LHCP POSTER SESSION – BOLOGNA, JUNE 2018

Search for resonant WZ production in the fully leptonic final state in proton-proton collisions at \(\sqrt{s} = 13\) TeV with the ATLAS detector

**Motivation**
- Search for resonant WZ production in the fully leptonic final state \((\ell\ell, \text{where } \ell = e, \mu)\) in exclusive q\(\bar{q}\) and VBF production modes
- Diboson vector and scalar resonances predicted by models like Composite Higgs models, Grand Unified Theories, theories with extra dimensions etc.
- Study two benchmark models:
  - Vector: Heavy Vector Triplets (HVT): \(W'\) [D. Pappadopulo et al., JHEP 09 (2014) 060]

**Production modes**
- Vector-boson fusion mode
- q\(\bar{q}\)-fusion mode

**Signature**
- 3 high \(p_T\) charged leptons
- Missing transverse energy
- VBF-category:
  - Two jets with large \(\eta\) separation
  - and high invariant mass
- q\(\bar{q}\)-category:
  - Falls VBF selection

**Object and event selection**
- Single lepton trigger
- 3 high \(p_T\geq25\) GeV isolated leptons
- 4\(^\text{st}\) jet veto \((p_T>7\text{ GeV})\) to reduce ZZ background
- \(Z\) selection:
  - Pair of same flavour, opposite sign leptons
  - Consistent with \(Z\) boson mass in a \(120\) GeV window
- \(W\) selection
  - Third lepton
  - MET > 25 GeV
- VBF category:
  - Use of jet vertex tagger to mitigate pile-up contamination
  - B-jet veto
  - Event selection:
    - \(q\bar{q}: p_T^f/m_{WZ}>0.35\) and \(p_T^{\ell}/m_{WZ}>0.35\)
    - VBF: 2 jets with \(m_{jj} > 500\) GeV and \(\Delta m_{jj} > 3.5\)
    - Reconstruct invariant \(WZ\) mass using MET, the third lepton and known \(W\) mass

**Background estimation**
- Dominant background: Standard Model production of WZ
- Normalization and shape are estimated from Monte Carlo (MC)
- Other smaller background estimated with MC
- \(t\bar{b}V\), ZZ, \(Z\), \(VVV\), WZ+\(b\bar{b}\)
- Events from backgrounds (2\(\ell+\)jets, \(Z\), \(W\), \(t\bar{b}\), single top or \(WW\)) where jets are misidentified as leptons (fake/non-prompt leptons) are estimated by a data-driven method using a global matrix method

**Acceptance x Efficiency**

**Validation regions**
- Invert q\(\bar{q}\) and VBF selection cuts
  - \(q\bar{q}: p_T^f/m_{WZ}<0.35\) and \(p_T^{\ell}/m_{WZ}<0.35\)
  - VBF: \(100 < m_{jj} < 500\) GeV and \(\Delta m_{jj} < 3.5\)
- Good agreement in both categories

**Results**
- Limit obtained using a binned likelihood function built from a sum of Poisson probabilities of the background distribution and a hypothetical signal
- Fit is performed separately for VBF- and q\(\bar{q}\)-categories

**Dominant systematics**

**Signal regions**

**Conclusion**
- First results for resonant WZ production in q\(\bar{q}\)- and VBF-Category using 36.1 \(fb^{-1}\) of \(\sqrt{s} = 13\) TeV data collected by ATLAS
- Limits are obtained as a function of the mass of a charged member of a heavy vector triplet or of the fiveplet scalar in the Georgi-Machacek model
- The largest deviation from the background prediction appears in the VBF-category at a resonance mass of around 450 GeV, this corresponds to a local (global) significance for \(h_2^2\) signals of 2.9 (1.6) and for heavy vector \(W'\) signals of 3.1 (1.9)