

Simple Z' models in the early LHC

Giovanni Villadoro

with *E.Salvioni and F.Zwirner* 0909.1320 + *A.Strumia* (to appear soon)

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*“ how bounds from existing experiments affect
the discovery reach in the very early phase of the LHC ? ”*

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Why Z' ?

- Z' s have no intrinsic motivation *per se*
- However they are present in many new physics models:
GUTs, little/composite Higgs(-less), ED, String theory models...
- Clean/easy signal at hadron colliders ($Z' \rightarrow e^+e^-, \mu^+\mu^-$)
- \Rightarrow "smoking gun" for new physics (usually first new physics analysed)

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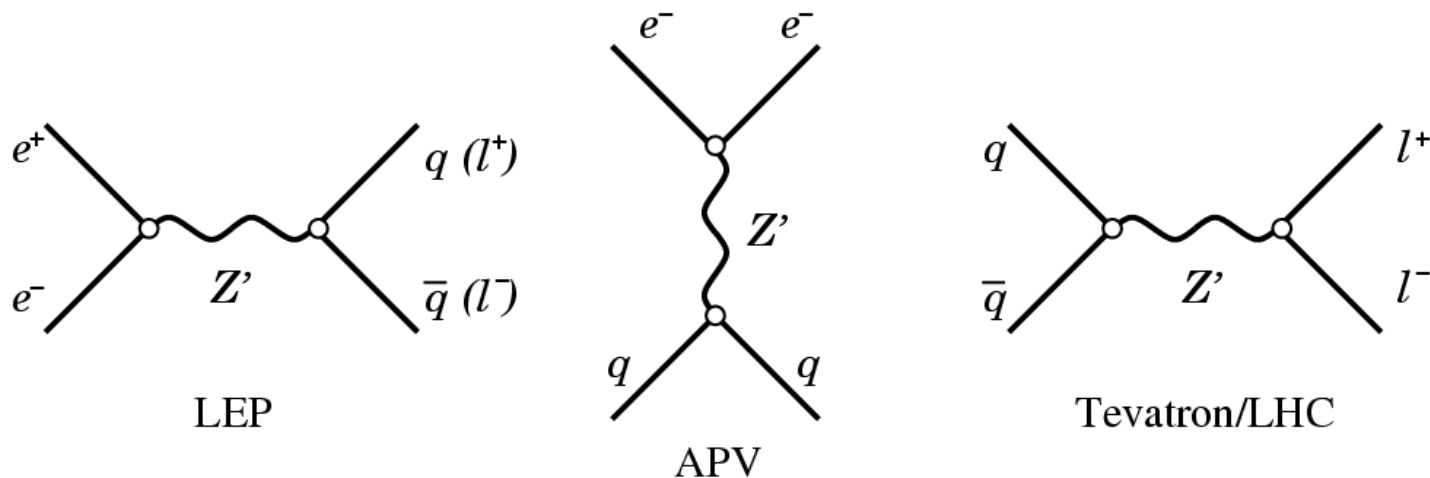
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All neutrino masses and mixings
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All experiments are sensitive to the same diagram



Bounds from EWPT

LEP1, Tevatron, SLD:

$$M_Z, M_W, m_{top}, G_F, \alpha_s(M_Z), \alpha_{em}(M_Z), \Gamma_Z, \sigma(e^+e^- \rightarrow \text{hadrons}),$$
$$A_{FB}^{e,\mu,\tau,b,c}, \tau\text{-pol asym}, BR(Z \rightarrow \text{hadrons}, cc, bb), A_{LR}^{e,\mu,\tau,b,c}.$$

LEP2 (183÷207 GeV):

$$\sigma(e^+e^- \rightarrow qq, bb, \mu^+\mu^-, \tau^+\tau^-), A_{FB}^{\mu,\tau,b}, d(e^+e^- \rightarrow e^+e^-) / d \cos \theta$$

Low-energy measurements:

$$\text{M\"oller scattering at } Q^2 = 0.026 \text{ GeV}^2, \text{ APV in Cs, } \nu\text{-N (NuTeV), } (g-2)_\mu$$

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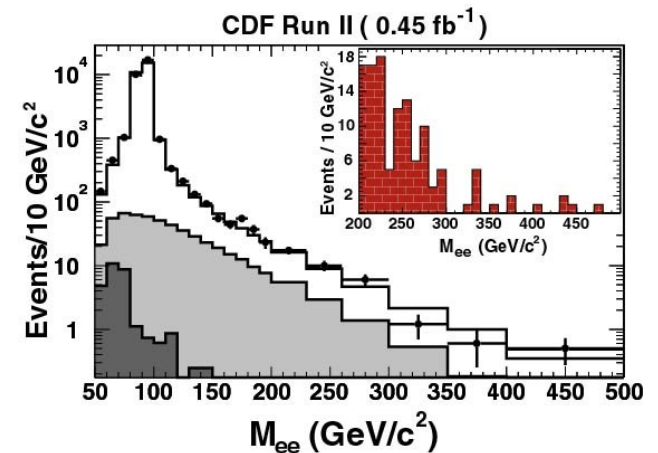
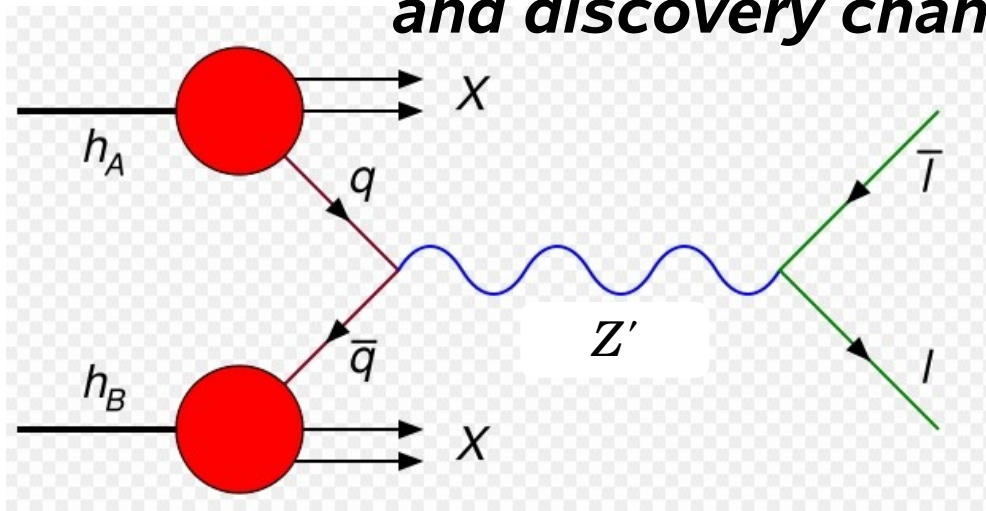
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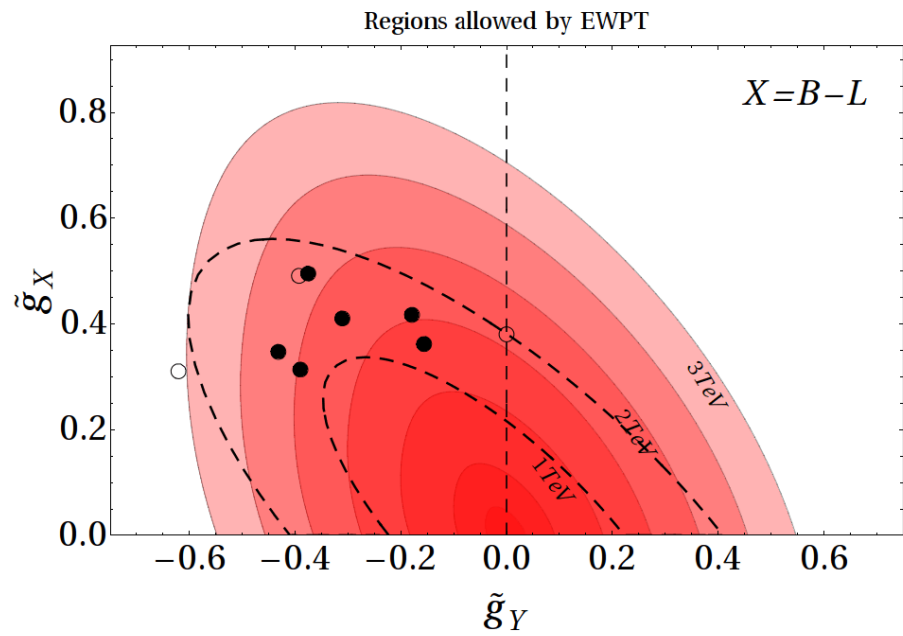
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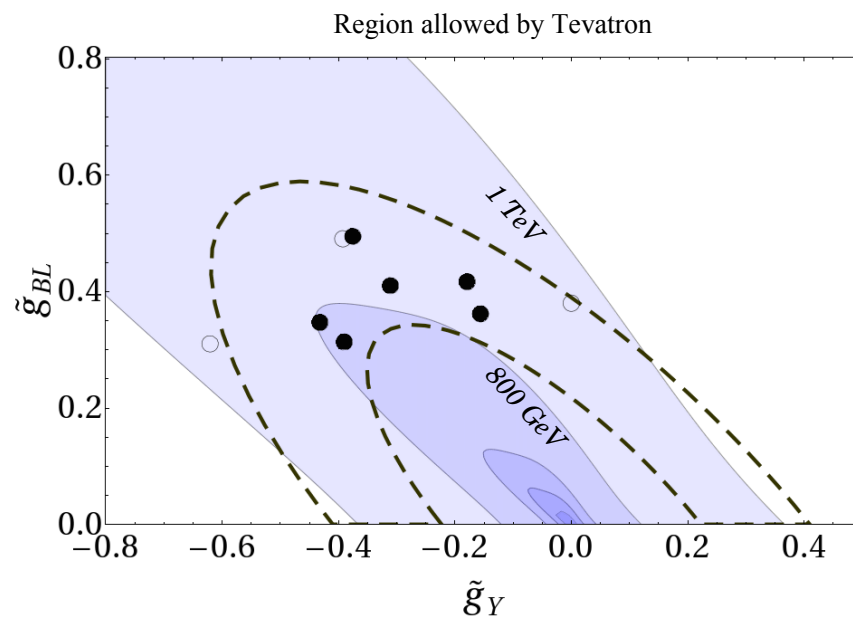
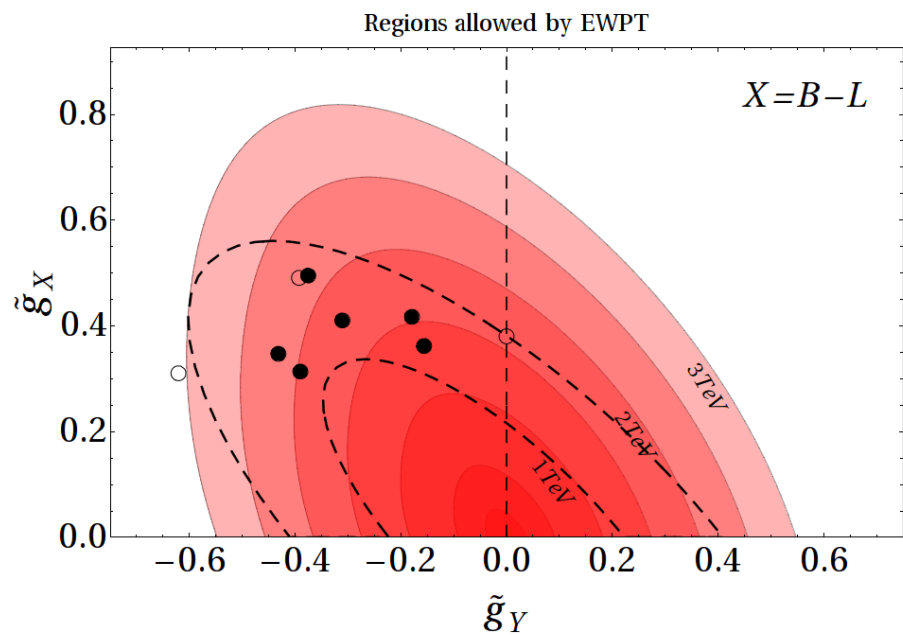
Bounds from direct searches at Tevatron and discovery channel at LHC



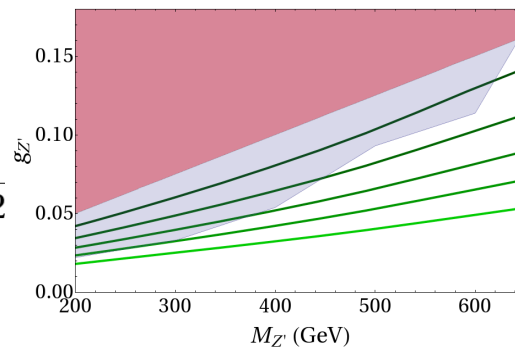
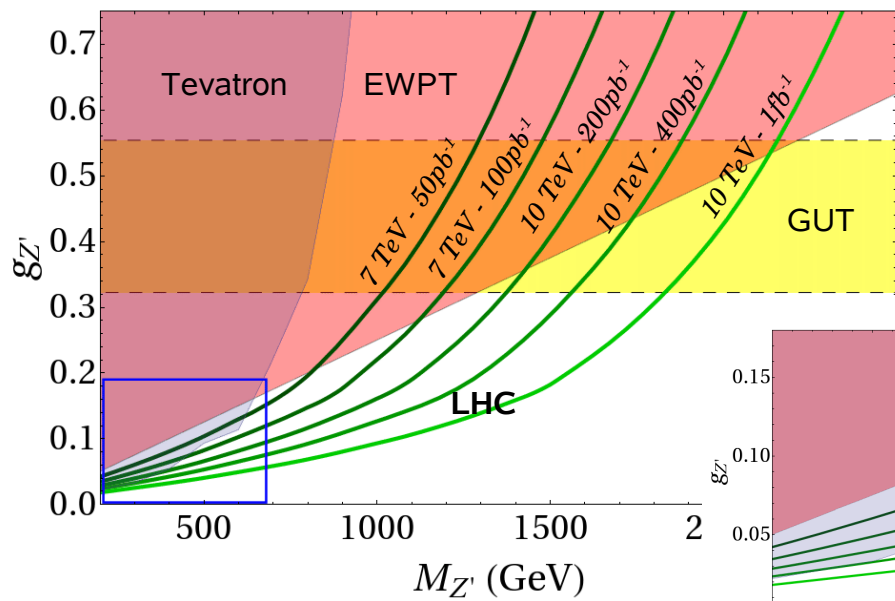
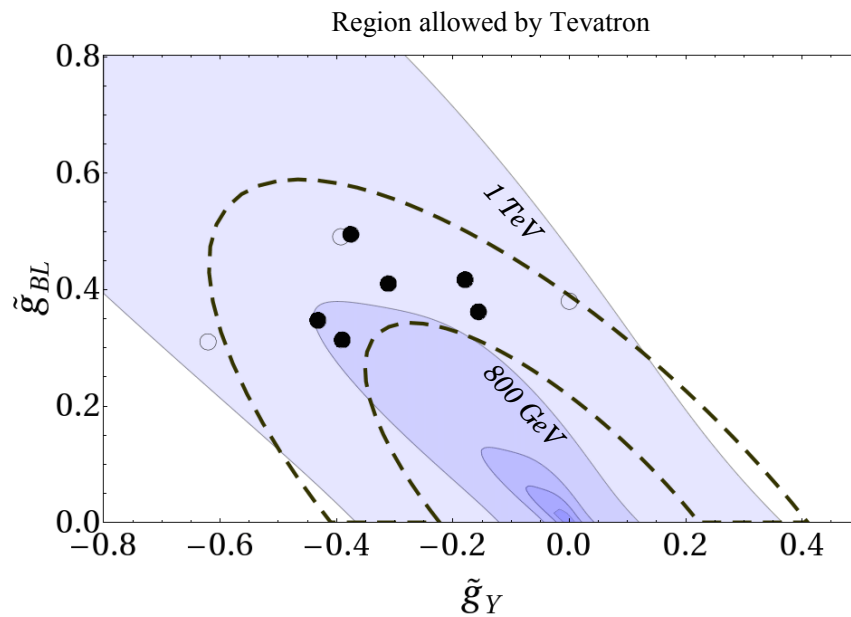
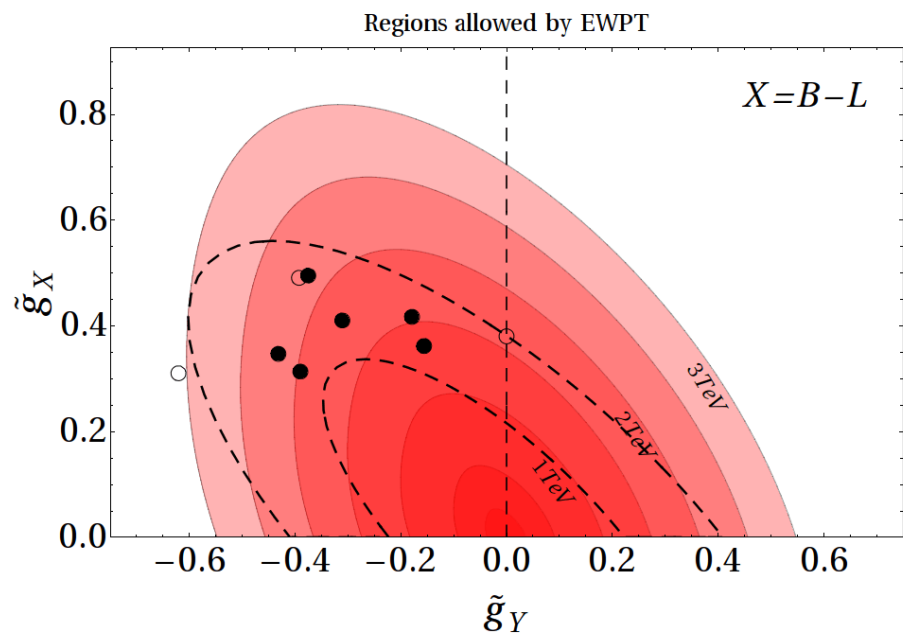
Flavour Universal model: B-L



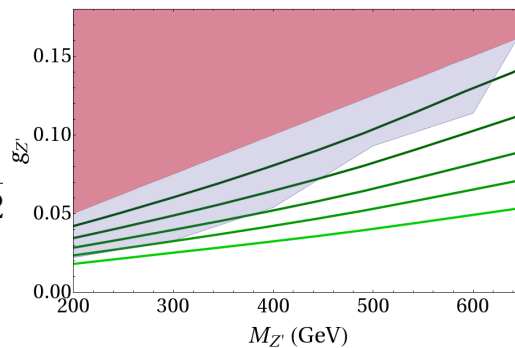
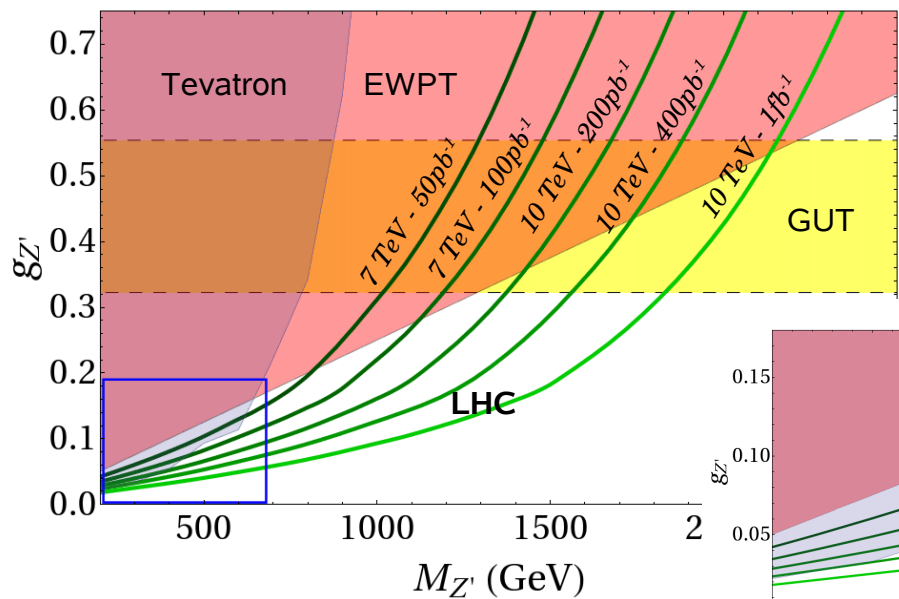
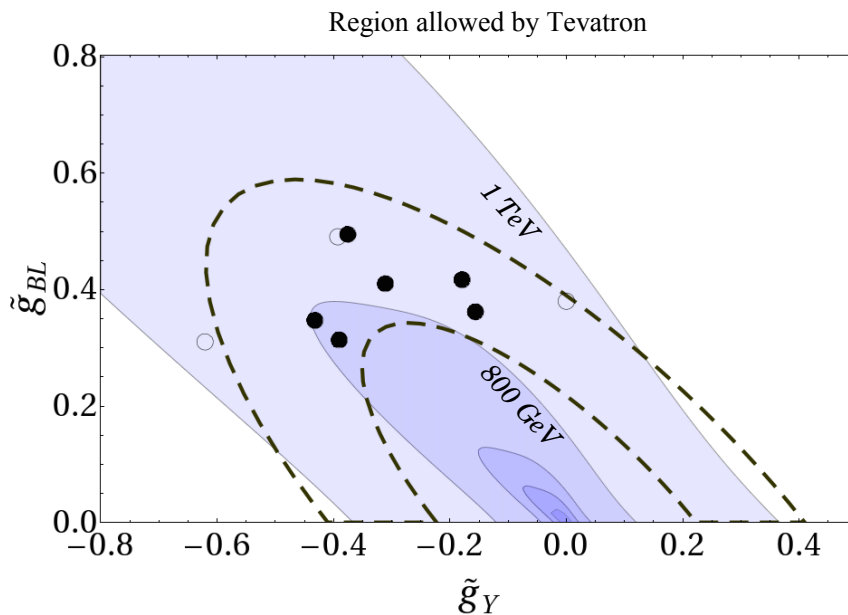
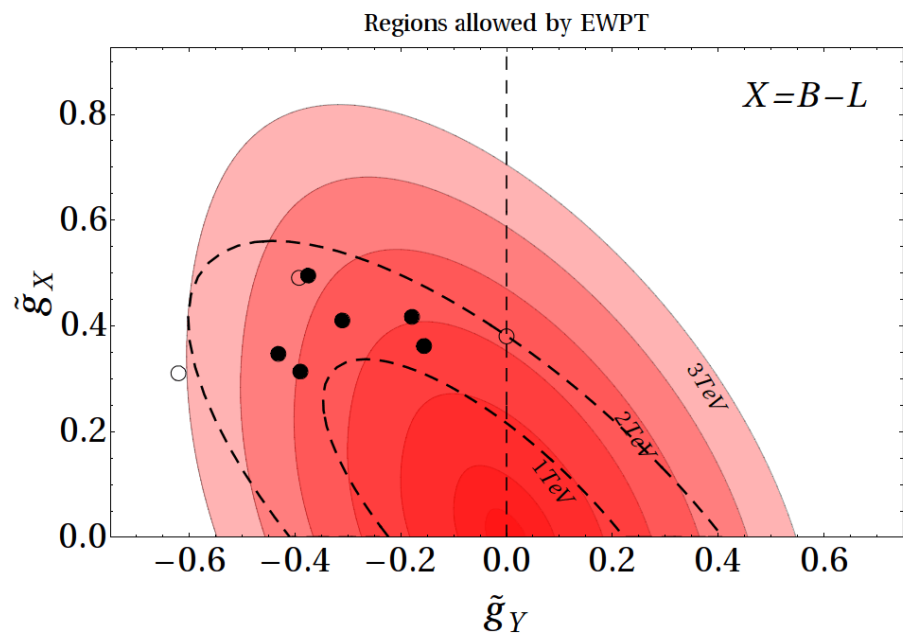
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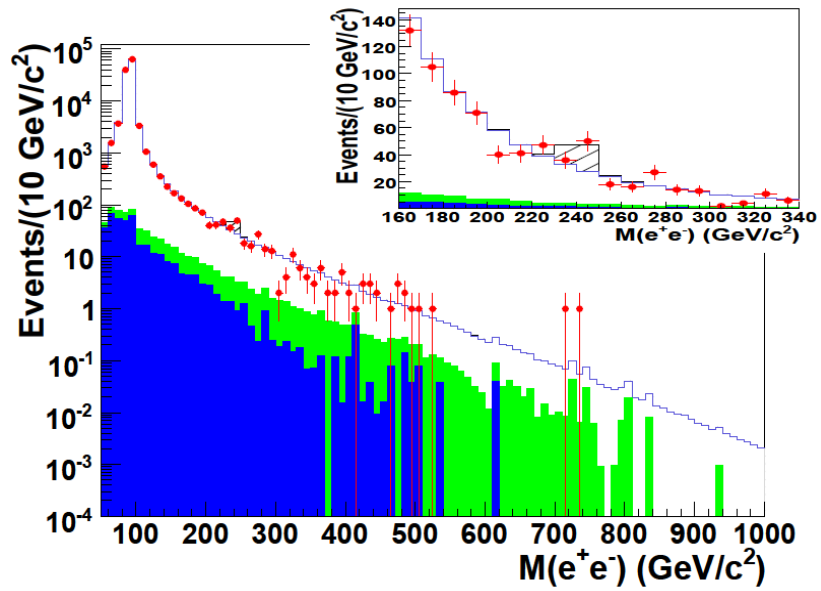
Flavour Universal model: B-L



*Existing bounds are strong
difficult to see
something new very soon*

Two representative examples:

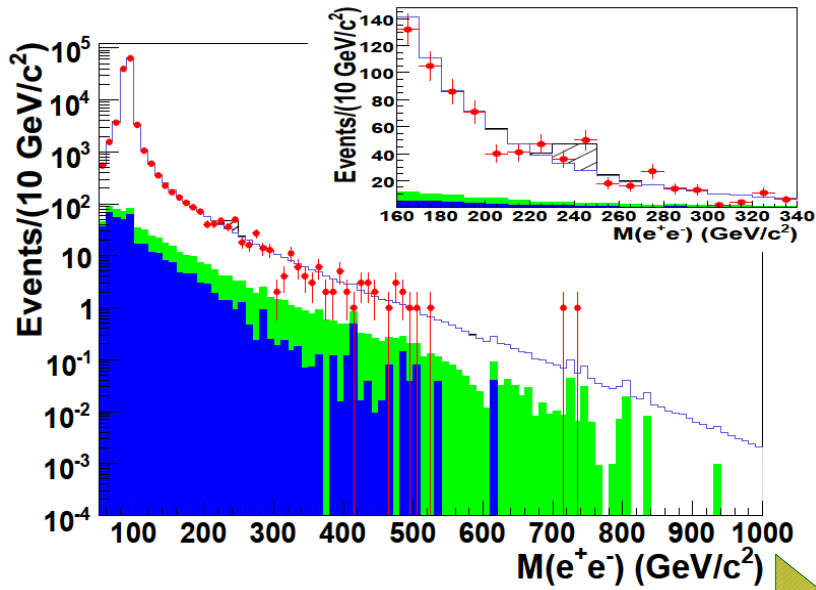
$B-3L_e$ model



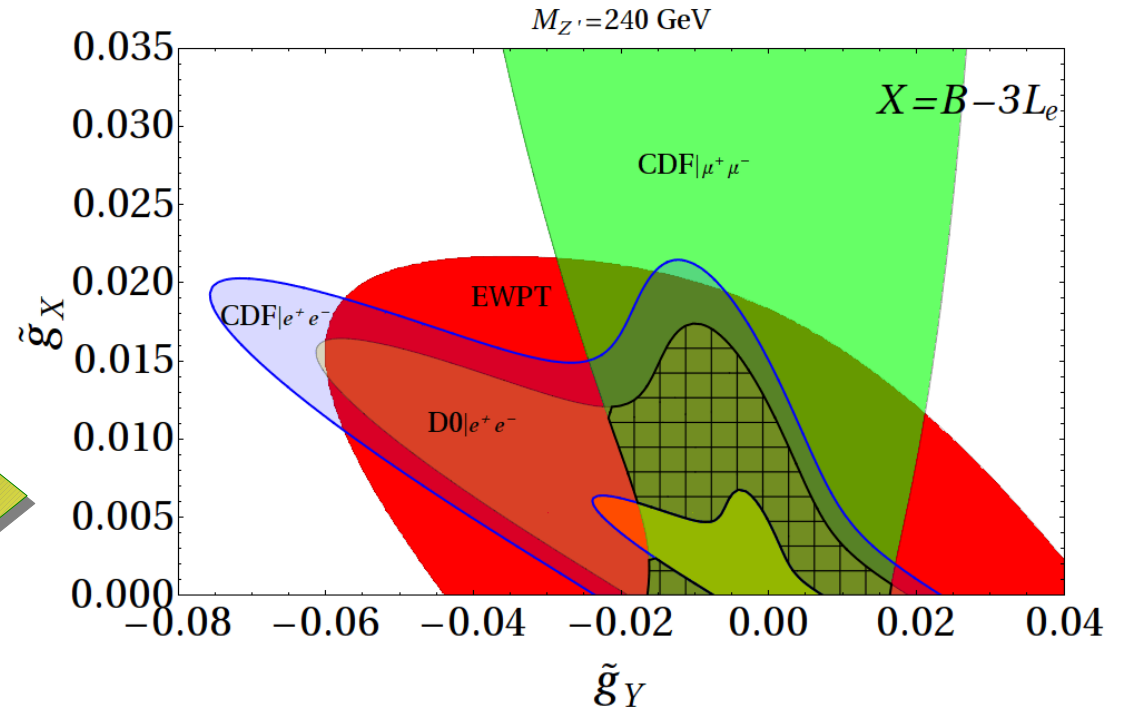
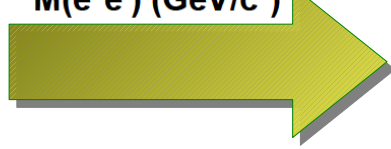
CDF e^+e^- excess

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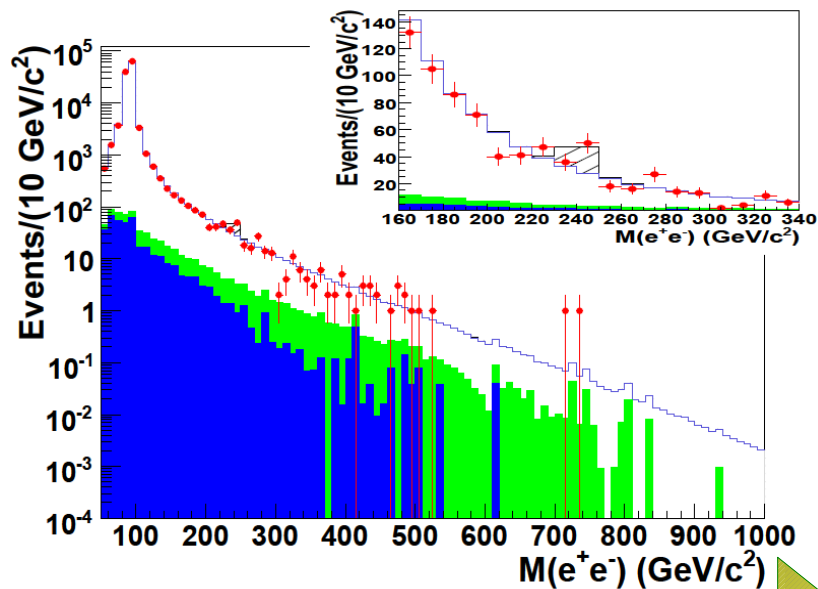
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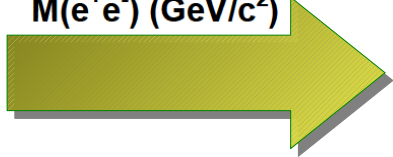
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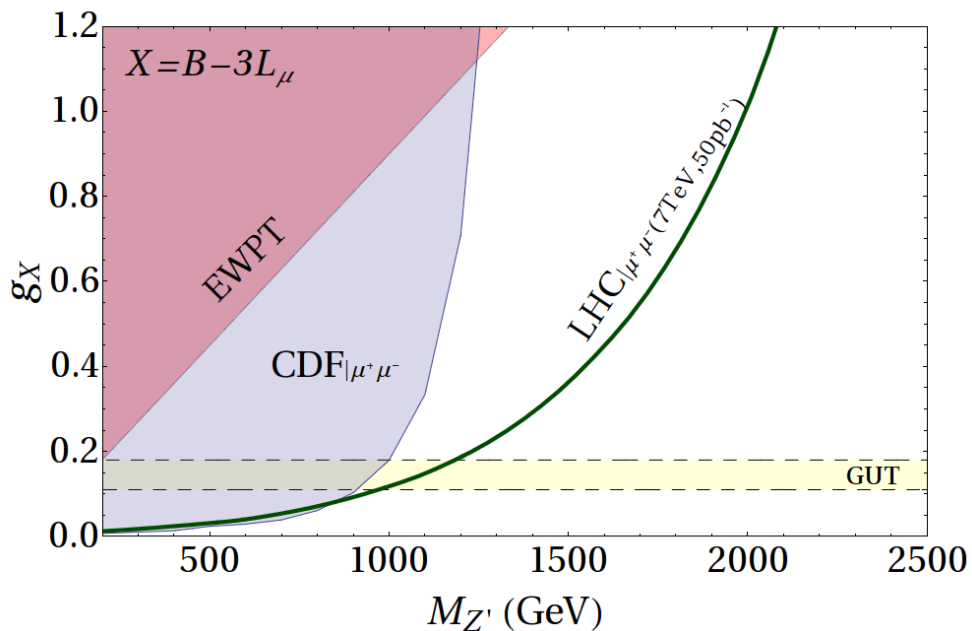
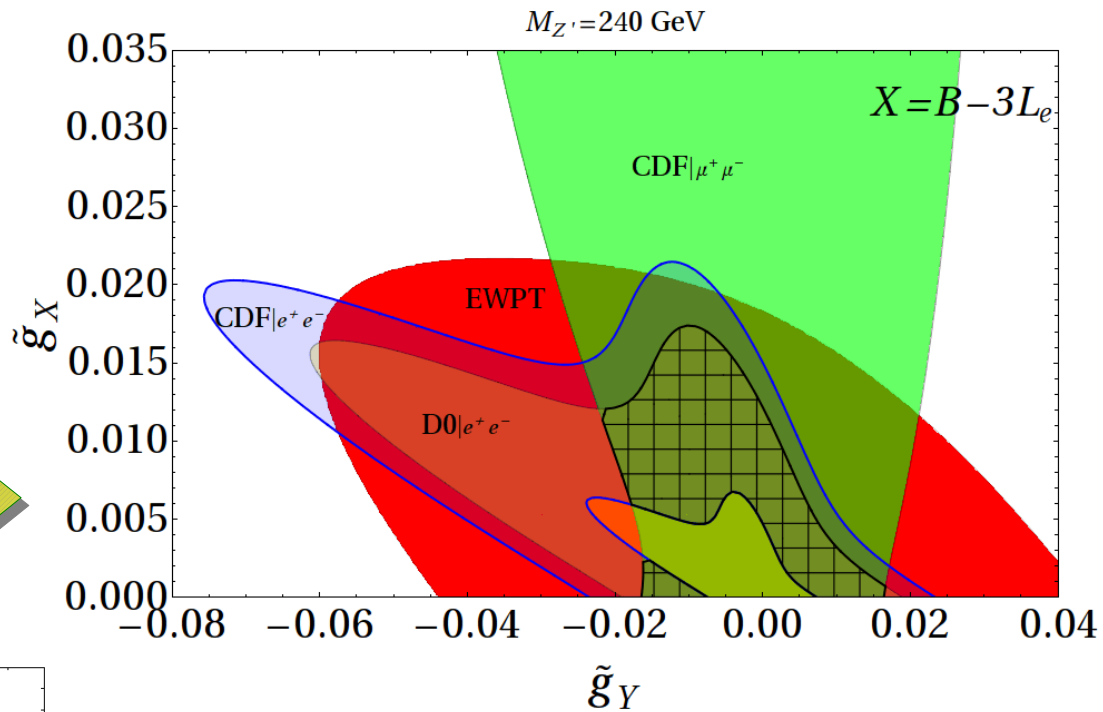
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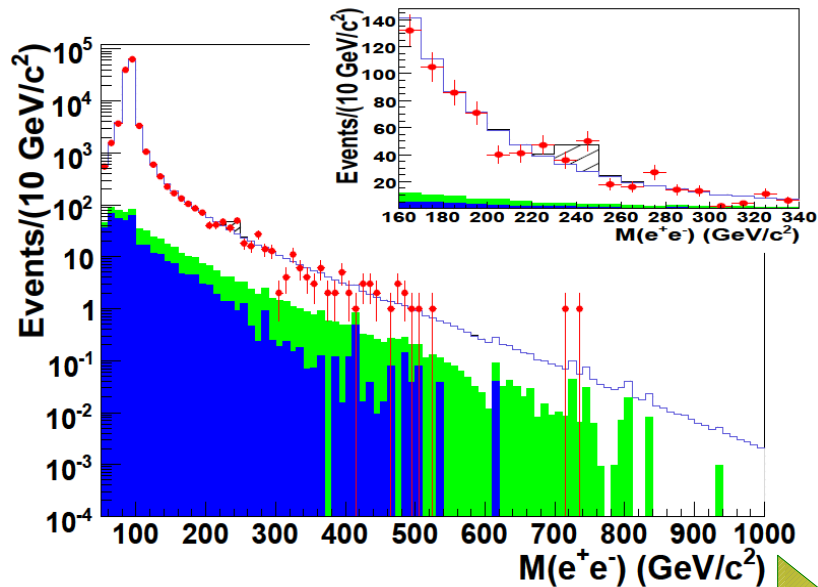


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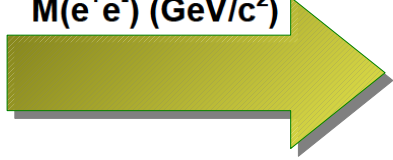


$B-3L_\mu$ model:

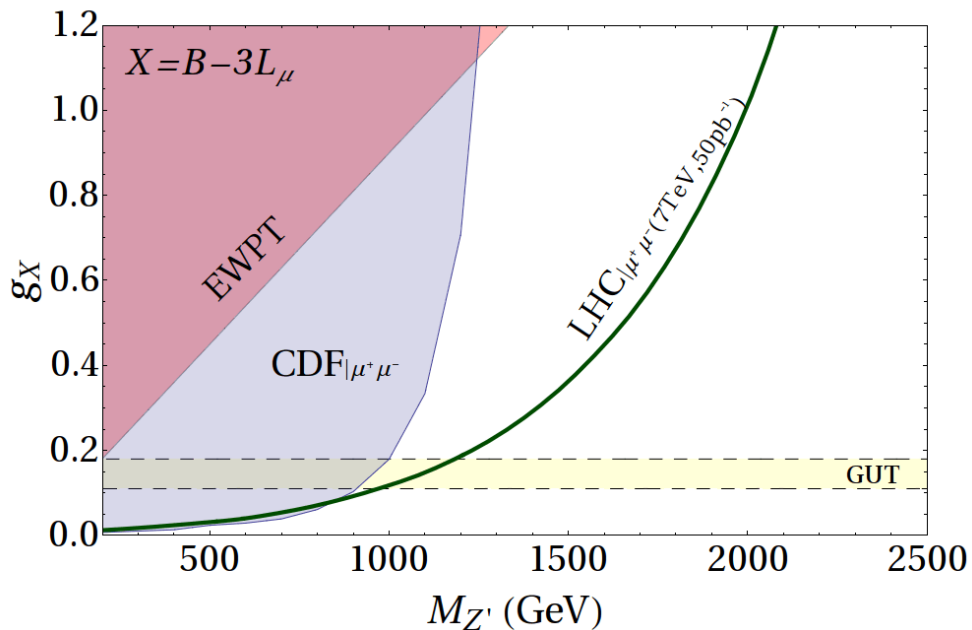
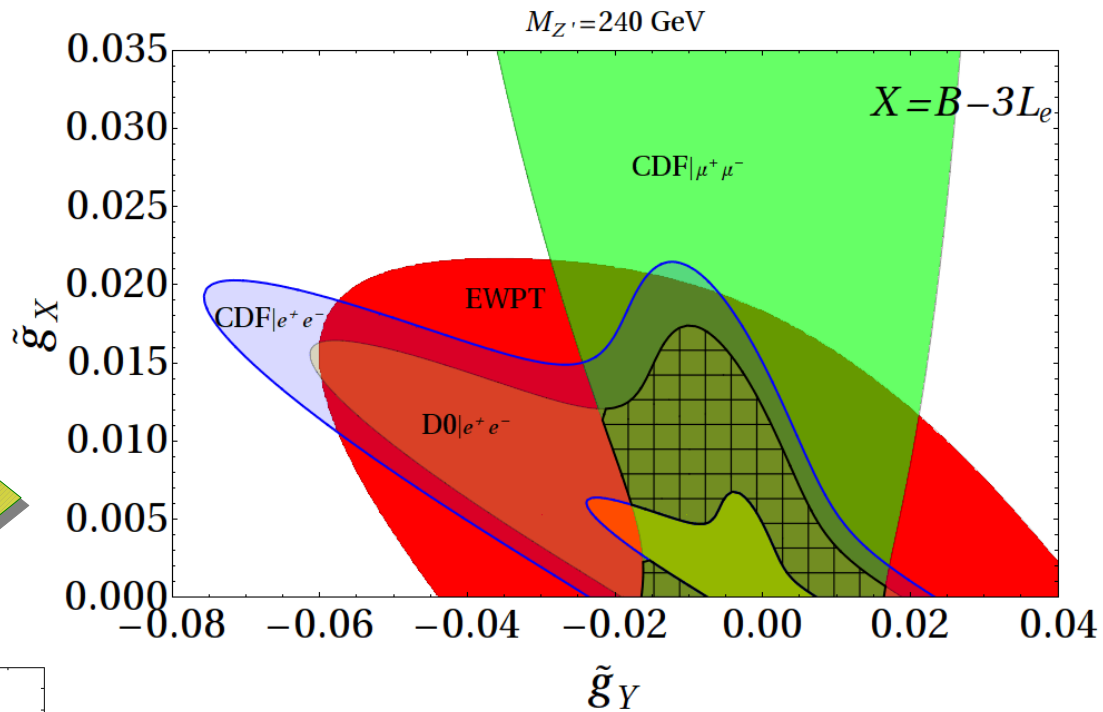
Two representative examples:



CDF e^+e^- excess



$B-3L_e$ model



$B-3L_\mu$ model:

a supermodel



Other interests:

(other than phenomenology of SM and beyond)

String compactifications:

Effective supergravity theory

Supersymmetry breaking

Moduli stabilization

Constraints from string theory to the low-energy theory (if any...)

...

Cosmology

Infrared effects from quantum gravity

Definition of observables in curved space

Eternal inflation

...