

# Constrains B-L model with Contur

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**One reason: B-L model can explain the two anomalous** 

muon anomalous magnetic dipole moment  $a_{\mu} = (g-2)/2$ 

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$$b \rightarrow s \bar{\mu} \mu$$
 induced rare B decay  
 $R_k = \frac{BR(B \rightarrow K \mu^+ \mu^-)}{BR(B \rightarrow K e^+ e^-)}$  3.1 $\sigma$ 

**Combine all the LHC** 

Contur

constrains

- **Z' Interaction Lagrangian**  $L_{int} = \frac{1}{3}\tilde{g} \left( \bar{Q}_{L_2} \gamma^{\mu} Q_{L_2} + \bar{u}_{R_2} \gamma^{\mu} u_{R_2} + \bar{d}_{R_2} \gamma^{\mu} d_{R_2} \right) Z'_{\mu}$   $- \tilde{g} \left( \bar{L}_{L_2} \gamma^{\mu} L_{L_2} + \bar{l}_{R_2} \gamma^{\mu} l_{R_2} + \bar{\nu}_{R_2} \gamma^{\mu} \nu_{R_2} \right) Z'_{\mu}$
- Get constrains from experiment data
- 1. LHC dilepton at Z pole
- 2. LHC Z' Searches  $(Z' \rightarrow \mu^+ \mu^-)$  ....
- 3. Other constrains(Neutrino trident process)



## **Constrains with contur**



• Model parameters: Z' mass, U(1)B - L coupling g

#### What we except:

Big couplings with  $m_{z'}$  around 10-1000GeV exclude.





## Constrains with contur: how to do

#### **Standard way:**

- 1. Copy the UFO files to the working dir.
- 2. Compile and make
- 3. Read FRModel.model
- 4. Set LHC-FRModel.in
- 5. Run the commands following the tutorial

#### read snippets/PPCollider.in

read FRModel.model

set /Herwig/FRModel/Particles/Zp:NominalMass 500\*GeV
set /Herwig/FRModel/FRModel:g1p 0.001

cd /Herwig/NewPhysics

RunInfo# ufo2herwig B-L-3/	
LENGTH 1 finished generating model: model directory: generated:	FRModel B-L-3/ 291 vertices
library: input file: model file:	FRModel.so LHC-FRModel.in FRModel.model
To complete the installation, c An example input file is provid you'll need to change the requi	ompile by typing "make". ed as LHC-FRModel.in, red particles in there.
DONE !	
But for the doc	eker we use:
<ol> <li>Run a clean cont</li> <li>Copy the UFO fi</li> <li>Change the para</li> </ol>	tainer les ameters in the

Original UFO files in parameters.py

4. Compile and make

# Our result: CMS Dileptons above the Z pole





### **Our result:**



## Conclusion

#### We scan four points and agree with the paper



## nTGC model: dim-8 effective model

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- Get the result but some error when plotting.
- No plots for lacking in LHC.in files in this model.

>> Herwig 7.2.2 / ThePEG 2.2.2				
======================================				
	generated events	number of attempts	Cross-section (nb)	
Total (from attempted events):	including vetoed e	 vents	16.5(3)e-03	
Total (from generated events): Events carry unit weights.	1000	1000	16.5(3)e-03	
Per matrix element breakdown:				
MEbbarg2bbarH	17	17	0.28(7)e-03	
MEcbarg2cbarH	6	6	99(4)e-06	
MEsbarg2sbarH	6	6	99(4)e-06	
MEubarg2ubarH	14	14	0.23(6)e-03	
MEdbarg2dbarH	14	14	0.23(6)e-03	
MEdubar2W-H	24	24	0.40(8)e-03	
MEddbar2gH	Θ	Θ	Θ	
MEddbar2gammaH	Θ	Θ	Θ	
MEddbar2Z0H	17	17	0.28(7)e-03	
MEdg2dH	33	33	0.54(9)e-03	
MEuubar2gH	Θ	Θ	Θ	
MEuubar2gammaH	Θ	Θ	Θ	
MEuubar2Z0H	11	11	0.18(5)e-03	
MEudbar2W+H	37	37	0.6(1)e-03	
MEug2uH	74	74	1.2(1)e-03	
MEscbar2W-H	1	1	20(20)e-06	
MEssbar2gH	Θ	Θ	Θ	
MEssbar2gammaH	Θ	Θ	Θ	
MEsshar270H	//	//	70(30)0-06	



# Why B-L model interesting ?

**One reason: B-L model can explain the two anomalous** 

Fermilab

muon anomalous magnetic dipole moment

$$a_{\mu} = (g - 2)/2$$

$$\downarrow$$

$$\Delta a_{\mu} = a_{\mu}^{exp} - a_{\mu}^{SM} \quad 4.2\sigma$$

$$= (251 \pm 59) \times 10^{-11}$$

#### LHCb

 $b\to s\bar\mu\mu~$  induced rare B decay

$$R_{k} = \frac{BR(B \to K\mu^{+}\mu^{-})}{BR(B \to Ke^{+}e^{-})}$$

$$\downarrow$$

$$R_{K} = 0.846^{+0.042+0.013}_{-0.039-0.012} \quad 3.1\sigma$$

# One model: Flavor specific B-L Model

• Only act on the 2nd generation of fermions in weak basis

$$B_q-B_2=1/3,\;L_\mu=1$$
 Gauge anomaly free

**Combine all the constrains** 

- **Z' Interaction Lagrangian**  $L_{int} = \frac{1}{3}\tilde{g} \left( \bar{Q}_{L_2} \gamma^{\mu} Q_{L_2} + \bar{u}_{R_2} \gamma^{\mu} u_{R_2} + \bar{d}_{R_2} \gamma^{\mu} d_{R_2} \right) Z'_{\mu}$   $- \tilde{g} \left( \bar{L}_{L_2} \gamma^{\mu} L_{L_2} + \bar{l}_{R_2} \gamma^{\mu} l_{R_2} + \bar{\nu}_{R_2} \gamma^{\mu} \nu_{R_2} \right) Z'_{\mu}$
- Get constrains from experiment data
- **1. Neutrino trident process**

2. LHC Z' Searches  $(Z' \rightarrow \mu^+ \mu^-) \dots$  Contur