

First Observation of the Production of a W Boson in Association with Two Photons in Proton-Proton Collisions at the Large Hadron Collider with the ATLAS Detector

Saturday, 17 February 2024 09:00 (15 minutes)

The ATLAS detector at Large Hadron Collider (LHC) at CERN has collected 140 fb^{-1} of proton-proton collisions over the course of the 2015-2018 data-taking period, allowing for some of the most stringent tests of the Standard Model of particle physics and new measurements of its parameters with unprecedented accuracy. This presentation details the first observation of the production of a W boson in association with two photons in proton-proton collisions. The production cross section of this process, mediated by triple and quartic gauge couplings between the W boson and the photon, is predicted and entirely determined by the Standard Model. It thus represents an important test of its validity and a unique opportunity to set limits on physics beyond the Standard Model. In addition, this process is a background to several important processes which will become accessible in the coming years as new data is collected from the LHC.

This measurement relies on the development of data-driven techniques to estimate several backgrounds to the $W\gamma\gamma$ process from misidentified particles in the ATLAS detector. In addition, a control region is used to constrain the background from top-quark decays in a simultaneous fit with the signal region. A significance of the $W\gamma\gamma$ process over background of 5.6 (5.6) standard deviations is observed (expected). The process is unfolded to particle level to obtain a fiducial cross section measurement of $\sigma_{\text{fid}} = 13.8 \pm 1.1(\text{stat}) \pm 2.1 - 2.0(\text{syst}) \pm 0.1(\text{lumi}) \text{ fb}$, in agreement with the latest Sherpa and MadGraph Next-to Leading Order Monte Carlo simulation samples.

Your Email

alessandro.ambler@mail.mcgill.ca

Supervisor

Brigitte Vachon

Supervisor Email

brigitte.vachon@mcgill.ca

Affiliation

Graduate Student

Your current academic level,

PhD student

Primary author: AMBLER, Alessandro (McGill)

Presenter: AMBLER, Alessandro (McGill)

Session Classification: Morning 3 - Feb. 17, 2024

Track Classification: Electroweak and Higgs Physics