Measurement of the electroweak cross-section for a same-sign W boson pair produced in association with two jets using 139 fb^{-1} of ATLAS data

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Abstract

Within the Standard Model (SM), weak vector bosons are allowed to be massive as a result of the spontaneously broken electroweak symmetry which is said to have been caused by a phase transition of the Higgs potential in the early universe [1]. However, there are still many unanswered questions surrounding the nature of this spontaneously broken electroweak symmetry. By probing the inner structure of electroweak interactions via measurements of the scattering of weak vector bosons at the Large Hadron Collider (LHC), we expect to have some answers. A deviation of these measurements from SM predictions would be indicative of the involvement of new physics. One important process used to probe the inner structure of electroweak interactions is the scattering of two same-charge W bosons. This is an extremely rare process within the SM, which was only observed for the first time about five years ago at a significance of 6.9σ [2] and 5.5σ [3] by the ATLAS and CMS experiments respectively. In ATLAS, the cross-section for this process was measured to be $2.91^{+0.51}_{-0.47}(stat.) \pm 0.27(sys.)$ fb using only 36.1 fb^{-1} of data collected at a $p-p$ center of mass energy of 13 TeV in Run II of the LHC. The large statistical uncertainties observed on this measurement are a consequence of the low statistics on the dataset used. Therefore, precision measurements have followed - utilizing the full Run II ATLAS dataset which amounts to 139 fb^{-1}. This contribution will present the latest cross-section measurement for the electroweak production of a same-sign W boson pair in association with two jets using 139 fb^{-1} of data collected by ATLAS. A model-independent interpretation of these results in the search for a doubly charged Higgs boson produced in Vector Boson Fusion (VBF) processes will also be presented.

References

[1] P.W.Higgs, "Broken symmetries and the masses of gauge bosons," *Phy.Rev.Lett 13*, vol. 508, 1964.

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[3] CMS Collaboration, "Observation of electroweak production of same-sign w boson pairs in the two jet and two same-sign lepton final state in proton-proton collisions at $\sqrt{s} =$ 13 TeV," *Phys. Rev. Lett.*, vol. 120, p. 081801, Feb 2018.