Uncovering Unparticles: Underpaid Untheorist's Unextorted Unpolished Understanding

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Experimental Issues

- Realistic simulations:
  - Can one use large ED generators?
- Monojets and monophotons:
  - Instrumental backgrounds
  - Good understanding of ME_T tails
- Virtual exchanges:
  - Clean signature
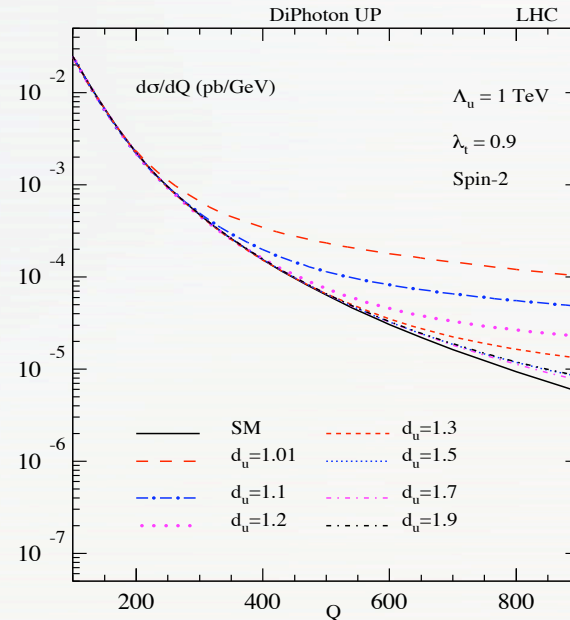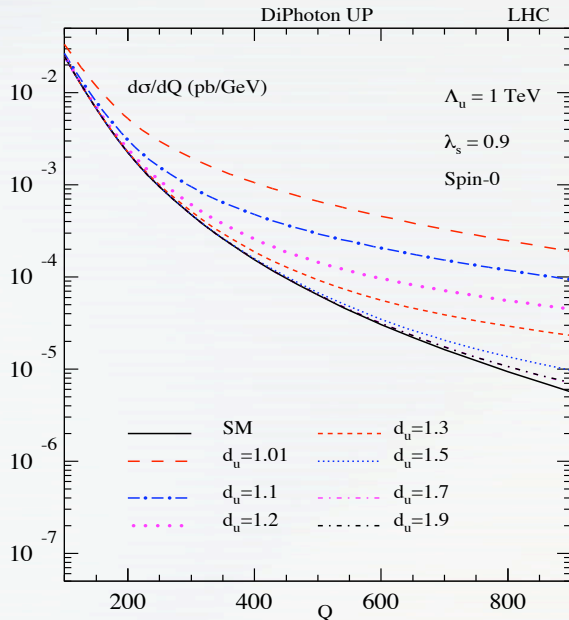 - If a signal found, how to distinguish from generic compositeness operator?

$$\mathcal{L}_{4f} = \frac{4\pi}{\Lambda^2} \sum_{\alpha,\beta=L,R} \eta_{\alpha\beta}(\bar{e}\gamma_\mu P_\alpha e)(\bar{f}\gamma^\mu P_\beta f)$$

[K.Cheung et al. arXiv:0710.2230]

$$\lambda_1^2 Z_{d_\mathcal{U}} \frac{1}{\Lambda_\mathcal{U}^2} \left(-\frac{P_\mathcal{U}^2}{\Lambda_\mathcal{U}^2}\right)^{d_\mathcal{U}-2} = \frac{4\pi}{(\Lambda^{95})^2}$$

  - Generally different energy dependence

Unissues

- Well-defined operators, easy to calculate:

[Rizzo, arXiv:0706.3025]

DiPhoton UP   LHC

dσ/dQ (pb/GeV)

$\Lambda_u = 1$ TeV

$\lambda_s = 0.9$

Spin-0

SM
$d_u=1.01$
$d_u=1.1$
$d_u=1.2$
$d_u=1.3$
$d_u=1.5$
$d_u=1.7$
$d_u=1.9$

DiPhoton UP   LHC

dσ/dQ (pb/GeV)

$\Lambda_u = 1$ TeV

$\lambda_t = 0.9$

Spin-2

SM
$d_u=1.01$
$d_u=1.1$
$d_u=1.2$
$d_u=1.3$
$d_u=1.5$
$d_u=1.7$
$d_u=1.9$

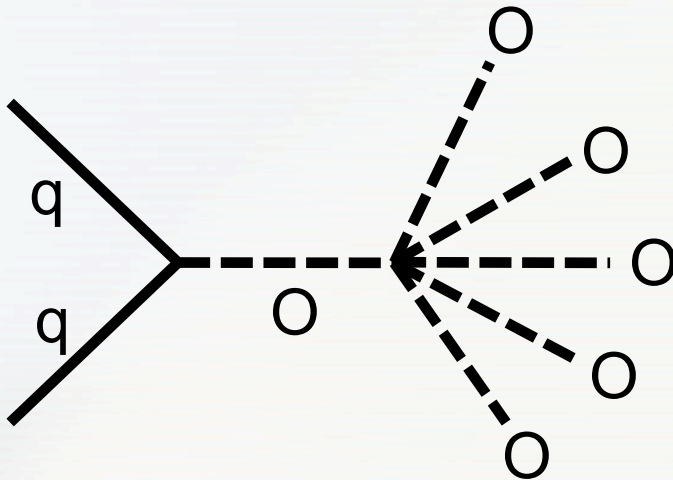[Kumar/Matthews/Ravindran/Tripathi, arXiv:0709.2478]
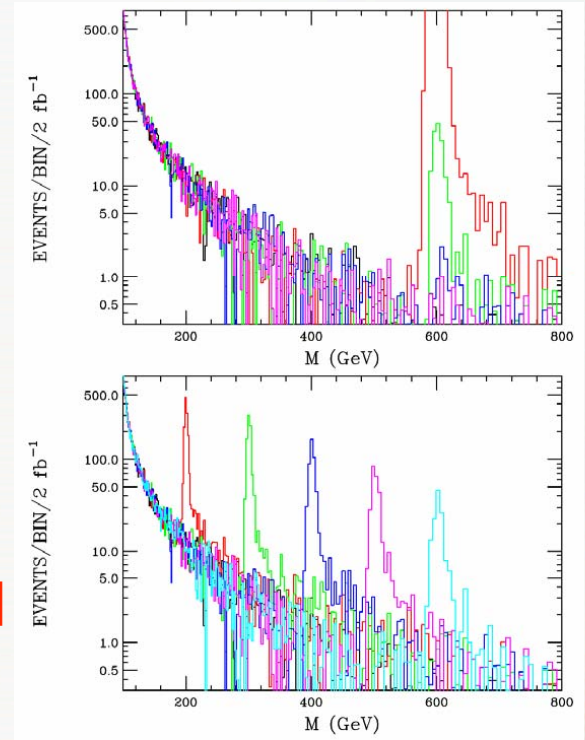
- Detection:

  – Many studies can be boot-strapped from generic searches for extra dimensions

- Triggering: high-p_T objects or large ME_T

Interesting signatures

- Photon/lepton mutiplicity vs. jet multiplicity in generic high-p_T events
  - QCD: $N(k\gamma)/N(kj) \sim 10^{3k}$
  - Unparticles: $N(k\gamma)/N(kj) \sim 10^{\alpha k}$, $\alpha \ll 1$

[Feng/Rajaraman/Tu, 2007]

- "Funny" jets