

$0\nu\beta\beta$ in Left-right Theories with Higgs doublets and Gauge Coupling Unification

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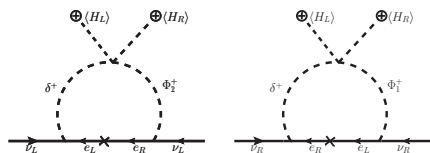
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Motivation and Model Description

- ▶ Theoretical predictions of Standard Model match well with experimental findings so far. Though some **discrepancies** are there :
 - ▶ Explanation of small neutrino mass generation.
 - ▶ Parity violation in low-energy weak interactions.

Left-Right Symmetric model (LRSM) has a unified answer for both.

- ▶ **Gauge Group** : $SU(3)_C \otimes SU(2)_L \otimes SU(2)_R \otimes U(1)_{B-L}$.
- ▶ **Particle Content** : $q_L \equiv (3, 2, 1, 1/3)$, $q_R \equiv (3, 1, 2, 1/3)$,
 $\ell_L \equiv (1, 2, 1, -1)$, $\ell_R \equiv (1, 1, 2, -1)$, $\Phi \equiv (1, 2, 2, 0)$, $H_L \equiv (1, 2, 1, 1)$,
 $H_R \equiv (1, 1, 2, 1)$, $\delta^+ \equiv (1, 1, 1, 2)$.



$$\begin{aligned} \text{▶ } M_{L,R}^{1\text{-loop}} &\simeq \frac{\lambda' \langle H_L \rangle \langle H_R \rangle}{16\pi^2} \frac{\lambda^{L,R} M_\ell Y_\ell^T}{M^2} \mathcal{I} \\ \text{▶ } \mathcal{I} &= \frac{\log \left[\frac{M_\ell^2}{M_{\delta^+}^2} \right] M_{\delta^+}^2}{M_{\delta^+}^2 - M_\ell^2} - \frac{\log \left[\frac{M_\ell^2}{M_\Phi^2} \right] M_\Phi^2}{M_\Phi^2 - M_\ell^2} \end{aligned}$$

Figure: Radiative one-loop Majorana mass generation.

Gauge Coupling Unification

- ▶ We have achieved **successful unification** within this extended framework.

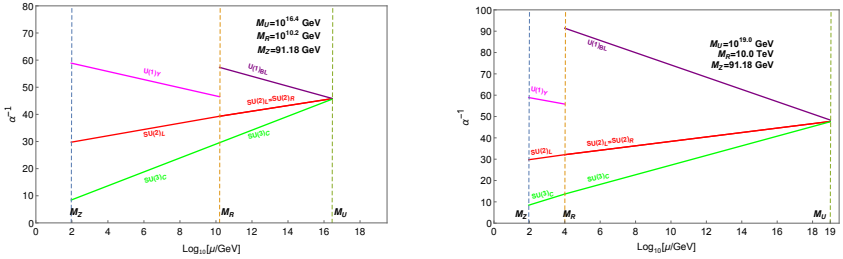


Figure: Left: Gauge Coupling unification with **usual particle content** of doublet LRSM described in Model Description section, LR breaking scale at about 10^{10} GeV (**Out of collider reach**). Right: Gauge coupling unification **with extended scalar sector**, now LR symmetry breaks at **10 TeV** (**can be easily probed in present-day collider searches**).

$0\nu\beta\beta$ Signatures and Cosmological Connection

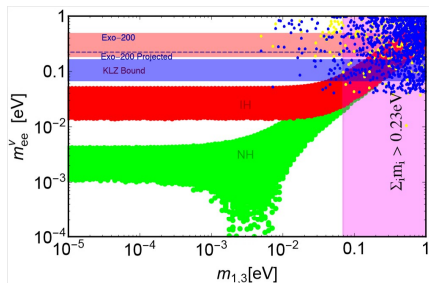


Figure: Plots for effective Majorana mass in context of $0\nu\beta\beta$ with various cosmological as well as collider constraints along this line.

- ▶ Yellow and Blue dots represent new physics contributions arising from λ and η diagrams can easily saturate current-day experimental bounds on $0\nu\beta\beta$.
- ▶ In this model we can have keV -MeV range massive right-handed neutrinos \Rightarrow these can be visualised as warm DM candidate.

Thank You.