# Gauged Axions and Anomaly-mediated Interactions

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Based on: R.Armillis, C. Corianò, M.Guzzi and S.Morelli in preparation

## Abstract

*Additional Abelian gauge interactions arise frequently in many extensions of the SM, like in left-right symmetric models, in GUTs and in string inspired constructions. For this reason the identification of extra neutral interactions in the future collider experiments will be an important task. We try to quantify the impact of gauge anomalies at LHC by studying the invariant mass distributions in Drell-Yan leptoproduction and Double Prompt Photon production comparing the results of the SM with those from models with extended gauge symmetries*

## $SU(3)_C$ x $SU(2)_W$ x $U(1)_Y$ x $U(1)_B$ Models

### Anomalous Z' vs Non-Anomalous Z'

• Minimal Low Scale Orientifold Model (MLSOM) with *anomalous* spectrum under the additional $U(1)_B$ symmetry. The anomaly cancellation mechanism involves an axion-like particle *b* via Wess-Zumino (WZ) counterterms or the subtraction of the anomaly pole from the triangle diagram via Green-Schwarz (GS) counterterms.

• Free Fermionic Model (FF model) in a L - R symmetric (anomaly free) class of heterotic-string models

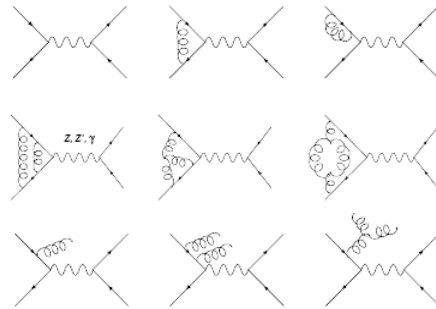• Bottom-up models (anomaly free construction) with extra symmetry $U(1)_{B-L}$ or $U(1)_{q+u}$

REFERENCES:
• C.Corianò, N.Irges, and S.Morelli, Nucl. Phys. B789 (2008) 133
• C.Corianò, A.Faraggi, M.Guzzi, Phys. Rev. D78 (2008) 015012
• M.S.Carena et al., Phys. Rev. D70 (2004) 093009
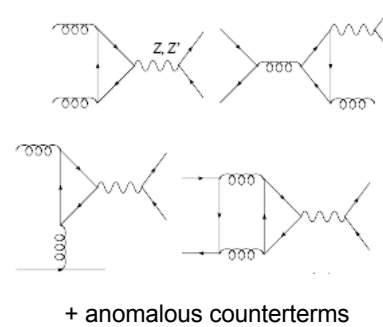
### SM background for Di-Photon with DIPHOX and gamma2MC



+ real corrections
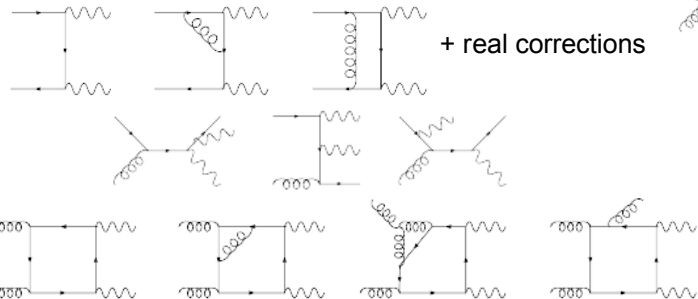
## SM background for DY with CANDIA



## Anomalous corrections for DY



+ anomalous counterterms

REFERENCES:
• A.Cafarella, C.Corianò and M.Guzzi, to appear on Comput. Phys. Commun.,arXiv: 0803.0462
www.le.infn.it/candia
• T.Binoth et al., Eur. Phys. J. C16 (2000) 311
• Z.Bern et al., Phys. Rev. D66 (2002) 074018

## Corrections to Drell-Yan leptoproduction on the Z, Z' resonances and QCD indetermination
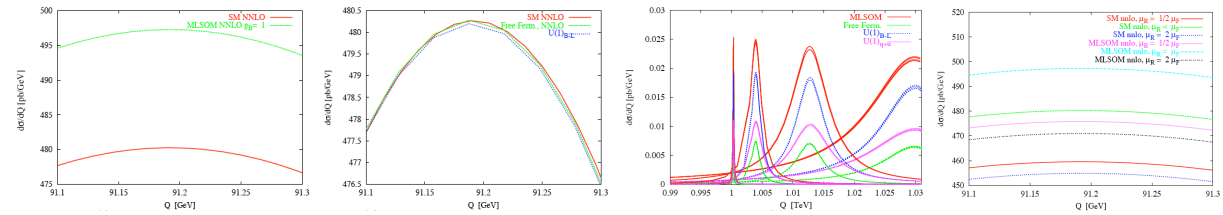


Zoom on the Z and Z' resonances for DY with $\mu_F = \mu_R = Q$ at NNLO for all the models at $\sqrt{S}=14$ TeV and $M_1=1$ TeV. The difference between MLSOM and the anomaly-free models is about 3.5% (left). Nevertheless the dependence on factorization $\mu_F$ and renormalization $\mu_R$ scales induces changes of about 4% in the SM case at NNLO and about 3.5% in the MLSOM (right). We assume $\tan\beta$, $g_B$, $M_1$ and $M_\chi$ as free parameters.

## Anomalous Corrections to Di-Photon
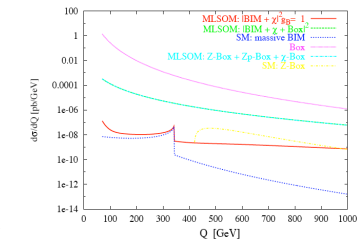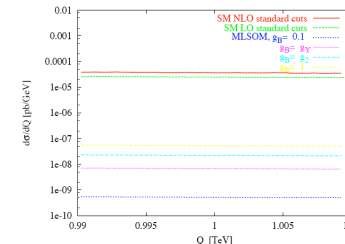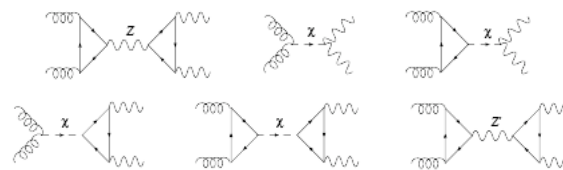


The anomalous contributions to Di-Photon at $\sqrt{S}=14$ TeV and $M_1=1$ TeV for different couplings are down by a factor of $10^3 - 10^7$ respect to the SM background (left). The isolated anomalous contributions to the gg sector are down up to $10^5$ respect to the dominant box contributions of the SM background (right). We assume $\tan\beta$, $g_B$, $M_1$ and $M_\chi$ as free parameters.

## Conclusions

*Anomalous effects are found to be very small, below the percent level. As the presence of an extra Z ' is ubiquitous in model building, the difference among the various constructions may remain unresolved, unless additional physical requirements are imposed in order to strengthen the possibility for their unique identification. The correlation of the anomalous effects with the axion resonance is the possible way to isolate the class of anomalous models from the anomaly-free ones*