Lepton mass and flavour violation in Randall Sundrum Models

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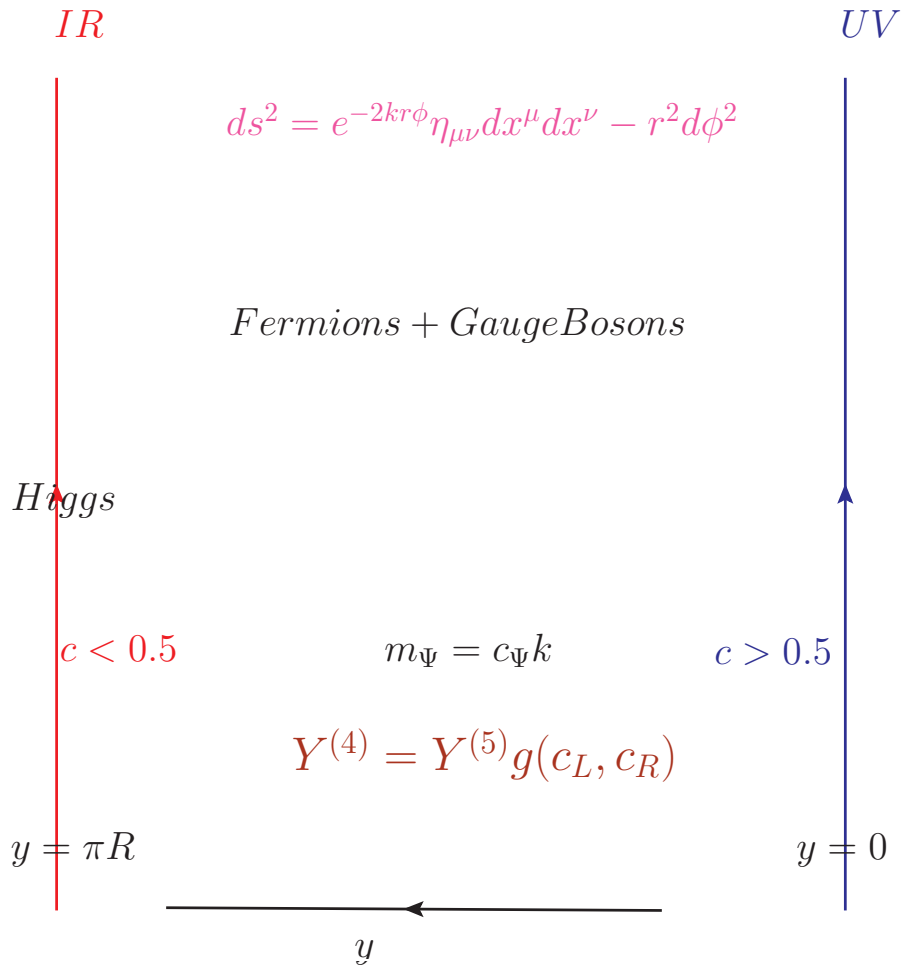
RS in 45 seconds

One extradimension compactified on S_1/Z_2 Randall, Sundrum '99



χ^2 analysis

- Fit the bulk RS parameters to the leptonic masses and mixing angles
- Results presented for normal hierarchy of neutrino masses.
- Perform the analysis for different models of neutrino masses
  a) LHLH case
  b)Dirac Case
  c) Bulk 'Majorana' mass terms

- Preferably c should be $\mathcal{O}(1)$ and $Y^{(5)} \in [0.08, 1]$

LHLH Case

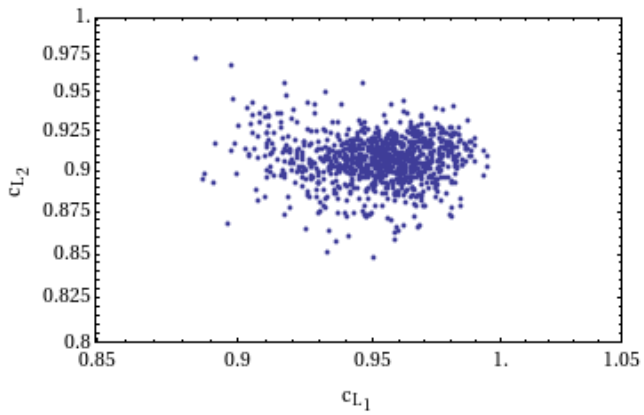
No Right Handed neutrinos

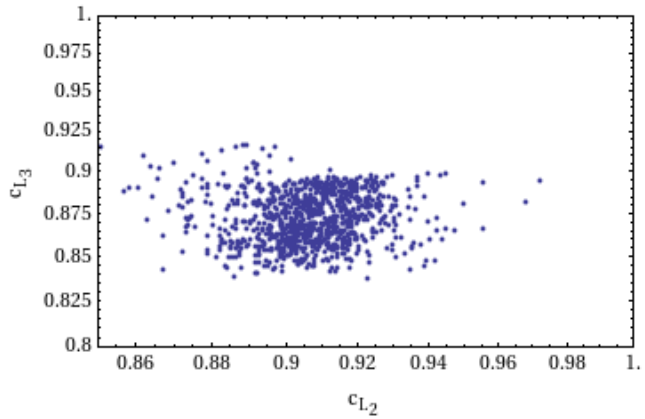
9+6+6=21 parameters

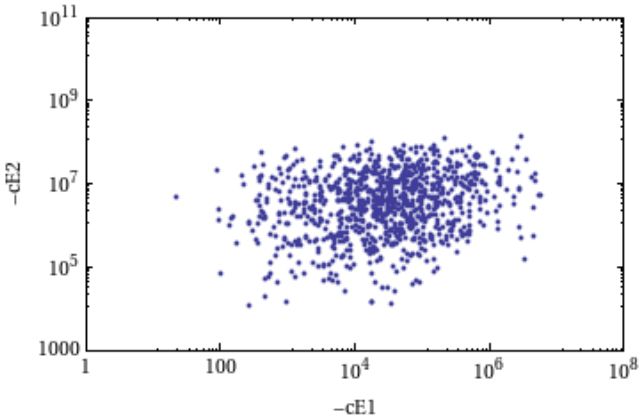
$$(\mathcal{M}_e^{(0,0)})_{ij} = \frac{v}{\sqrt{2}}(Y'_E)_{ij} e^{(1-c_L-c_E)kR\pi} N^{(0)}(c_{L_i}) N^{(0)}(c_{E_j})$$

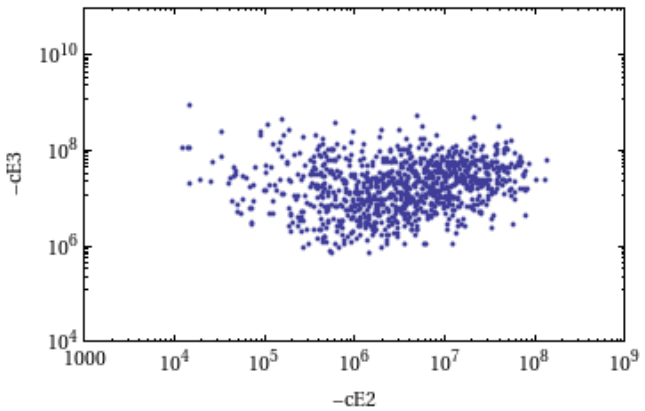
$$(\mathcal{M}_\nu^{(0,0)})_{ij} = \frac{v^2}{2\Lambda^{(5)}}(\kappa')_{ij} e^{(2-c_{L_i}-c_{L_j})kR\pi} N^{(0)}(c_{L_i}) N^{(0)}(c_{L_j})$$

Parameter space for bulk masses in LHLH case









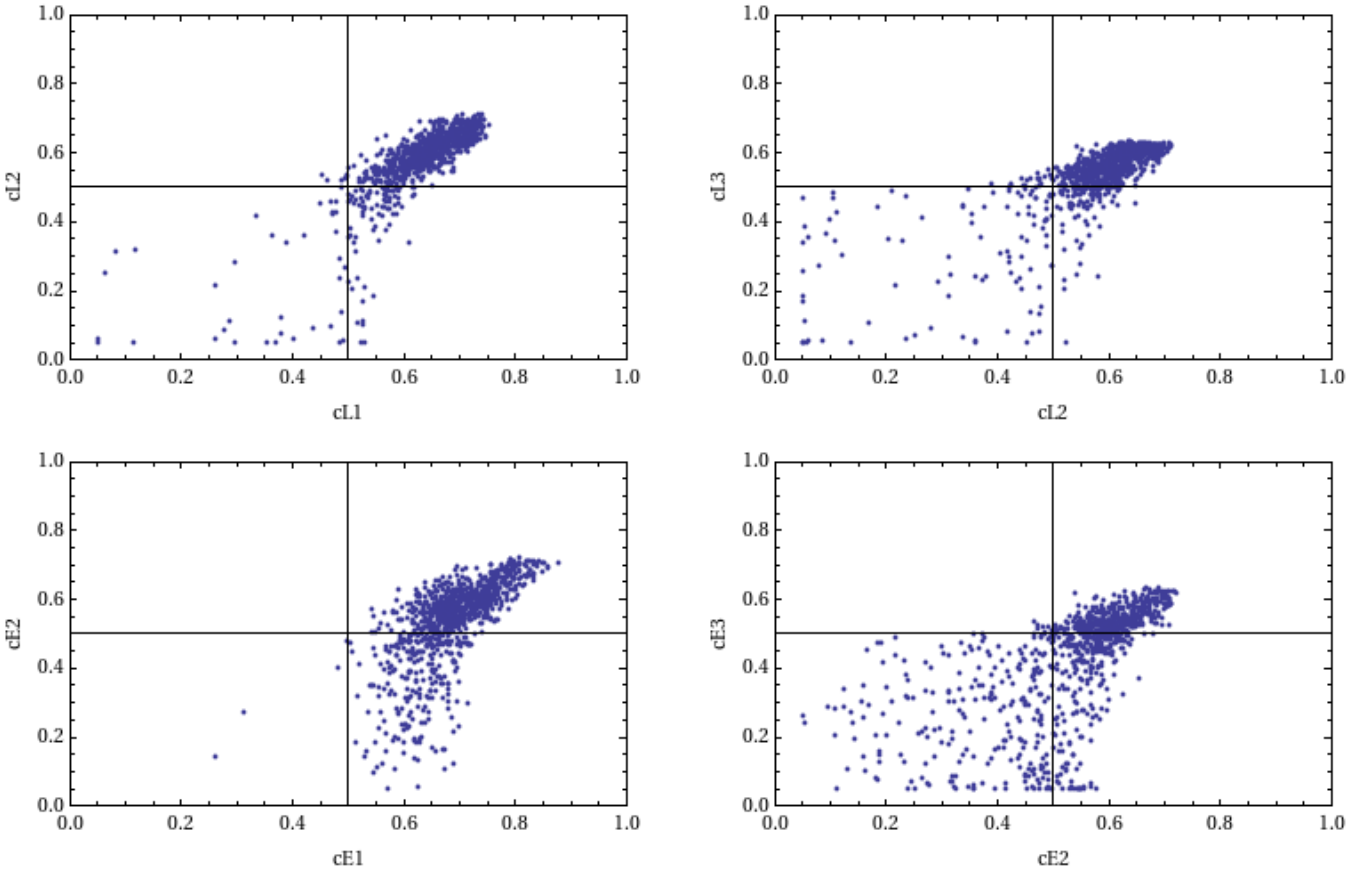
Dirac Neutrinos

Add three right Handed neutrinos

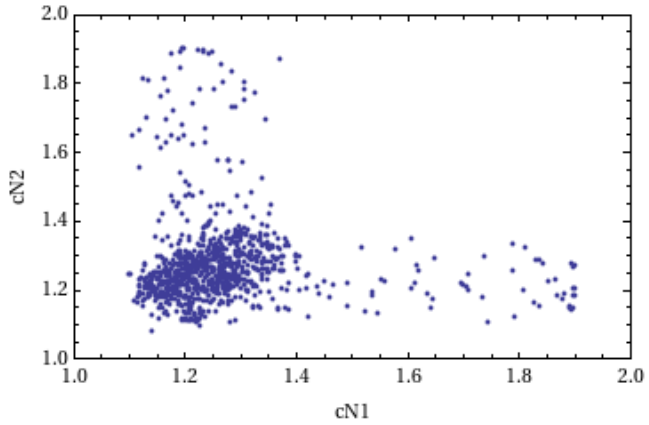
9+9+9=27 parameters

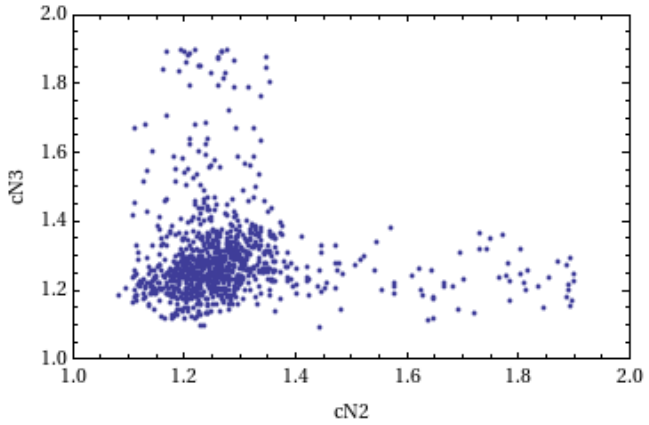
$$Y^{(4)}_{ij} = \frac{Y^{'(5)}_{ij}}{N_{0L}N_{0R}} e^{(1-c_{iL}-c_{iR})}$$

Parameter space for the bulk masses of doublets and charged singlets.



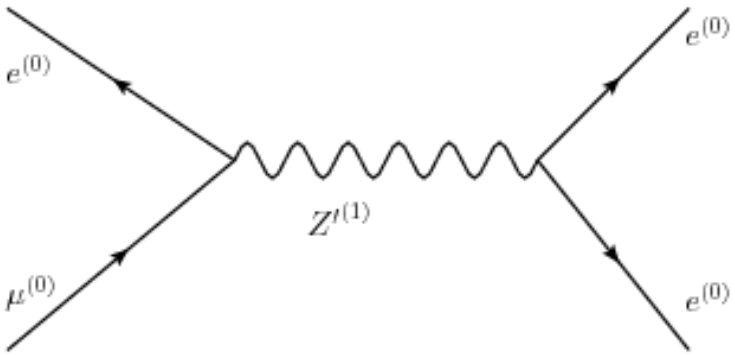
Parameter space for the bulk masses of neutral singlets.

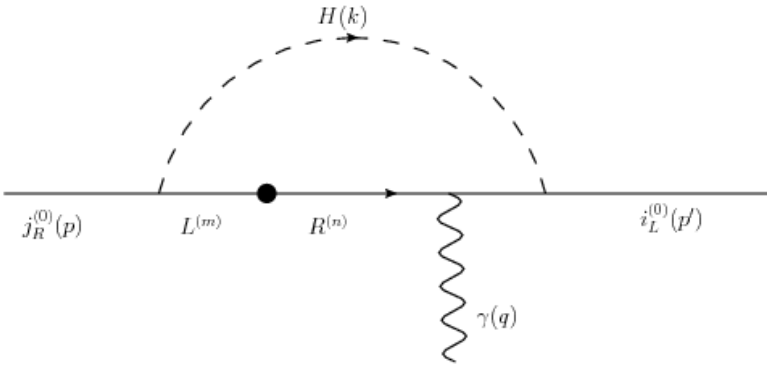




Flavour

$l_i \to l_j l_k l_k$ and $l_i \to l_j \gamma$





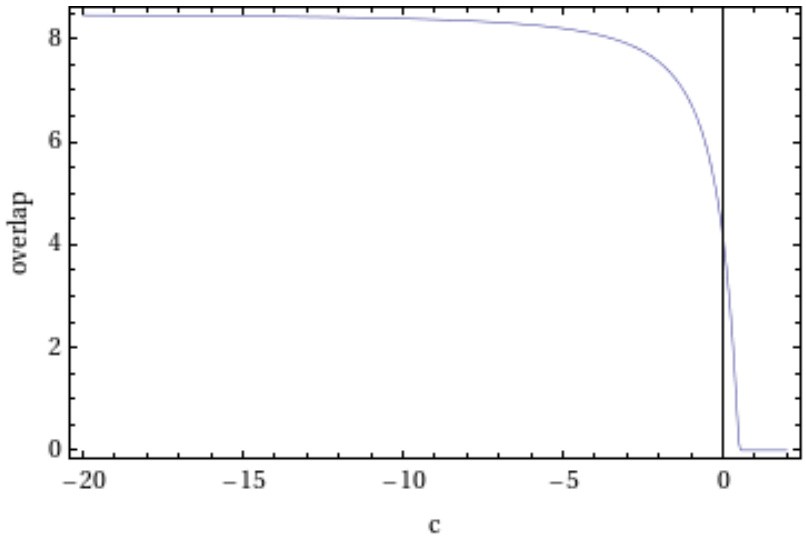


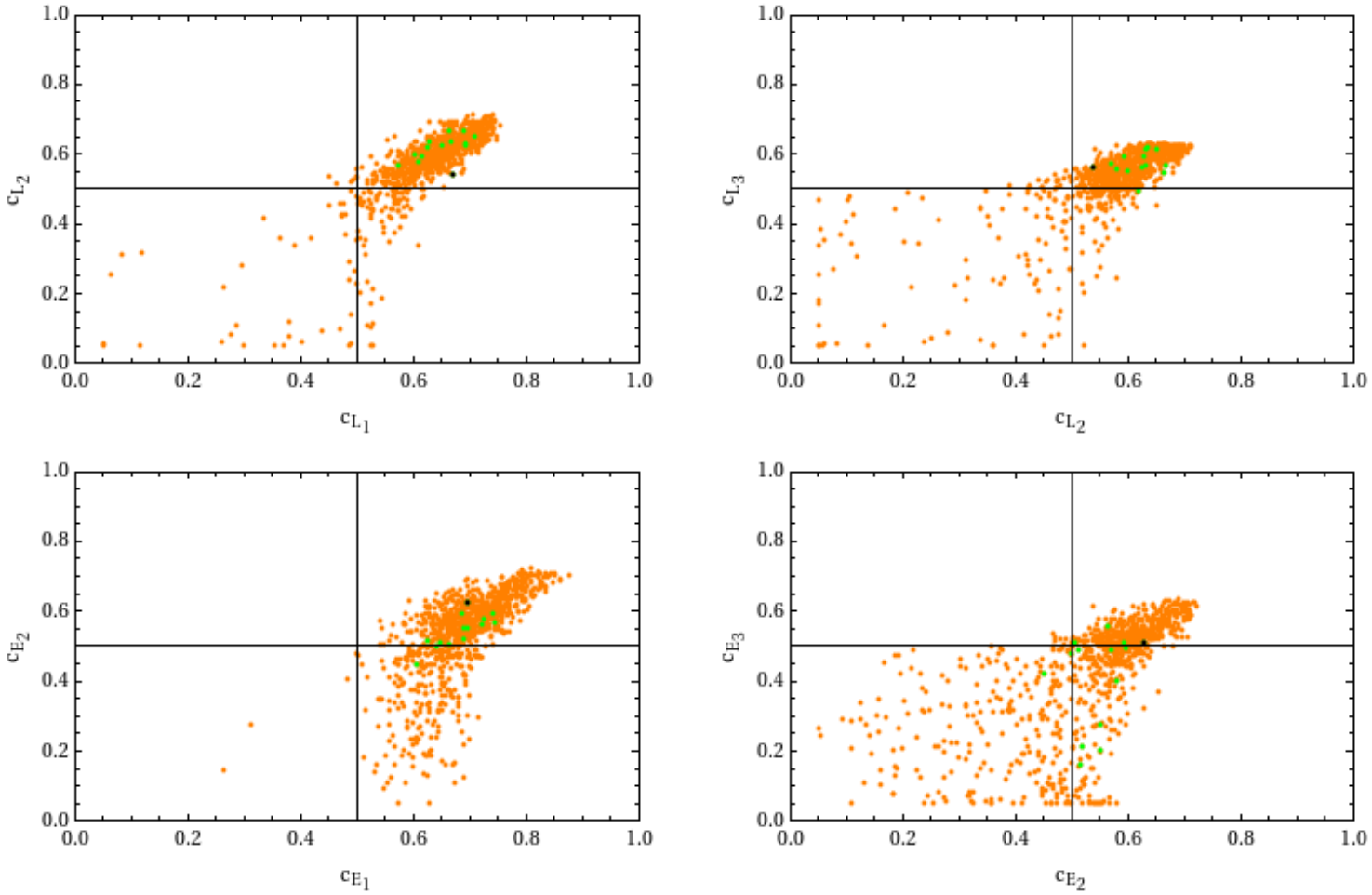
Figure: Coupling of two zero mode fermions to Z_1 as a function of bulk mass parameter

Flavour Contraints on LHLH case

- Doublets and the charged singlets couple universally to the KK gauge boson, thus leading order effects are highly suppressed.
- The large effective Yukawa coupling of the zero mode singlet to the KK mode $\propto \sqrt{0.5 - c}$
- The dipole processes due to gauge boson contribution is suppressed due to heavy KK scales.
- The large universal shift in the gauge coupling can be suppressed by either a very high KK gauge boson scale or by invoking custodial symmetry.

Constraints on Dirac Case

NO Point survives the $\mu \to e\gamma$ constraint



The black dot and the green region represent the parameter space permitted by tree-level constraints for a KK gauge boson scale of 1920 and 3000 GeV respectively

Flavour symmetries

- The parameter space of Dirac and the bulk Majorana case are not consistent with flavour constraints.
- Turn to the ansatz of Minimal Flavour Violation (MFV)Perez & Randall, Mu-chun Chen & Hai-Bo Yu
- Dipole Constriaints can be satisfied for KK fermion scales as low as 3 TeV
- We are looking at various definitions of MFV applicable to the bulk Majorana case.