mathrm{jet}/\gamma + Z(\to \nu\bar{\nu})$, has been simulated in PYTHIA
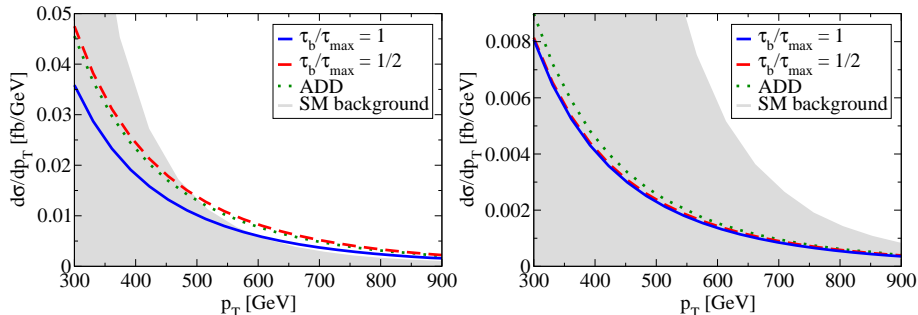
Cross sections — hadronic jet production
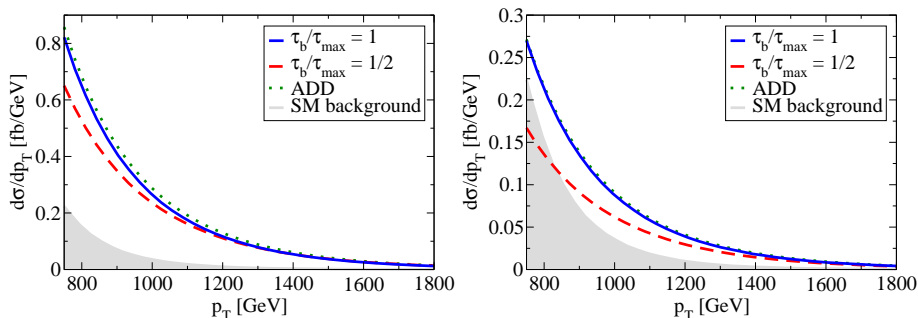
Figure: The differential cross section for graviton plus jet production with respect to p_T. Left panel: $M_* = 1.5$ TeV. Right panel: $M_* = 2$ TeV.
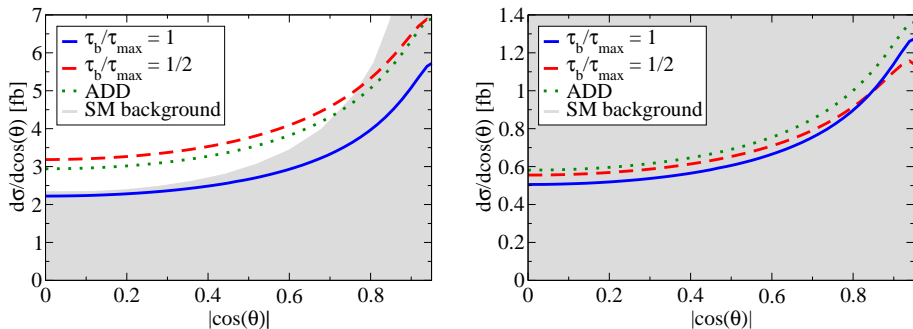
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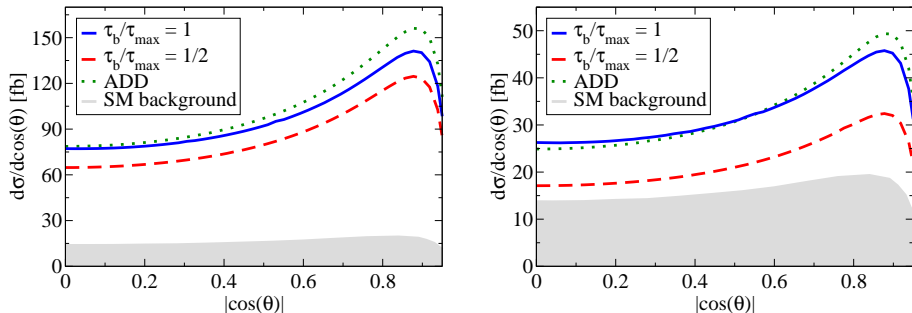
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Cross sections — photon production

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