The high-scale SUSY seesaw: LHC vs low energy

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with A. Abada, J. C. Romão and A. M. Teixeira

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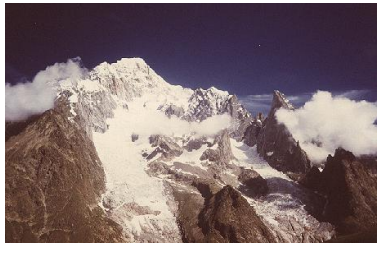
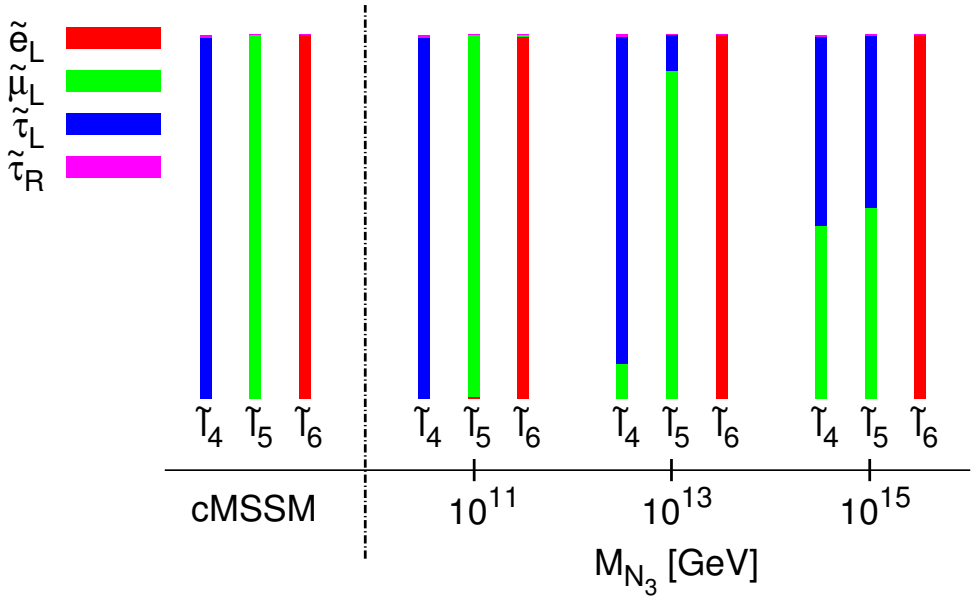


Introduction & Idea

- A **natural** way to explain the smallness of **neutrino masses** is with a **high-scale seesaw** via (lepton doublet)-(seesaw mediator) interactions – parameters constrained by neutrino oscillations
- **SUSY** predicts the existence of **sleptons** and adds (slepton doublet)-(seesaw mediator) interactions
- Consequence: lepton flavour mixing in the slepton sector rooted on (but not singly determined by) neutrino oscillation parameters



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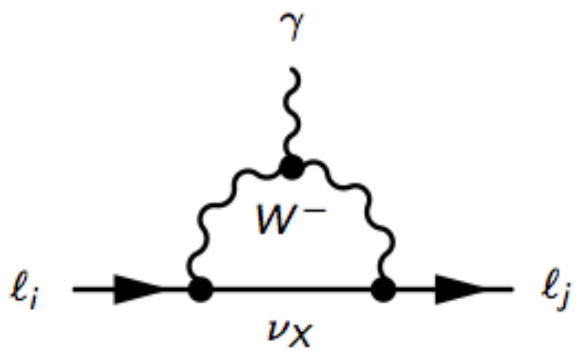

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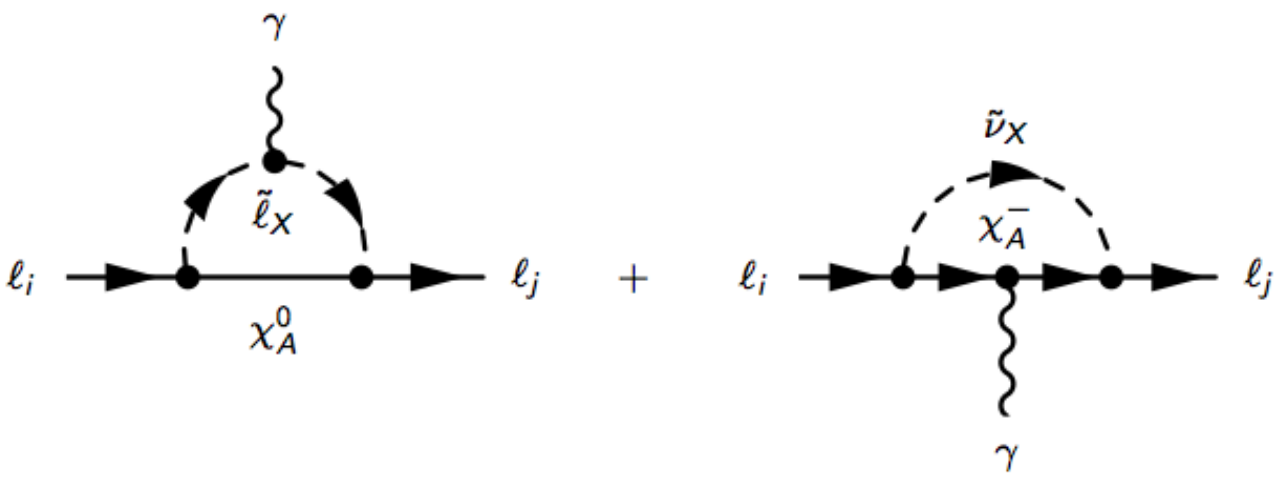

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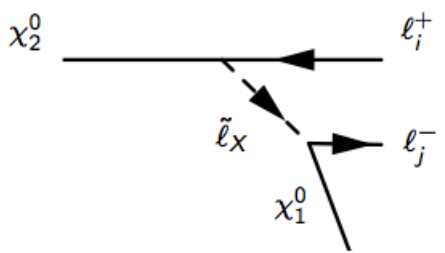

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Idea: extract information on ν mass mechanism via collider vs low energy interplay

Models analysed

Fermionic seesaws with **three generations** of mediators

- Type-I (singlet mediators)
- Type-III (triplet mediators) with **SU(5)** embedding in **24**-plets

$$\mathbf{24} = (1_C, 3_L, 0_Y) \oplus (1_C, 1_L, 0_Y) \oplus \text{colored fields}$$

Besides LFV and ν-mass, main **differences** in comparison to **cMSSM**?

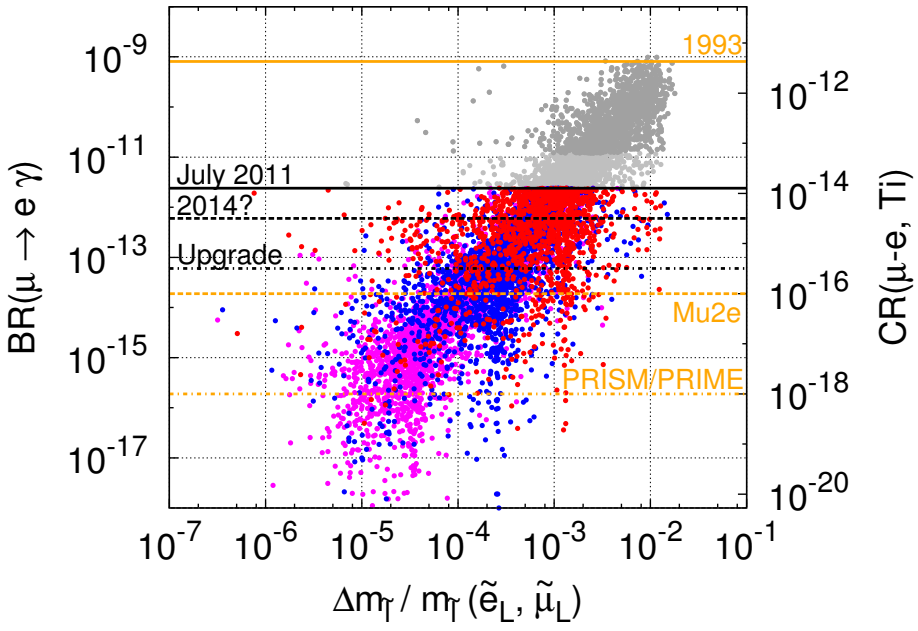
- **Type-I**: unconventional slepton mass splittings (i.e. non-universality $\not\propto \ell$ masses)
- **Type-III**: slepton mass splittings; GUT gauge coupling stronger (implying perturbative lower bound on seesaw scale) & sparticle spectrum lighter

Analysis updated taking into account

- Latest bounds
  - from **MEG** on $\mu \to e\gamma$
  - from **LHC** on mass spectrum
- $\theta_{13} \sim 9^{\circ}$ (Daya Bay, RENO, Double Chooz)
- **cMSSM analogue** param. space **constraints heavily dictated** by the **Standard Model Scalar mass** ~ 125 GeV

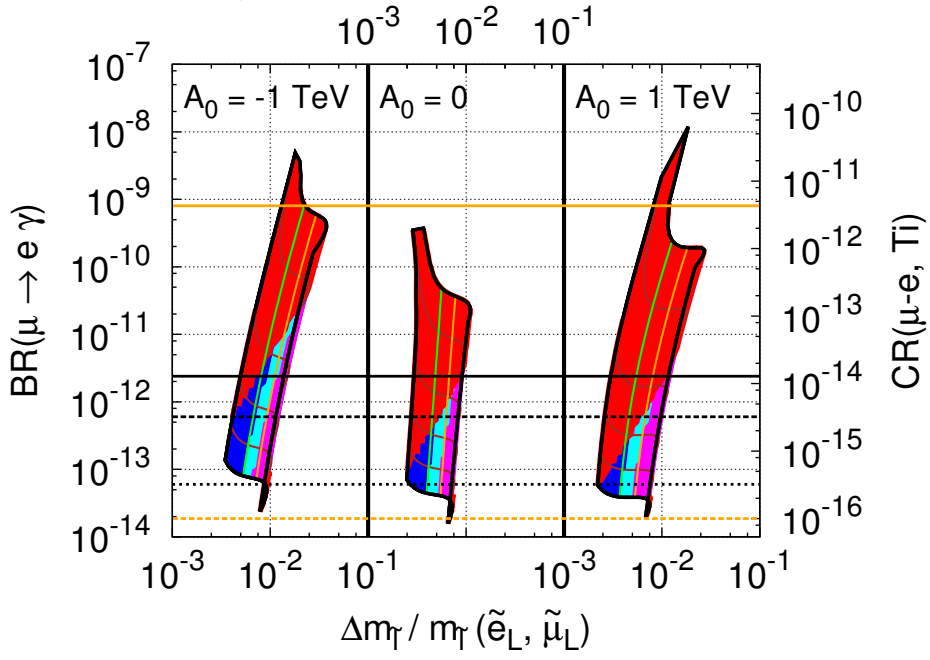
Results

Type-I



$M_3 = 10^{12}$ GeV
$M_3 = 10^{13}$ GeV
$M_3 = 10^{14}$ GeV

Type-III



- Manifest **correlation** between **slepton mass splittings** and **low energy cLFV**
- **Non-universal slepton masses** would **hint** on possible **cLFV observation**
- **CR(μ-e, Ti)** future sensitivities **probe** a **vast portion** of **parameter space**

Conclusions

- Ongoing and upcoming low energy cLFV experiments (MEG, Mu2e, PRISM/PRIME, etc.) are able to **constrain** the **supersymmetric seesaw** parameter space

- Slepton mass reconstruction at the LHC may either be **consistent with universality** or show a **strong departure from universality**

- Combining the two pieces may **favour** a high-scale seesaw explanation or **strongly disfavour** it as the unique source of LFV

- In this way, supersymmetric high-scale seesaws can be probed

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Thank you