Electroweak Physics and Beyond the SM Session

Conveners:

SM, Jadranka Sekaric, Xiaochao Zheng

Summary: Theory Talks

Sonny Mantry

DIS 2011, Newport News, VA

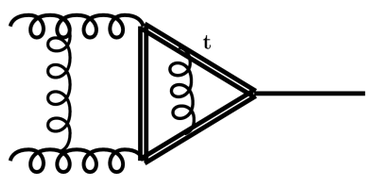
Topics Covered

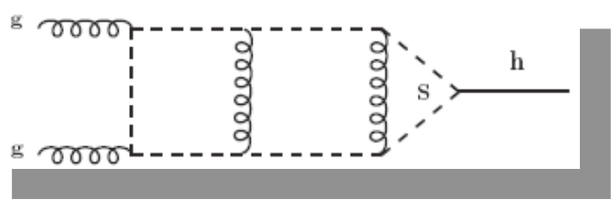
- Constraining new colored physics from Higgs exclusion bounds
  (Radja Boughezal)
- Boosting BSM Higgs discovery with jet substructure
  (Adam Martin)
- Discovery in Drell-Yan processes at the LHC
  (Neil Christensen)
- Weak mixing angle at a future Electron-Ion Collider
  (Yingchuan Li)
- Anomalous gauge boson couplings
  (Christophe Royon)
- Top quark cross-sections and differential distributions
  (Nikolaos Kidonakis)
- Radion Diphoton Signals in Little Randall-Sundrum Models
  (Thomas McElmurry)
- Z' models from E(6): Collider and electroweak constraints
  (Jens Erler)
- Flavor in in Type-III Two Higgs Doublet Models
  (Andrew Blechman)
- Flavored Dark Matter
  (Jen Kile)
- Fourth Generation Leptons
  (Linda Carpenter)

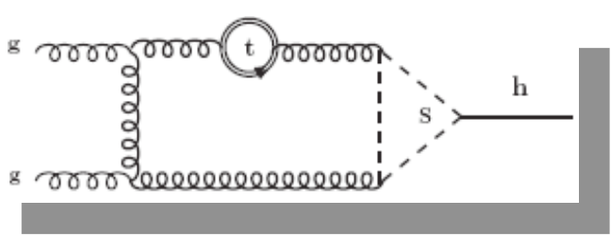
Constraining Colored Scalars from Higgs Exclusion bounds

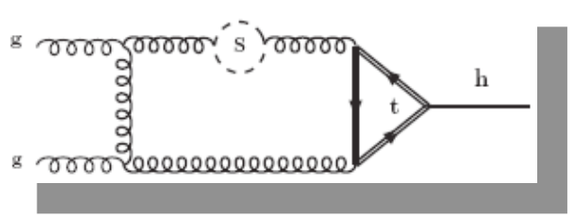
(Radja Boughezal)

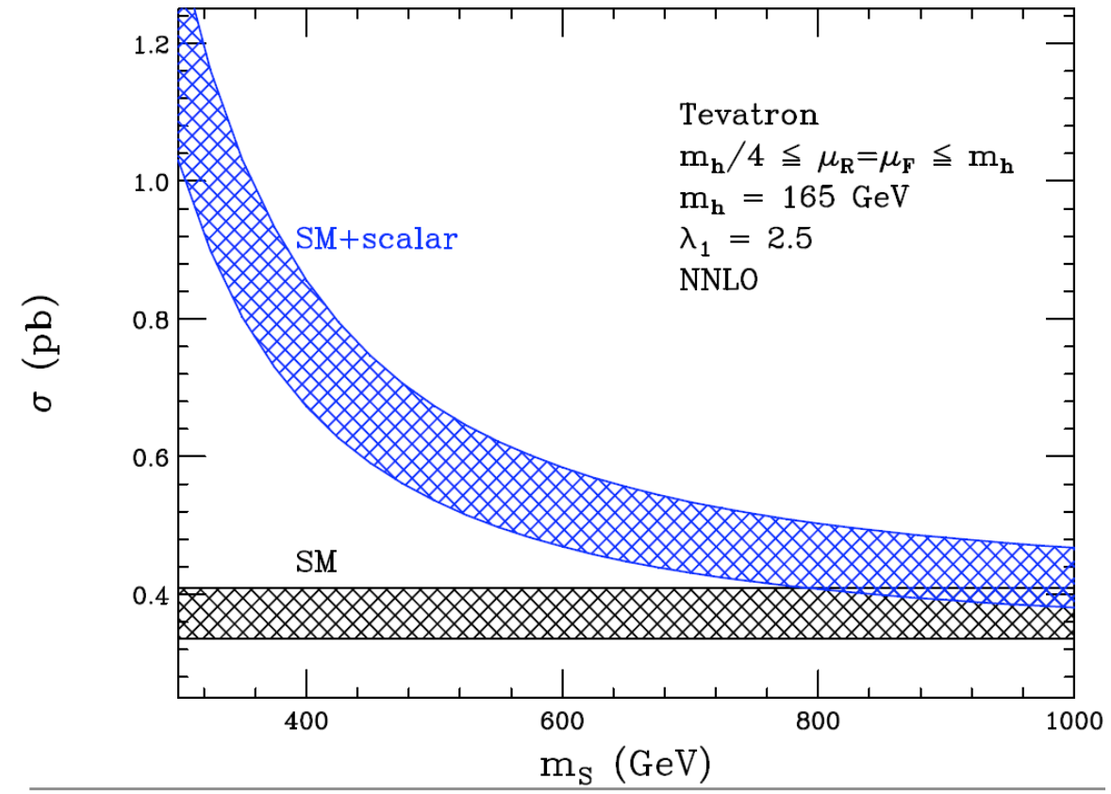
- Higgs production sensitive to new colored scalars. NNLO corrections computed.

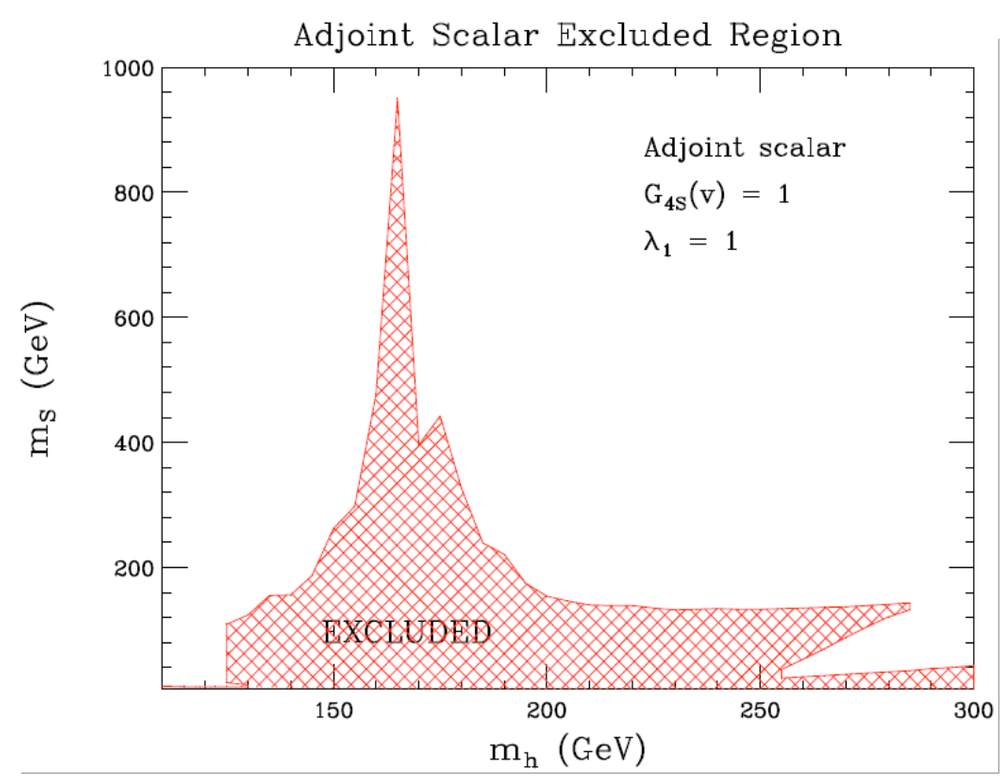






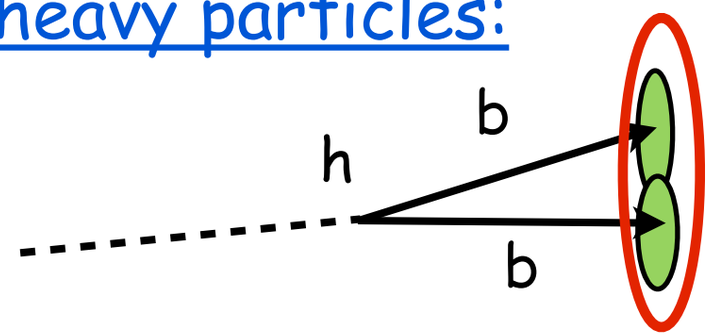






Boosting BSM Higgs searches:

for highly boosted heavy particles:

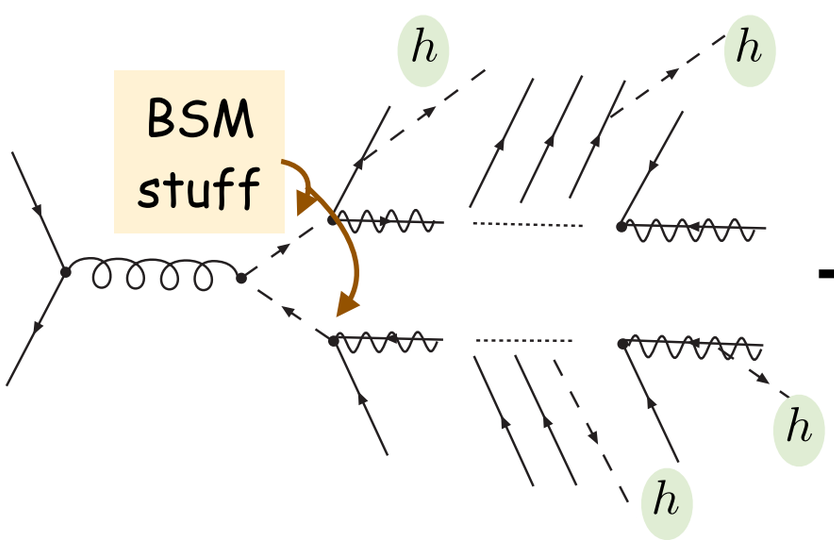


high jet mass, **jet substructure** allow efficient S vs. B discrimination

(Butterworth et al 0802.2470)

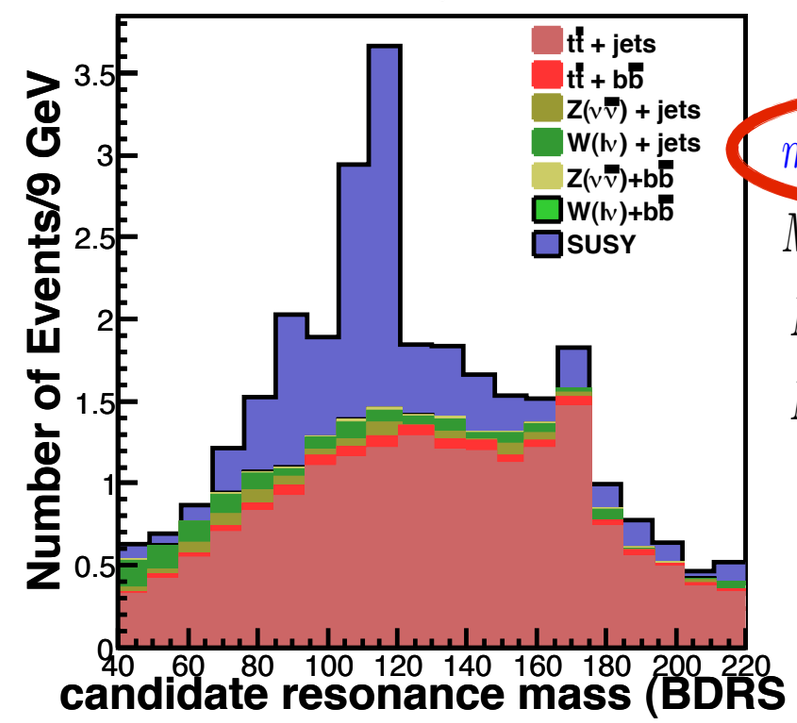
BSM decays are a source of **boosted Higgses**

ex.) Higgses from SUSY decays



+ **substructure** techniques =

7 TeV, 1 fb^{-1} !!



$m_H = 115\,\mathrm{GeV}$

$M_Q = 700\,\mathrm{GeV}$

$M_1 = 350\,\mathrm{GeV}$

$M_2 = 250\,\mathrm{GeV}$

$M_3 = 1.5\,\mathrm{TeV}$

$\mu = 170\,\mathrm{GeV}$

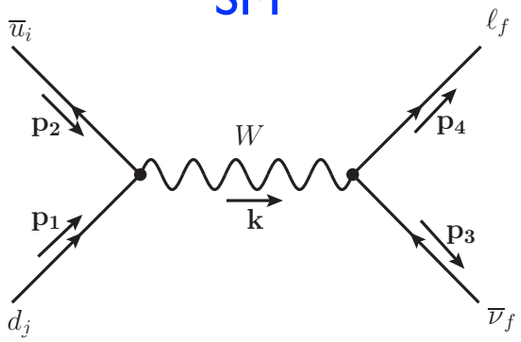
a **great** way to find light Higgses!

Adam Martin (aomartin@fnal.gov)

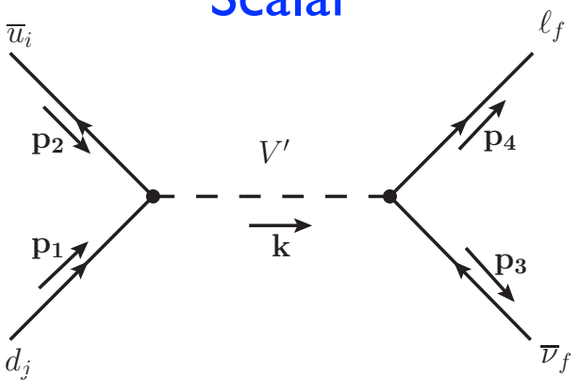
New Physics in Drell-Yan

(Neil Christensen)

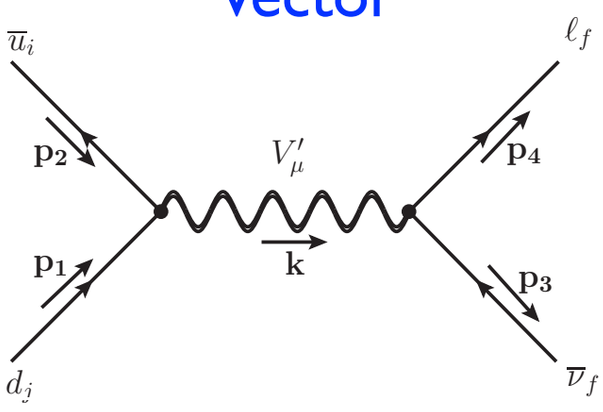
SM

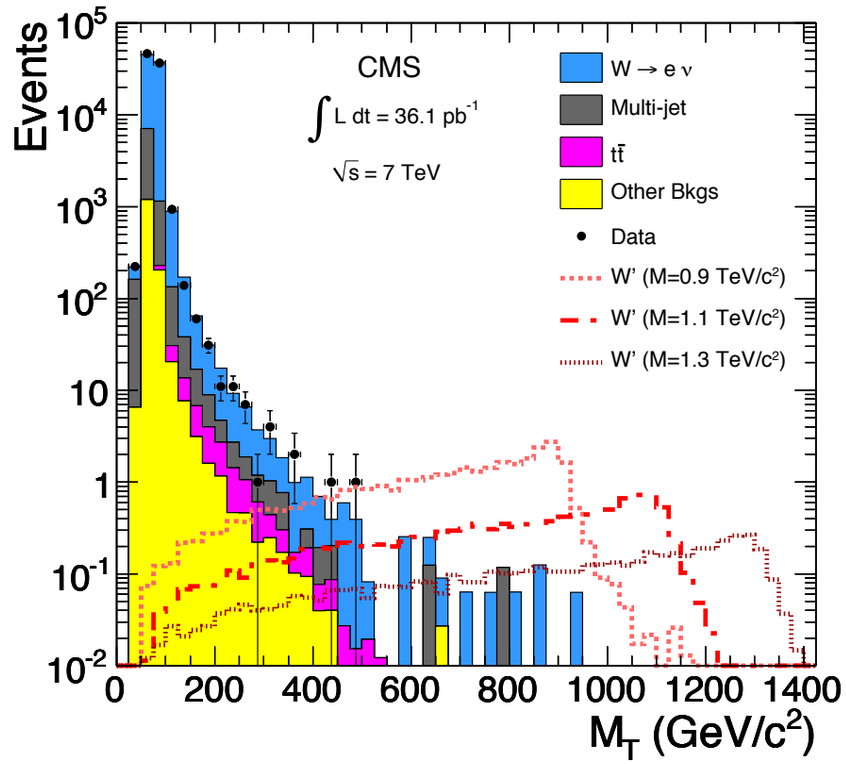


Scalar

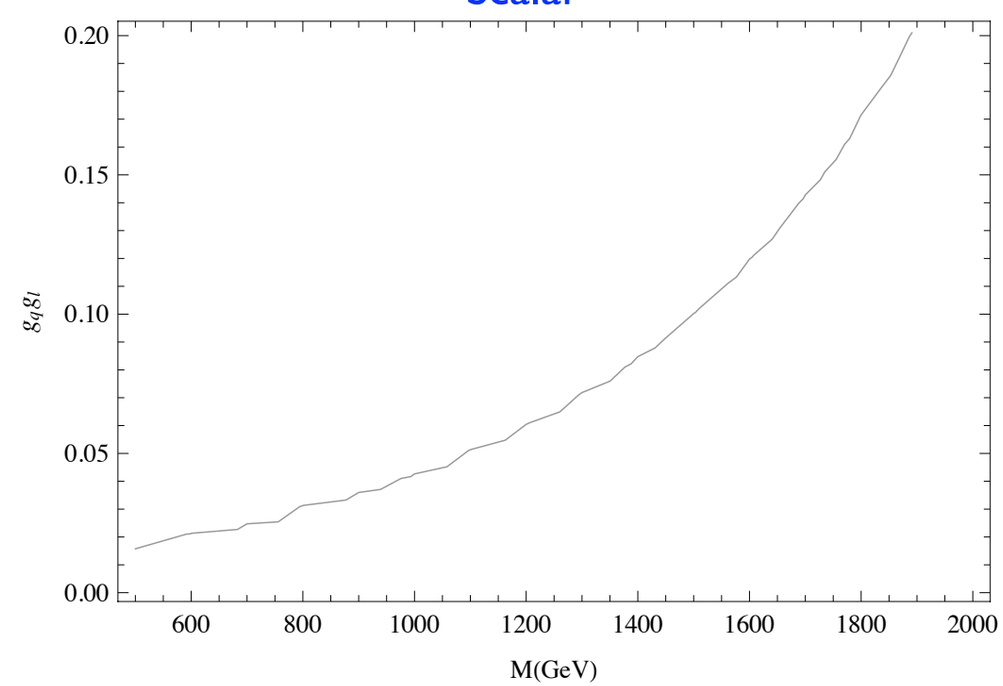


Vector





Scalar

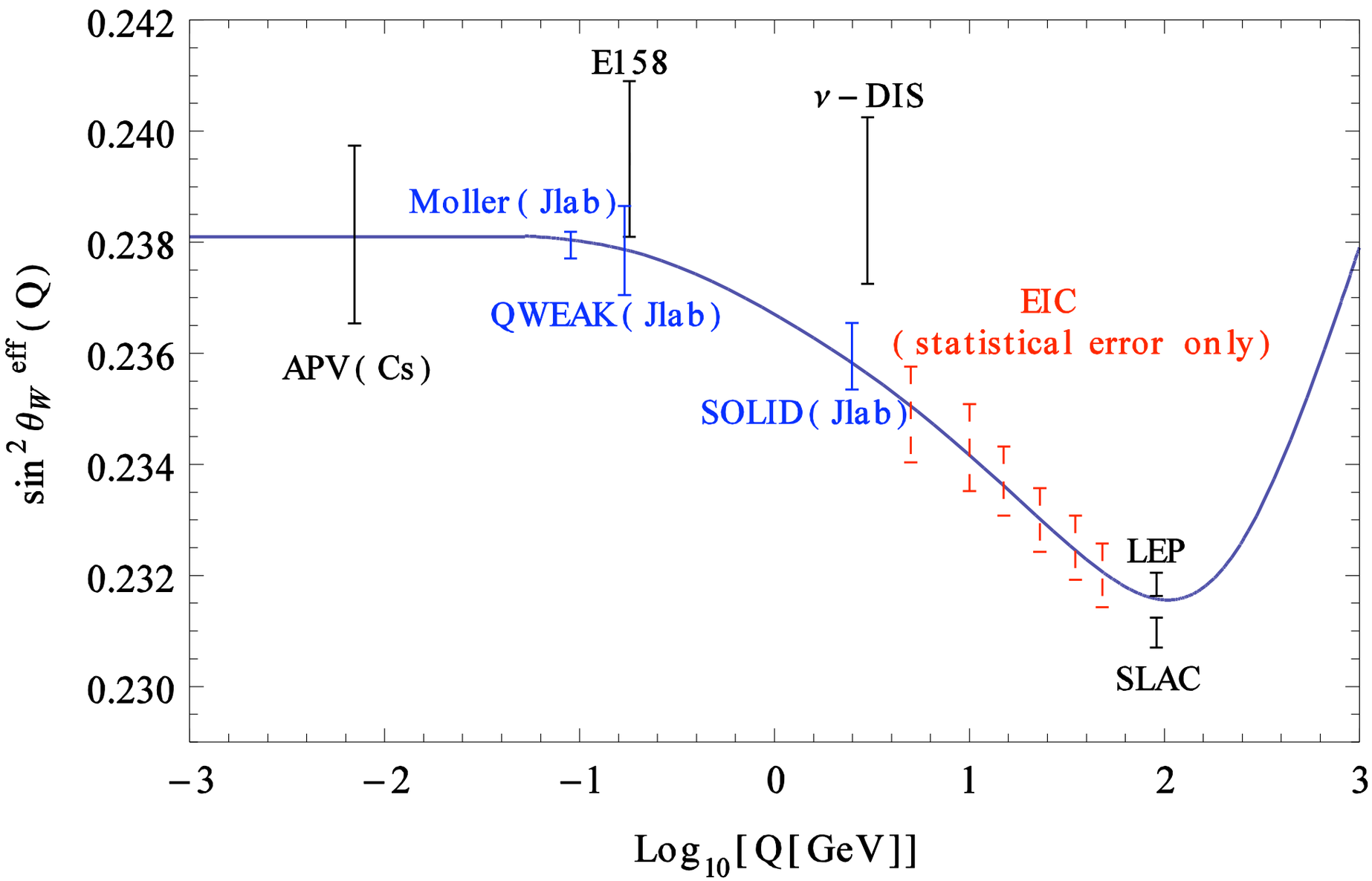


- New data from the LHC can already constrain models with new scalar, vector, or tensor particles.

- If new particles are discovered in Drell-Yan, novel techniques can be applied to determine the spin.

Past, currently planed, and EIC experiments:

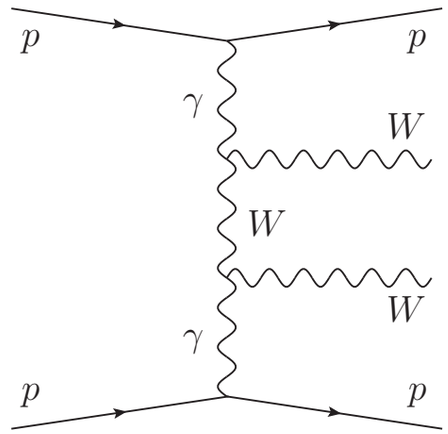
- Weak mixing probed at wide range of Q at EIC:



(Yingchuan Li)

WW/ZZ anomalous quartic coupling at the LHC

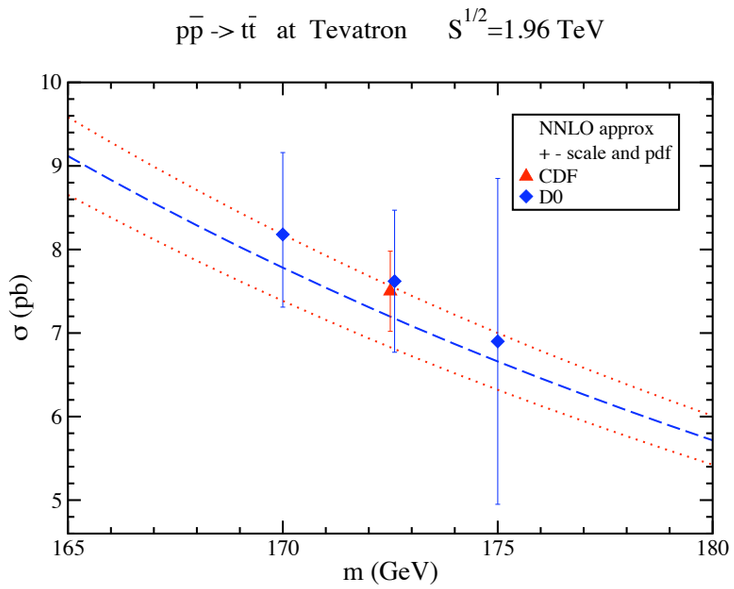
(Christophe Royon)

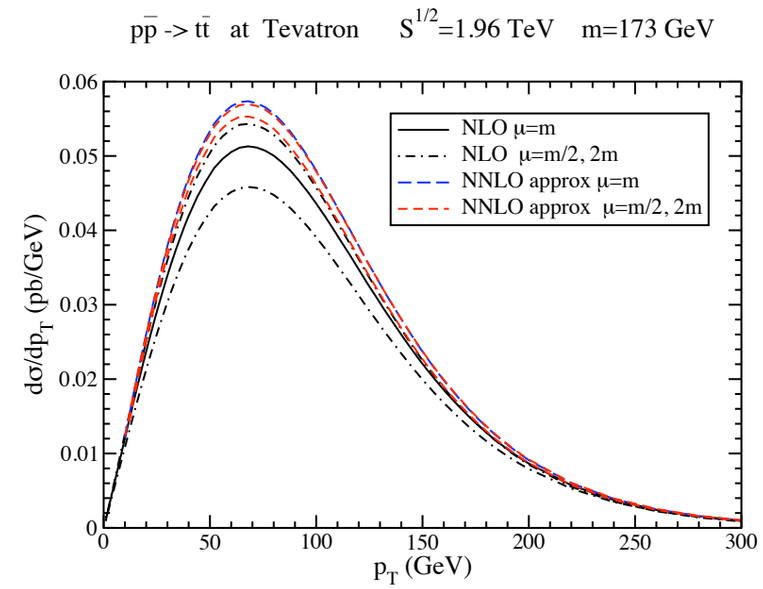


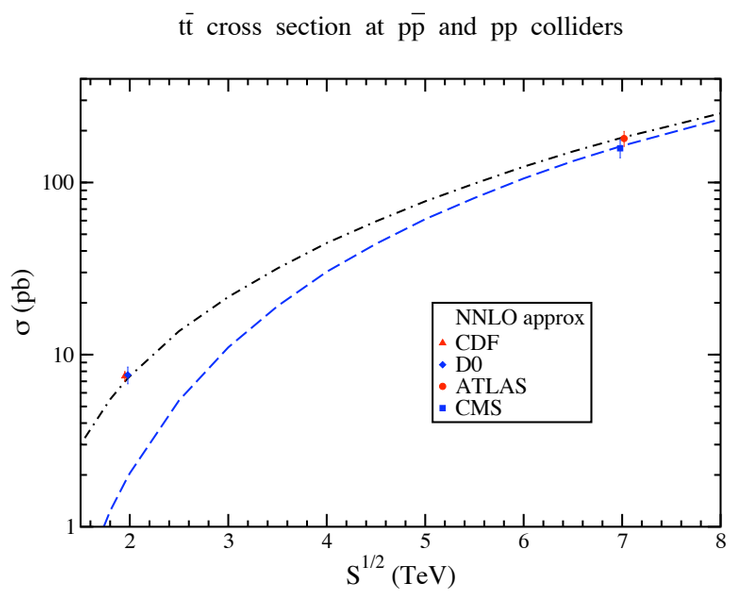
Couplings	OPAL limits [GeV^{-2}]	Sensitivity @ $\mathcal{L} = 30$ (200) fb^{-1} 5σ	95% CL
a_0^W/Λ^2	[-0.020, 0.020]	5.4 10^{-6} (2.7 10^{-6})	2.6 10^{-6} (1.4 10^{-6})
a_C^W/Λ^2	[-0.052, 0.037]	2.0 10^{-5} (9.6 10^{-6})	9.4 10^{-6} (5.2 10^{-6})
a_0^Z/Λ^2	[-0.007, 0.023]	1.4 10^{-5} (5.5 10^{-6})	6.4 10^{-6} (2.5 10^{-6})
a_C^Z/Λ^2	[-0.029, 0.029]	5.2 10^{-5} (2.0 10^{-5})	2.4 10^{-5} (9.2 10^{-6})

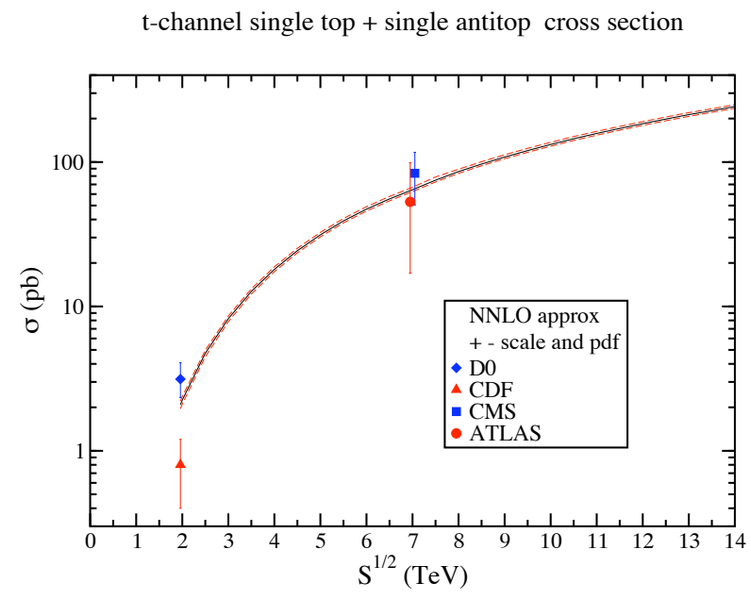
- Improvement of LEP sensitivity by more than 4 orders of magnitude with 30/200 fb^{-1} at LHC!!!
- Reaches the values predicted by Higgsless/extradimension models
- Without AFP: these values cannot be reached, only gain of two orders of magnitude by studying $pp \to l^{\pm}\nu\gamma\gamma$, see ArXiv 0907.5299

NNLO approx from NNLL resummation for top pair and single top production





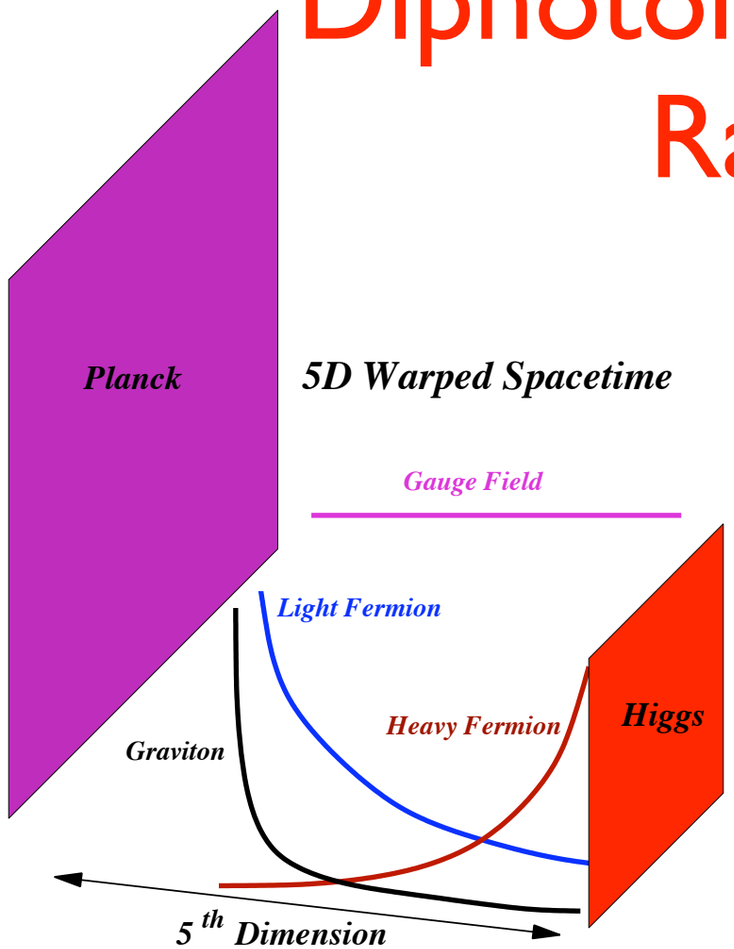




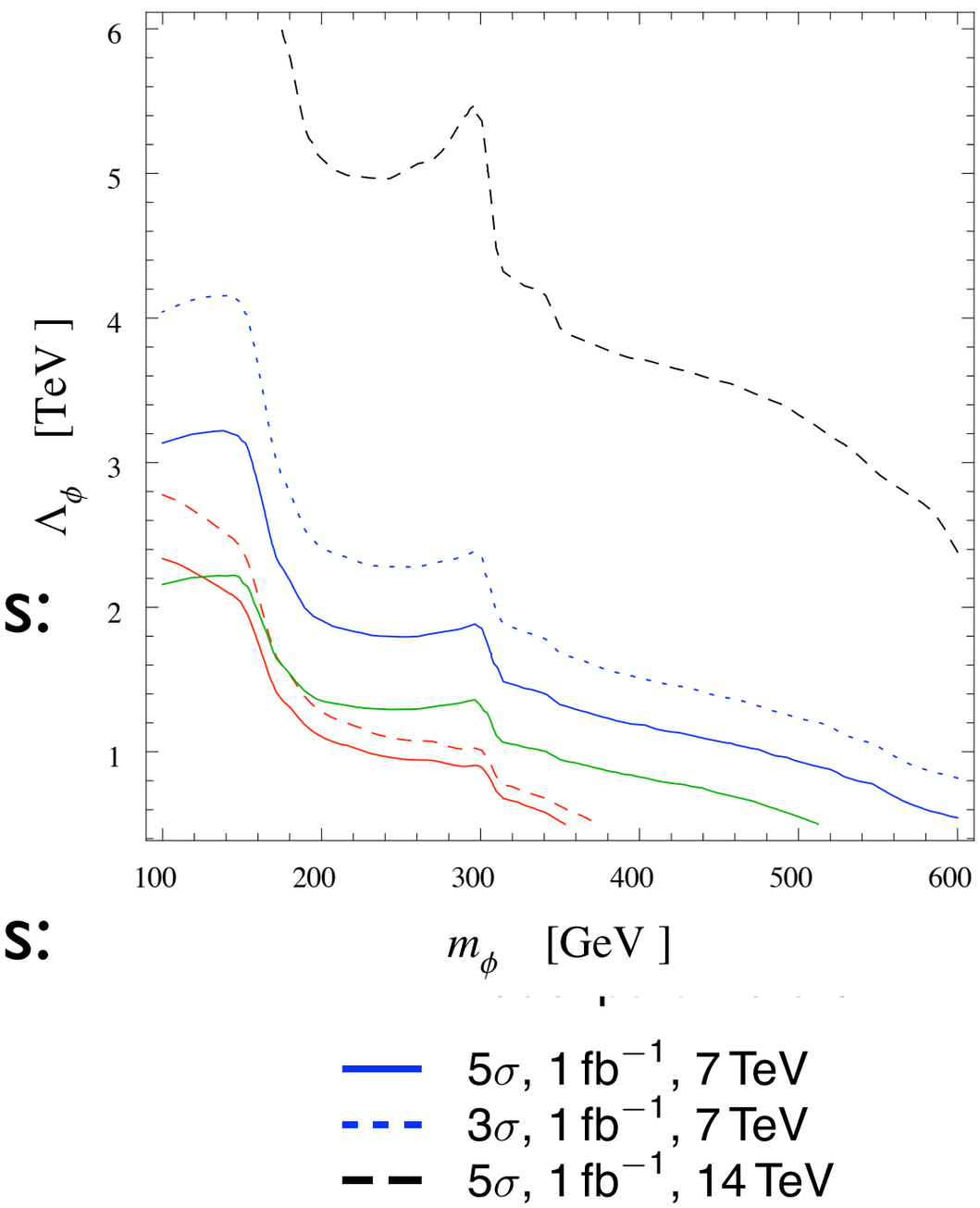
NNLO approx corrections are significant for $t\bar{t}$ production, s- and t-channel single top, $bg \to tW^-$ and $bg \to tH^-$, and top quark p_T and rapidity distributions

scale dependence reduced

Diphoton signals of the Radion in Little Randall Sundrum Models (Thomas McElmurry)



- Extra Dimension as a dynamical model of flavor.



- Enhanced radion coupling to photons:

$$\mathcal{L}_A = -\frac{1}{4\Lambda_\phi kL}\left[1 + \frac{\alpha_G}{2\pi} b_G kL\right] \phi F_{\mu\nu} F^{\mu\nu}$$

- Enhanced radion coupling to photons:

$$gg \to \phi \to \gamma\gamma$$

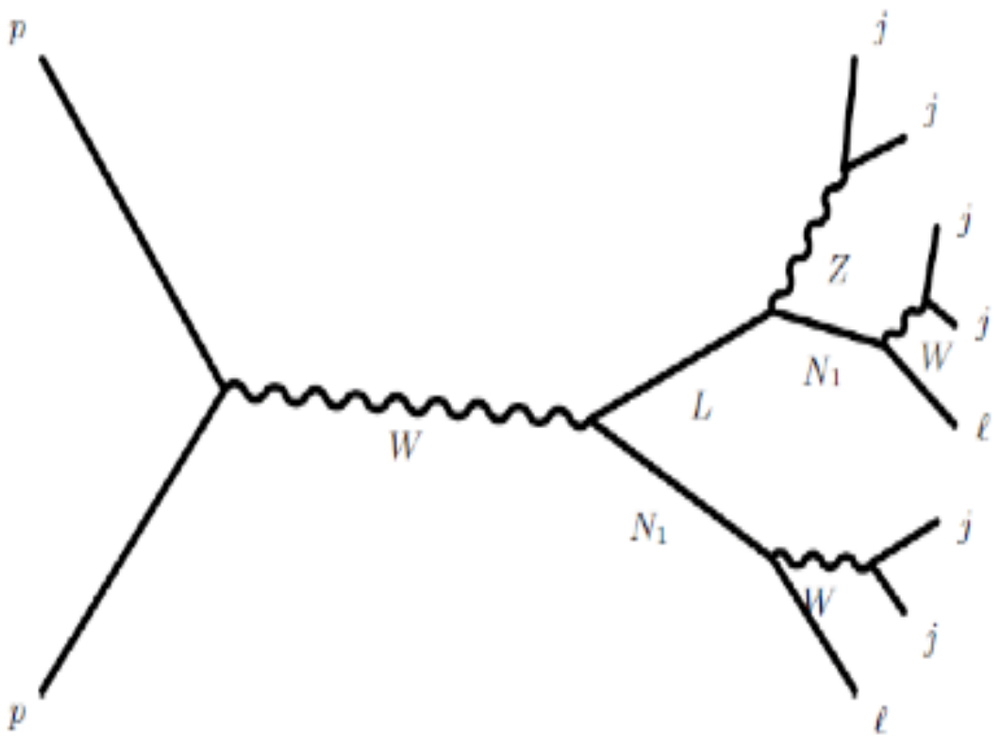
FOURTH GENERATION LEPTONS

Most General Fourth Generation Lepton Sector consists of a charged lepton and two Majorana neutrinos

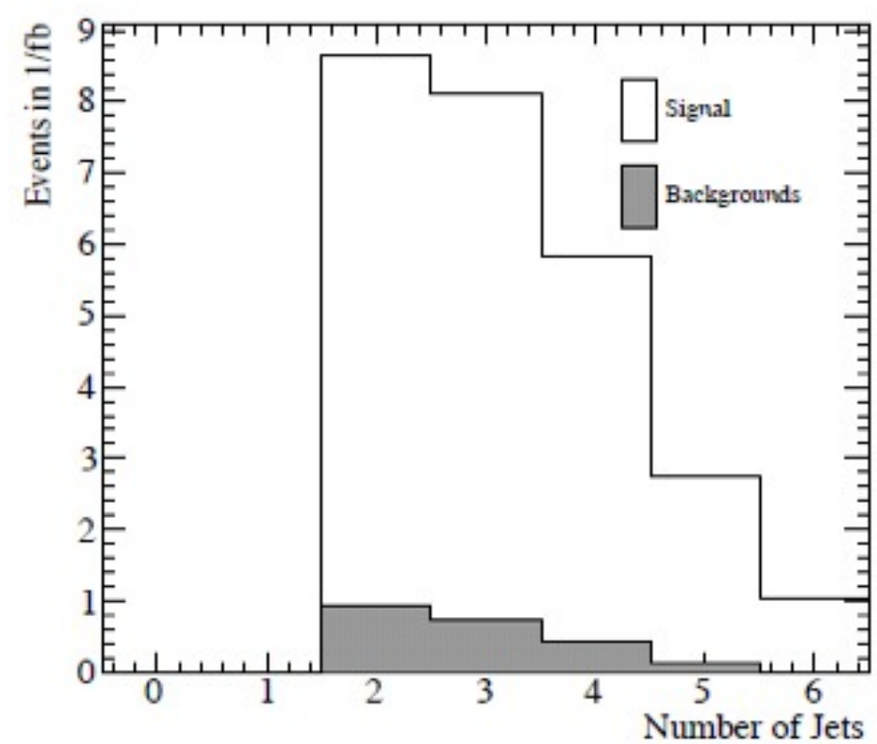
(Linda Carpenter)

$$L_m = m_1 \bar{N}_1 N_1 + m_2 \bar{N}_2 N_2 + \sum_{i=1}^{4} m_e^i \bar{L}_i E_{Ri}$$

Taxonomy of decays is interesting, with multi-particle final states and like-sign dileptons from Majorana neutrino decay e.g.



Some decays are visible to LHC in The first inverse fb of data



Flavored Dark Matter (J. Kile)

Flavor, DM both require BSM physics. Related?

Investigated flavor interactions between DM and s, d quarks.

Extremely rich phenomenology:

- K decays: probe NP scales of $40 - 80$ TeV if DM light ($\lesssim 180$ MeV).
- DM Direct Detection: probes NP scales $O(1 - 10\ \text{TeV})$; possible inelastic scattering signatures.
- $K - \bar{K}$ mixing: sensitive to DM mass splittings and mixing angles.
- Monojet, other Z' signatures at LHC.

And many more possibilities!