DOE Site Visit

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Outline

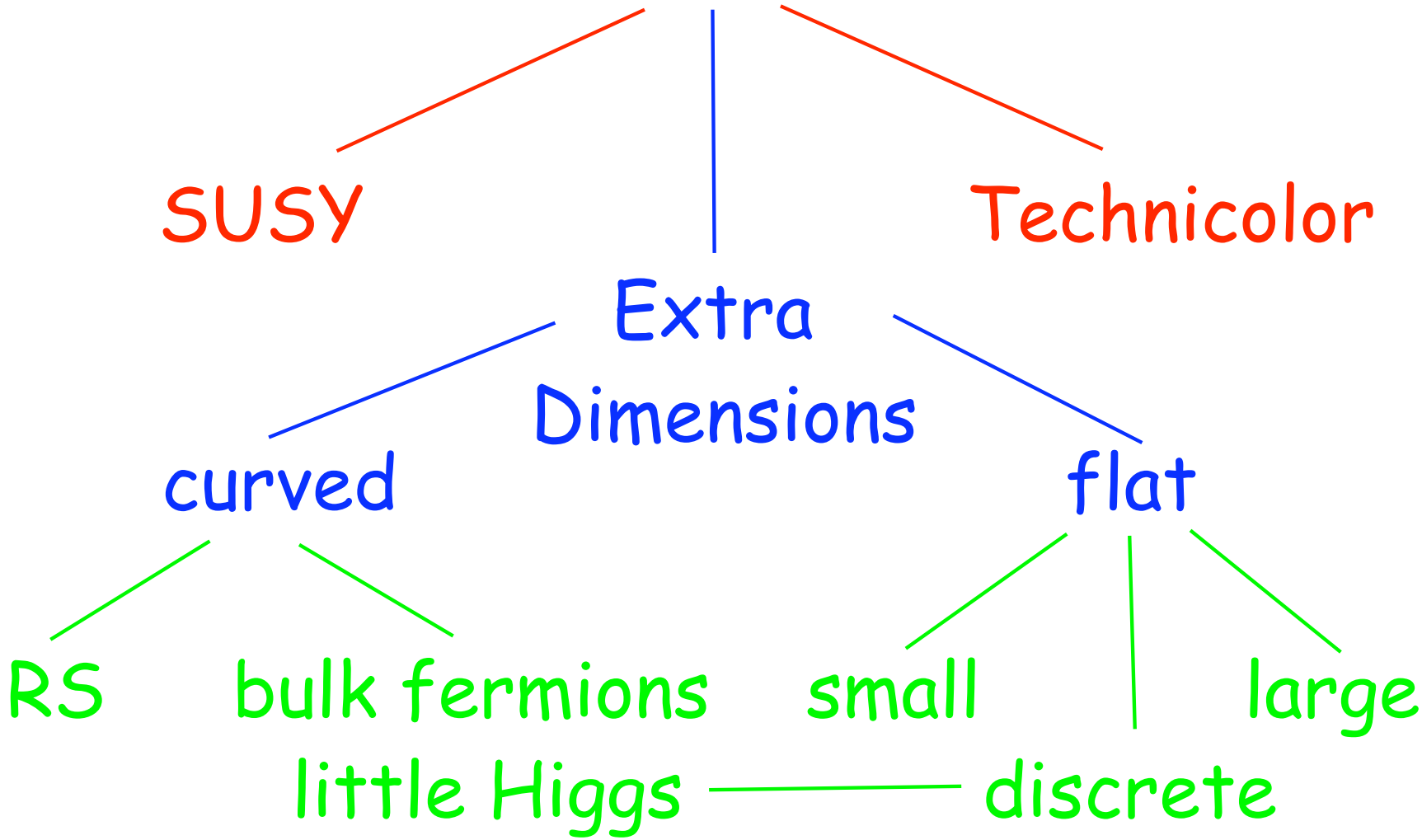
- Higgsless Models
- Multithroat Backgrounds
- Acclerated Cosmic Expansion

Particle Data Group

W. M. Yao *et al.* [Particle Data Group], J. Phys. G **33**, 1 (2006).

Hierarchy Problem

Hierarchy Problem



EWSB by Boundary Conditions

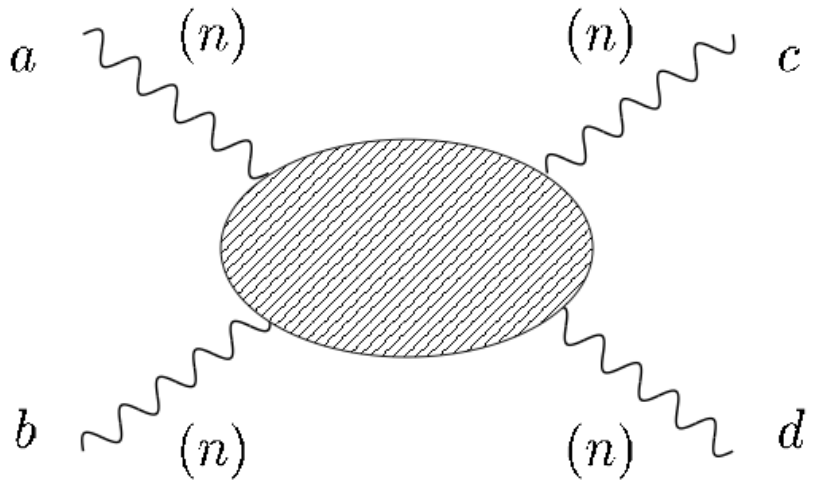
- is WW scattering unitary?
- why is $M_W = \cos\theta_W M_Z$?
- how do we pass precision tests?

Csáki, Cacciapaglia, Marandella, JT with

Grojean, Hubisz, Murayama, Pilo, Reece, Shirman

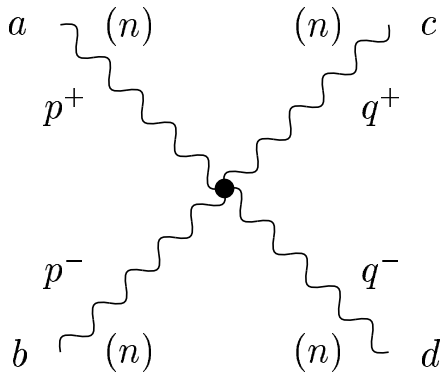
hep-ph/0305237, hep-ph/0308038, hep-ph/0310355,
hep-ph/0401160, hep-ph/0409126,
hep-ph/0505001,hep-ph/0607146

Scatttering Amplitude

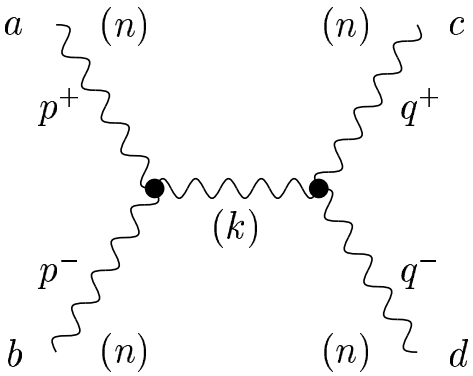


$$\mathcal{A} = A^{(4)} \frac{E^4}{M_n^4} + A^{(2)} \frac{E^2}{M_n^2} + A^{(0)} + \ldots$$

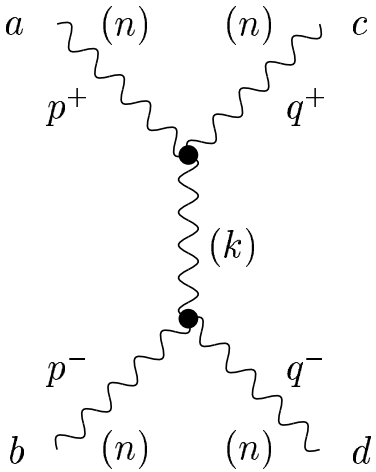
WW Scattering via KK bosons



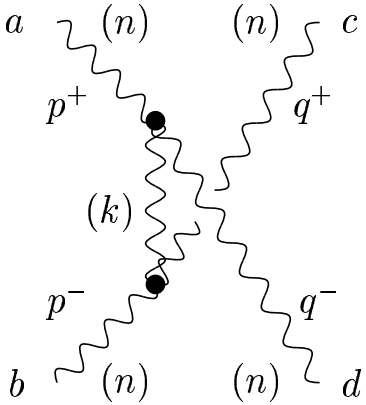
contact interaction



s channel exchange



t channel exchange



u channel exchange

Cancellation

E^4 term: $g^2_{nnnn} - \sum_k g^2_{nnk}$

$$\int_0^L dy\, f_n^4(y) = \sum_k \int_0^L dy \int_0^{\pi R} dz\ f_n^2(y) f_n^2(z) f_k(y) f_k(z)$$

completeness of hermitian operator:

$$\sum_k f_k(y) f_k(z) = \delta(y - z)$$

E^2 term: $4 g^2_{nnnn} M_n^2 - 3 \sum_k g^2_{nnk} M_k^2$

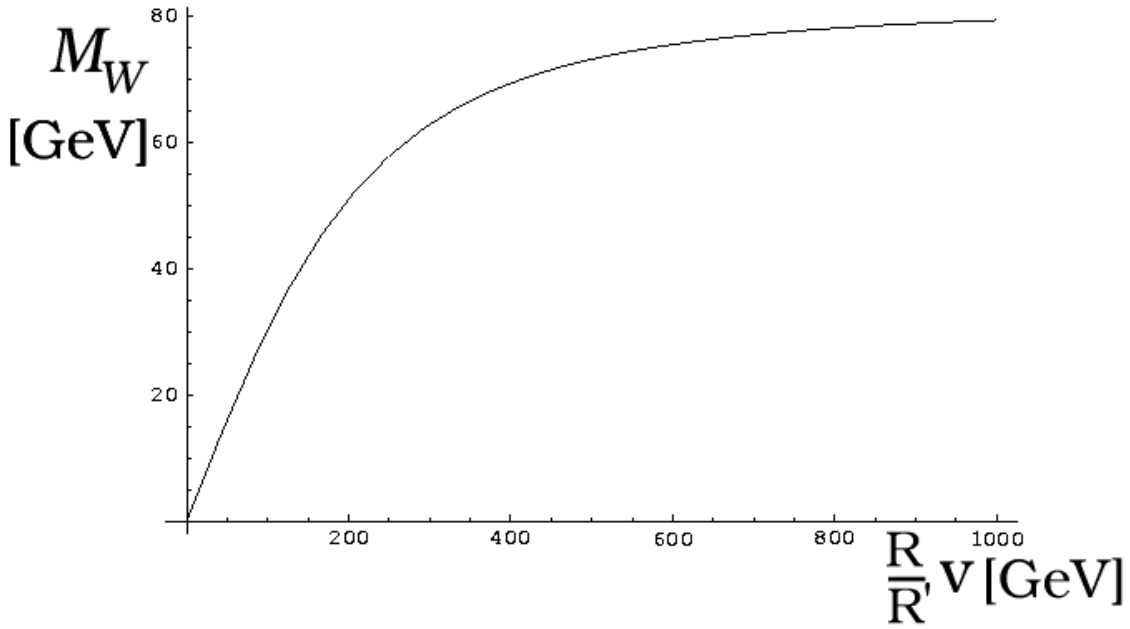
$$\begin{aligned} \sum_k M_k^2 \left(\int dy f_n^2(y) f_k(y)\right)^2 \quad = \quad & \tfrac{4}{3} M_n^2 \int dy f_n^4(y) - \tfrac{2}{3}[f_n^3 f_n'] \\ & + 2 \sum_k [f_n f_n' f_k] \int dy f_n^2(y) f_k(y) \\ & - \sum_k [f_n^2 f_k'] \int dy f_n^2(y) f_k(y) \end{aligned}$$

for Dirichlet or Neumann BC's the E^2 terms cancel

Finite VEV

at $z = R' : \quad \partial_z \psi = -\frac{g_5^2 v^2}{2} \psi$

for small v: $M_W^2 = \frac{g^2 v^2}{4} \frac{R^2}{R'^2}$

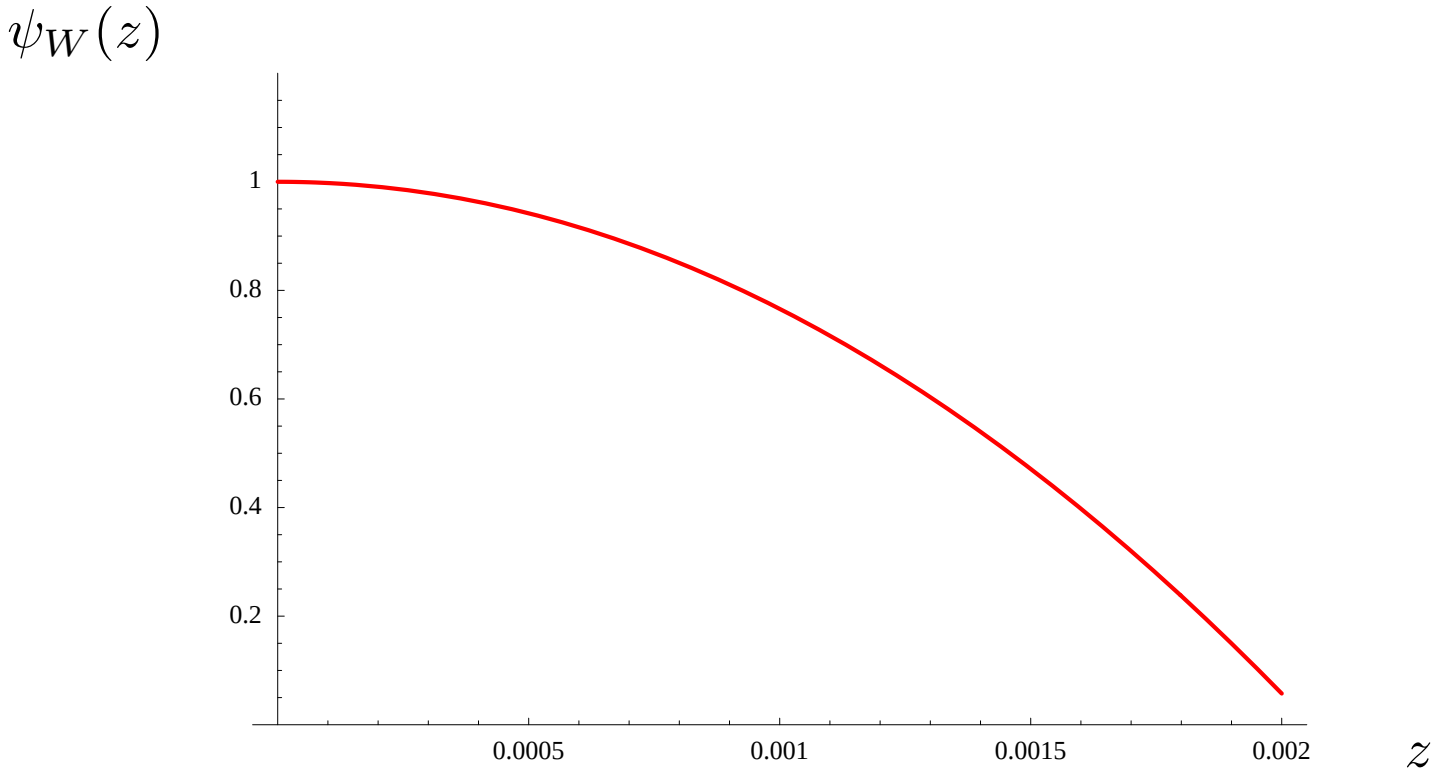


for $R' = 2 \cdot 10^{-3}$ GeV^{-1}, $R = 10^{-19}$ GeV^{-1}

Lattice: Bhattacharya, Csaki, Martin, Shirman JT hep-lat/0503011

Decoupling the Higgs

for $v = 1$ TeV



Higgs decouples from scattering as $v \to \infty$

Towards a Realistic Model

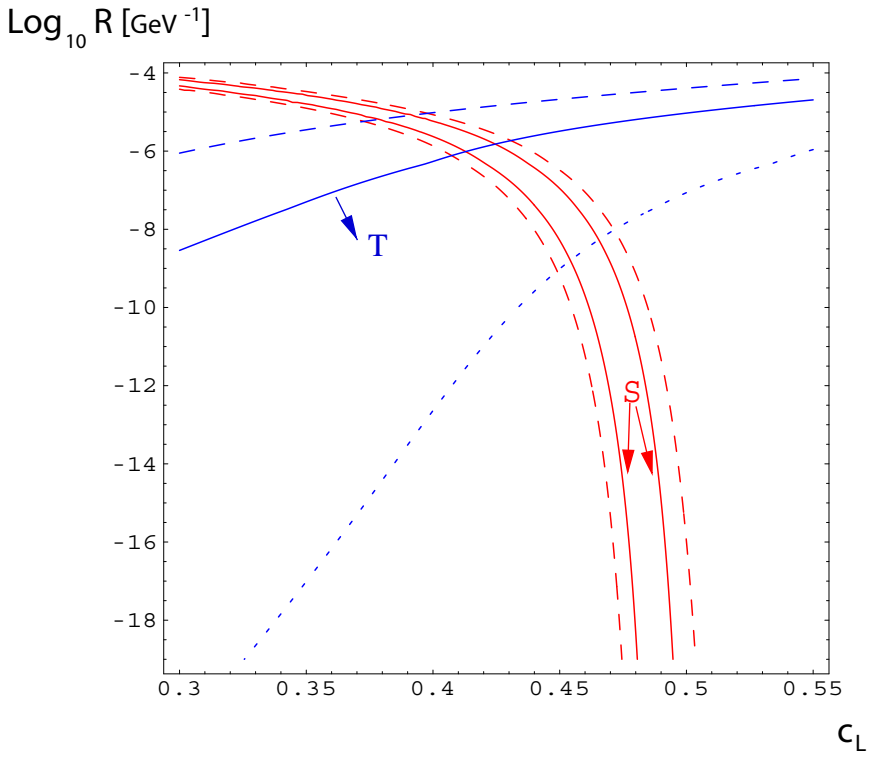
$$ds^2 = \left(\frac{R}{z}\right)^2 \left(\eta_{\mu\nu} dx^\mu dx^\nu - dz^2\right)$$

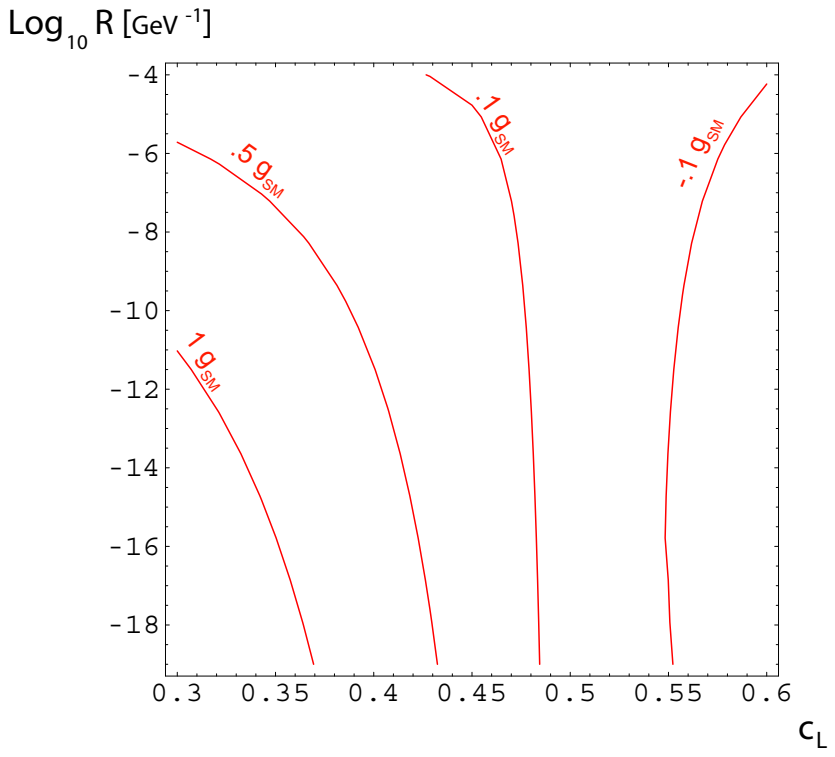
gauge symmetry $SU(2)_L \times SU(2)_R \times U(1)$

AdS/CFT correspondence

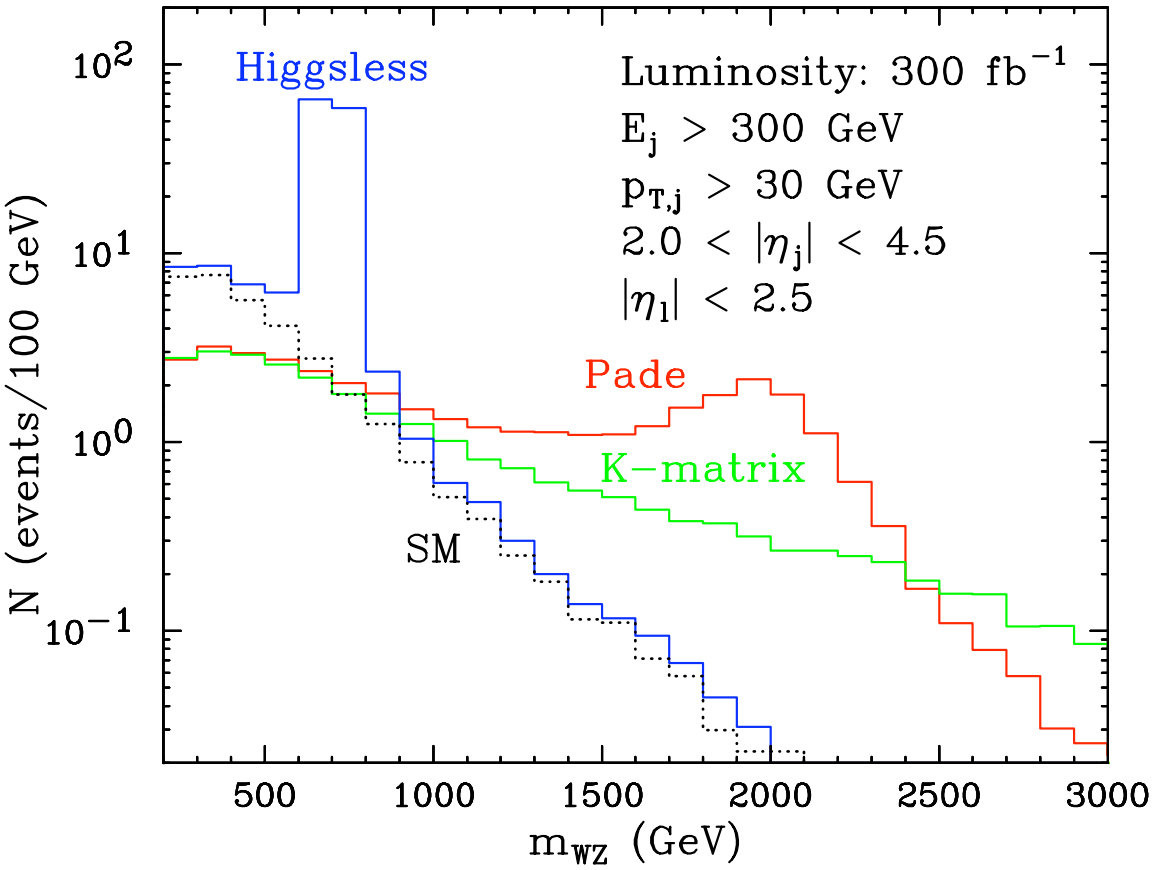
guarantees a custodial symmetry that protects T

Precision Constraints



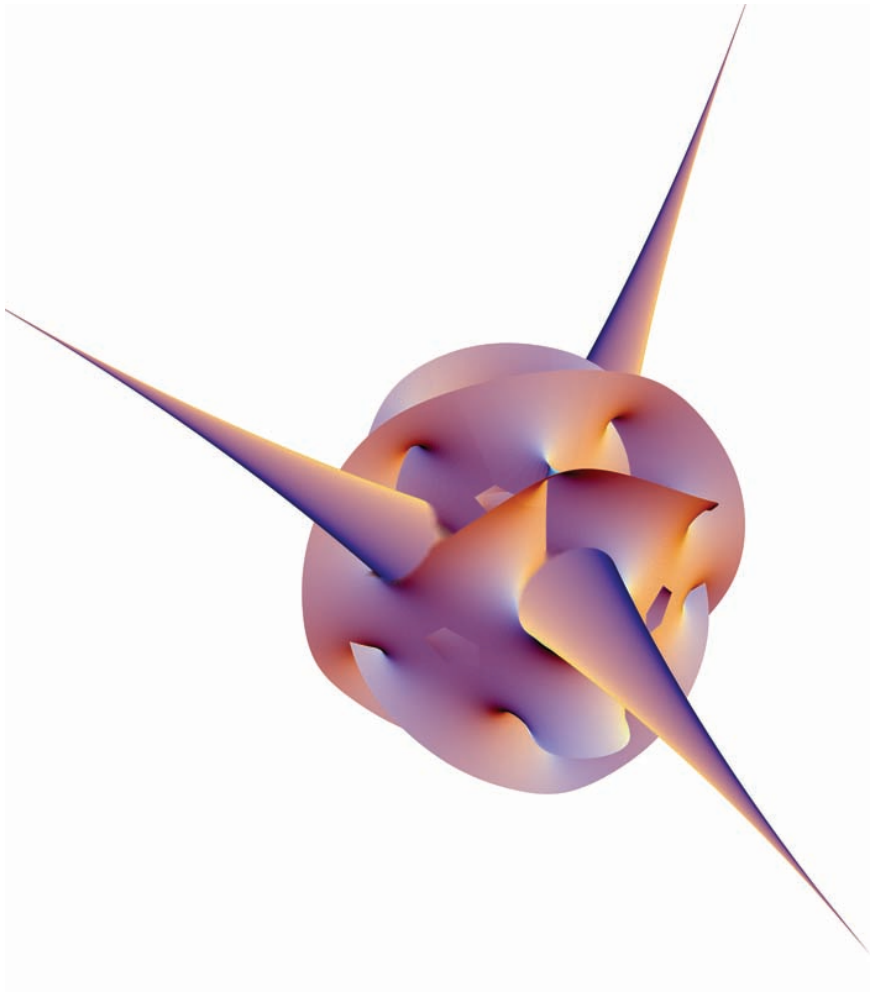


LHC Signal



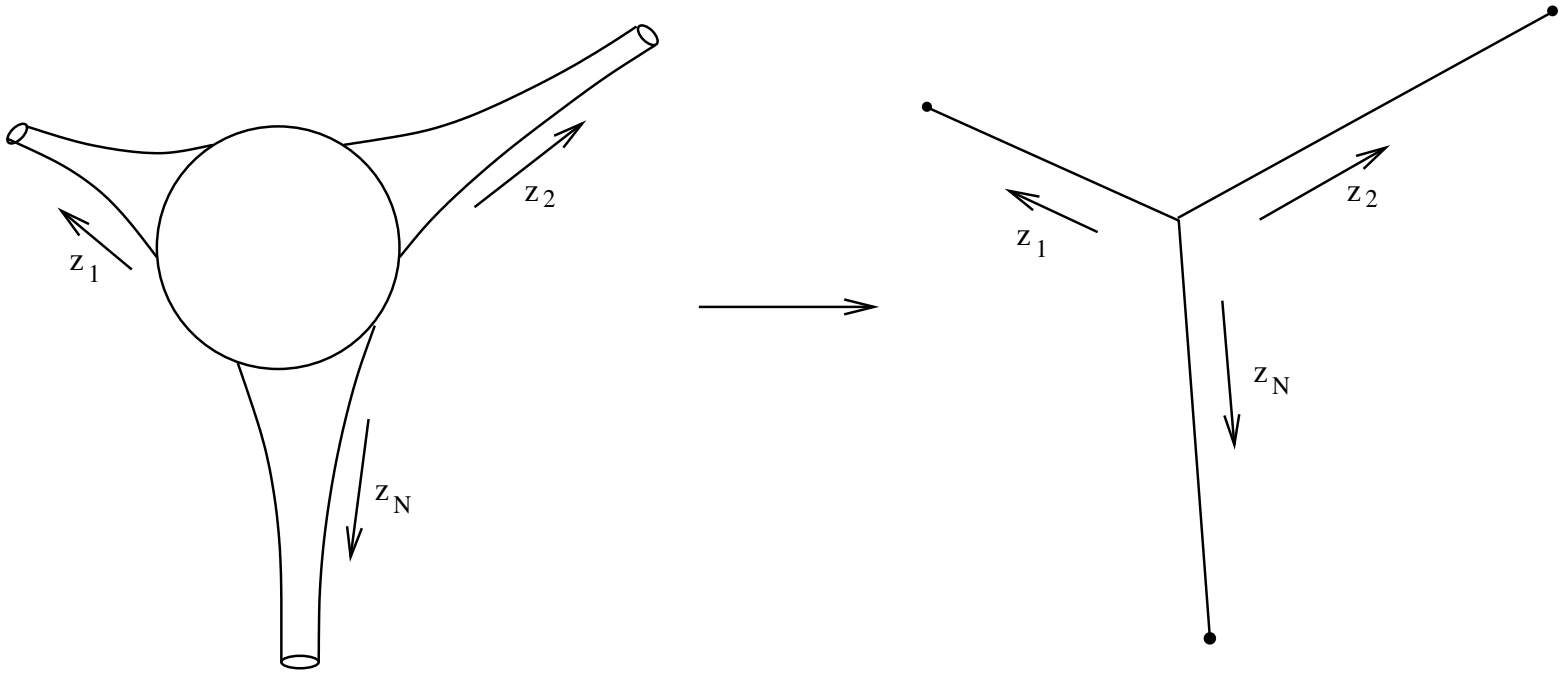
Birkedal, Matchev, Perelstein, hep-ph/0308038

Multithroat Backgrounds

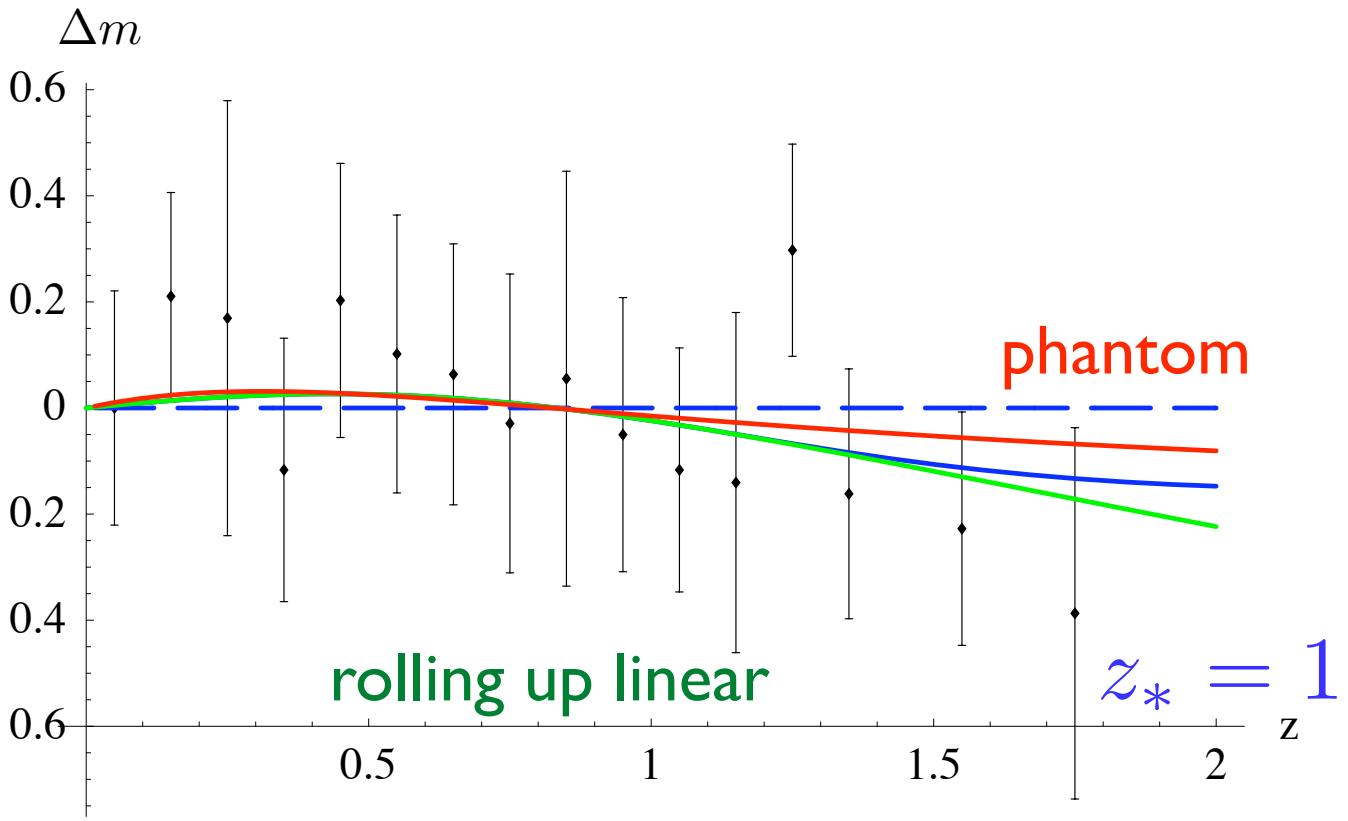


Cacciapaglia, Csáki, Grojean, JT hep-ph/0604218

Multithroat Backgrounds

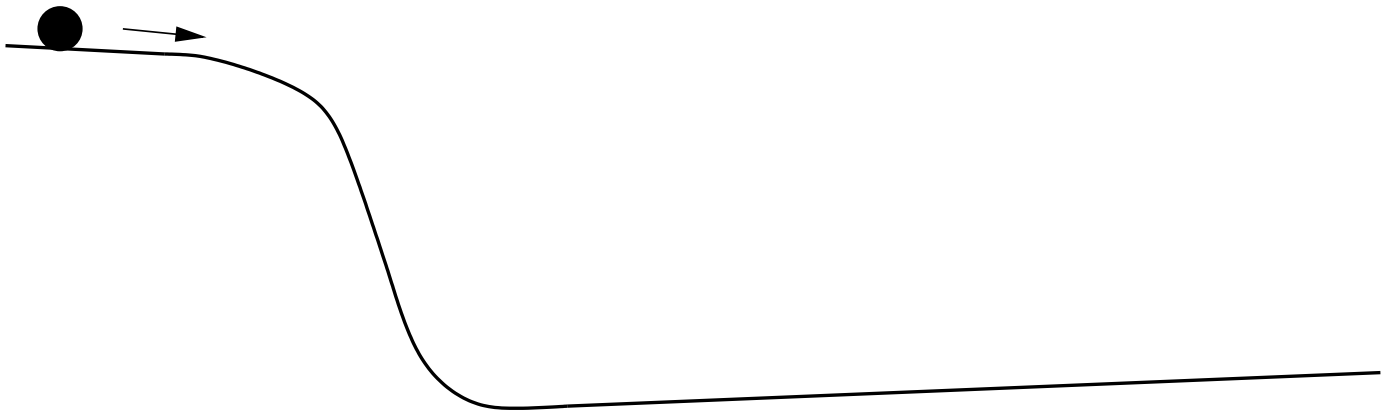


Accelerated Acceleration



Csáki, Kaloper, JT astro-ph/0507148

Quintessence



Conclusion

- Cosmological data and the promise of the LHC data has sparked many new theoretical ideas