SO(10) at the LHC

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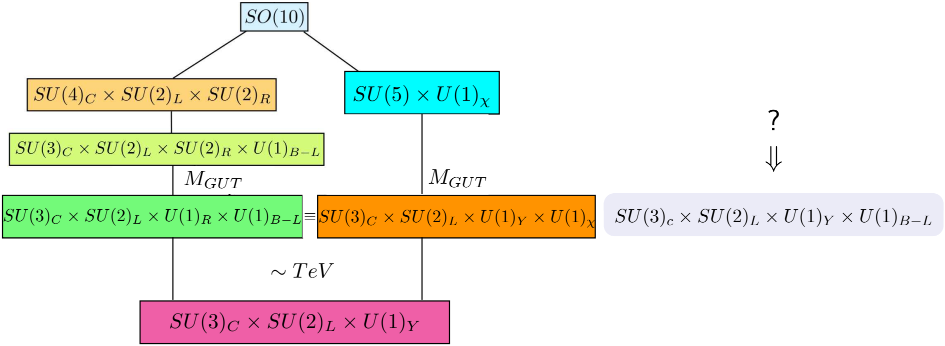
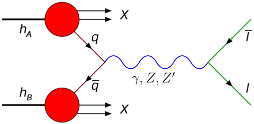
Introduction

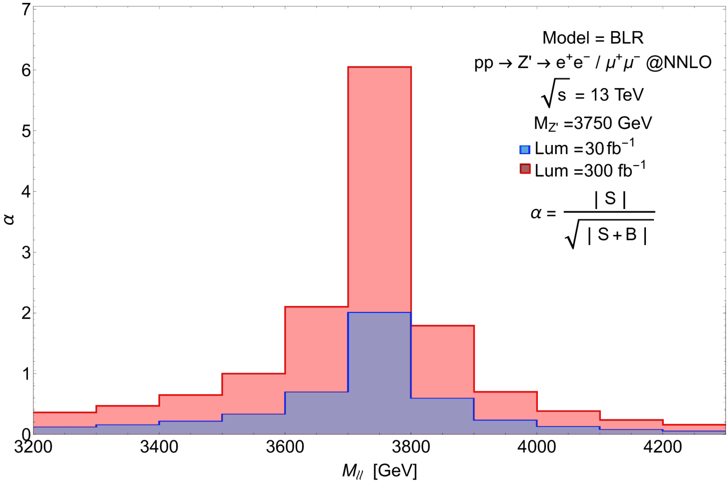
- Several breaking patterns for $SO(10)$ to SM
- The gauge group $SU(3)_C \times SU(2)_L \times U(1)_R \times U(1)_{B-L}$ may survive down to TeV scales, this is the "BLR" model
- More popular is $B-L$ model, $U(1)_Y \times U(1)_{B-L}$
- Both $B-L$ and BLR offer Z', which we may distinguish at the LHC



Finding the Z'

- The most promising channel to search for Z's at the LHC is Drell-Yan production, $pp \to \gamma, Z, Z' \to e^+e^-, \mu^+\mu^-$

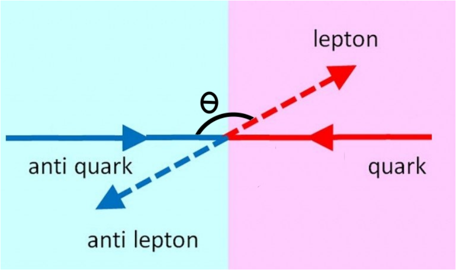




Whose Z' is that?

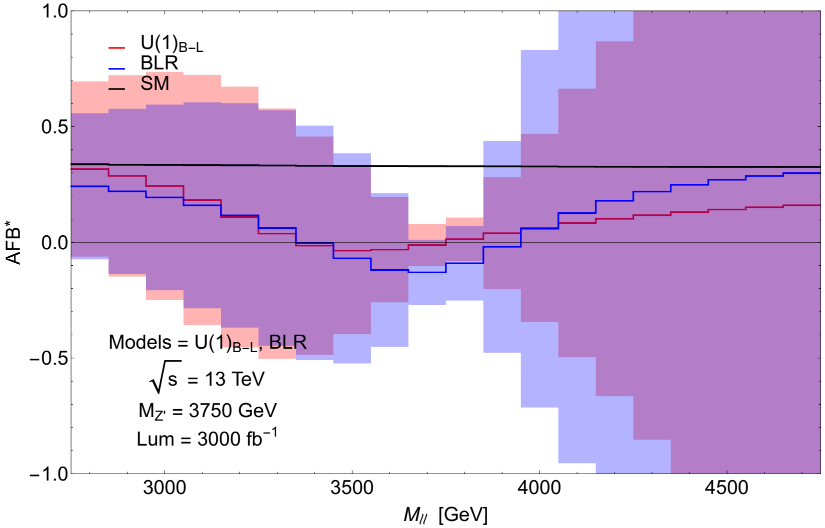
- If a Z' is discovered, one needs to differentiate to which model it belongs
- Forward-Backward Asymmetry measures the difference in the number of forward $(\theta < 90^\circ)$ and backward $(\theta > 90^\circ)$ events
- The BLR Z' couples based on $U(1)_{B-L}$ (L/R fermions have same charge) and $U(1)_R$ (L/R fermions have different charges)

$$A_{FB} \equiv \frac{d\hat{\sigma}_F - d\hat{\sigma}_B}{d\hat{\sigma}_F + d\hat{\sigma}_B}, \quad d\hat{\sigma}_{F,B} = \int_{0,-1}^{1,0} \frac{d\hat{\sigma}}{d\cos\theta} d\cos\theta$$



AFB Results

- At HL-LHC, including statistical errors, $\delta A_{FB} = \sqrt{1 - A_{FB}^2/N}$, one may be able to disentangle $B-L$ and BLR models



Conclusions

- The BLR is a well motivated model, with motivations from GUT theories
- Identifying which model a Z' belongs to may become an important task in the near future, as candidates undetectable now offer clear signals in the next runs of the LHC
- Low scale phenomenology of Z' is an interesting way to probe different high-scale models

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