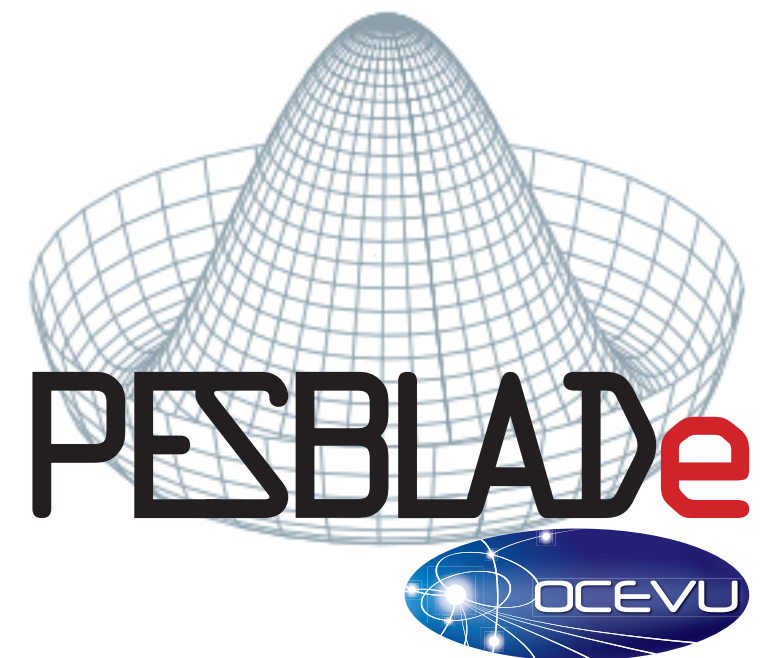


# Probing the nature of Electroweak Symmetry Breaking at the LHC with the ATLAS detector

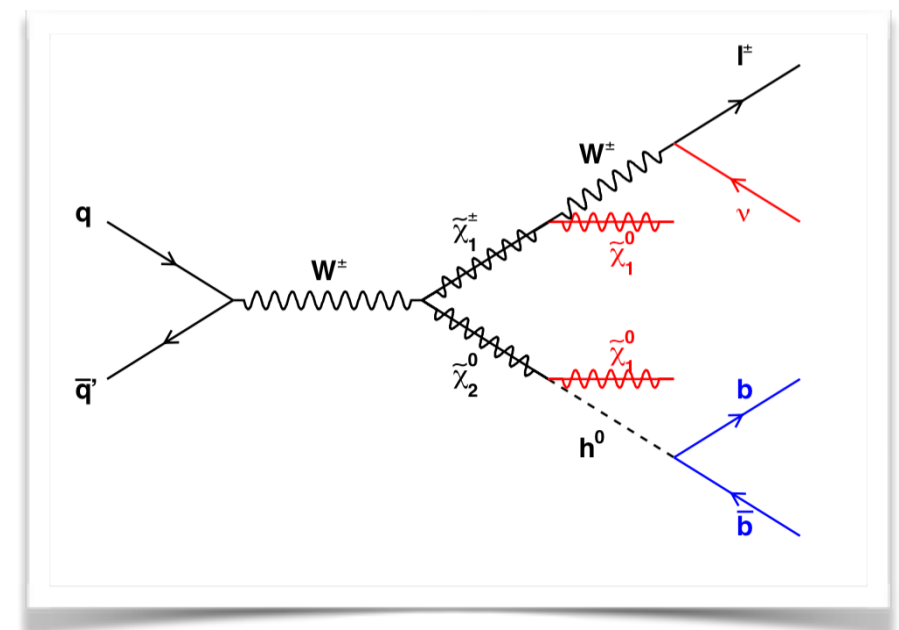
- Collaborative project among ATLAS experimentalists and IFAC pheno group
  - Investigating Run 2 discovery reach for interesting BSM physics models
    - Experimental final states where ATLAS-CPPM has leading role
    - Models of EWSB at TeV scale investigated at IFAC
  - Developing pheno tools to interpret experimental results
- Weekly meetings by video <https://indico.in2p3.fr/category/661/>
  - Mailing list 22 subscribers [OCEVU-P04-L@IN2P3.FR](mailto:OCEVU-P04-L@IN2P3.FR)



## Electroweak production of SUSY

- SUSY well motivated theory BSM: dark matter, etc.
  - Authorship at IFAC of SUSPECT: SUSY mass spectrum generator
- SUSY, if R-parity is conserved, could result in striking signatures at LHC
  - Electroweak production dominant for large sgluino masses
- S. Muanza [CPPM], J.-L. Kneur [L2C], R. El Kosseifi [CPPM, **PhD Oct 2015**]
  - SUSPECT: Inverted bottom up procedure from physical masses to constraint SUSY parameters in the Higgs and stop sector.
  - Preparation of Run 2 analysis based on Run 1 search for chargino production CPPM-ATLAS.

Search for chargino neutralino in final states with lepton,  $h(bb)$  and MET with ATLAS in Run 2

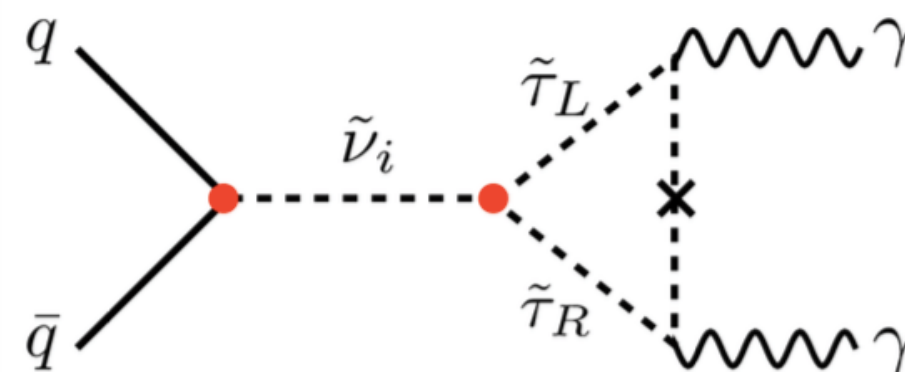


# Probing the nature of Electroweak Symmetry Breaking at the LHC with the ATLAS detector

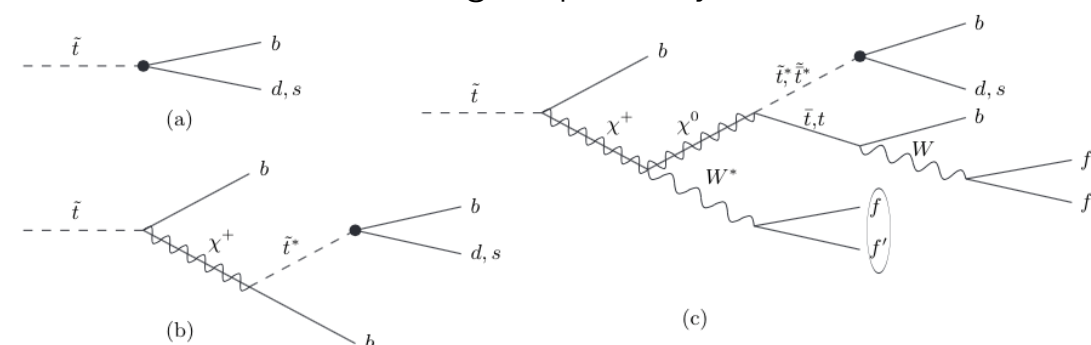
## Search for RPV stop production

- RPV viable SUSY model:
  - Strong experimental constraints for many RPC models
  - Light stop squarks could be hidden if SUSY RPV
- S. Diglio [CPPM, **PD Jan 2014-Apr 2015**], G. Moulaka [L2C], L. Feligioni [CPPM], L. Basso [CPPM, **PD Jan Sep 2015-Apr 2016**], N. Hoani Dai [M2, CPPM]
  - Findings: stop production in different RPV models leads to large b-jet multiplicity final states
    - final states with associated top and b-quarks production similar ttH where the CPPM has a leading role in ATLAS.
  - First simulated analysis to assess ATLAS Run 2 sensitivity
- Run 2 analysis start at the end of the summer
  - First finalization of Run 2 ttH analysis
  - In process of hiring 1 experimental PD

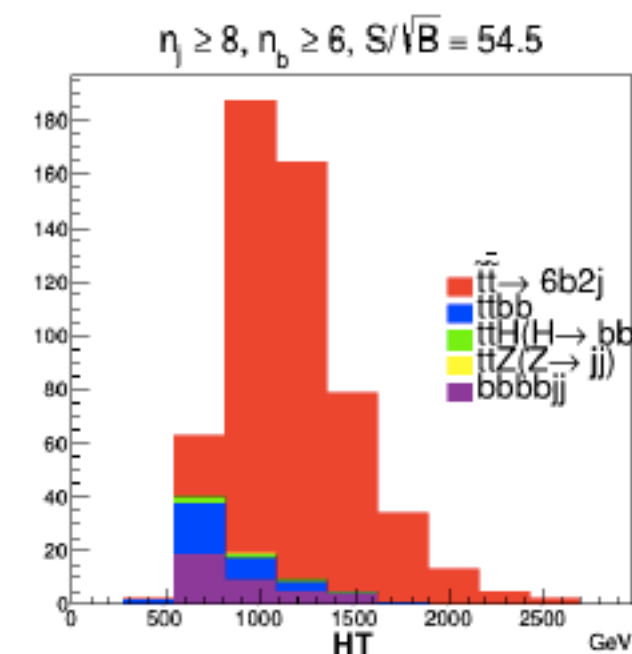
di-photon production from resonant neutrino production



leading stop decays



sensitivity at  $L = 100 \text{ fb}^{-1}$  for  
 $m_{\text{stop}} = 600 \text{ GeV}$   $m_{\chi} = 500 \text{ GeV}$



# Probing the nature of Electroweak Symmetry Breaking at the LHC with the ATLAS detector

## Doublet-triplet extension of the SM

- After Run 1 searches  $H^{++} \rightarrow WW$  still viable probe of extended Higgs sector
- V. Ellajosyula [CPPM, **PhD Oct 2014**], C. Diaconu [CPPM], Y. Liu [USTC], R. Zhang [USTC], L. Basso [CPPM, **PD Oct 2015-Apr 2016**], G. Moutaka [L2C]
- Implementation of the model in CalcHEP, Scan of parameter space, Generation of events
  - Pheno paper in preparation
- Simulation of the ATLAS detector, Model sensitivity and prospect study for Run-2 at the LHC.

$$H^{\pm\pm} H^{\mp\mp} \rightarrow 4W \rightarrow 3\ell + E_T^{miss} + 2j$$

$$H^{\pm\pm} H^{\mp\mp} \rightarrow 4W \rightarrow 2\ell^{ss} + E_T^{miss} + 4j$$

- Analysis ongoing in collaboration with visiting scientists at USTC
- Aiming at Short Term Association

