



Contribution ID: 253

Type: Oral Presentation

## Investigating the excess of two same-sign and three lepton final states via four top quark production

*Friday, 7 July 2023 11:40 (20 minutes)*

Despite the discovery of the Higgs boson at the Large Hadron Collider (LHC) confirming the SM's predictions, additional scalar bosons may exist as long as their mixing with the SM Higgs is minimal. The 2HDM model with a singlet scalar extension has been shown to accurately explain multi-lepton anomalies at the LHC, where the heavy scalar has a mass of  $m_H \approx 270$  GeV, and the singlet scalar has a mass of  $m_S \approx 150$  GeV. The excess production of two same-sign leptons and three isolated leptons with  $b$ -jets has been observed by both the ATLAS and CMS experiments. This study focuses on the CP-odd scalar of the 2HDM+S model, the heavy pseudoscalar ( $A$ ), with a mass between 400-600 GeV. The heavy pseudoscalar primarily decays into  $t\bar{t}$ ,  $ZH$  resulting in four top quarks and four lepton final states. This research investigates the production of two same-sign and three leptons from four top quark final states produced by  $t\bar{t}A$  ( $A \rightarrow t\bar{t}, ZH$ ) and compares the production mechanisms of four top quarks in the SM and beyond the SM.

### Apply to be considered for a student ; award (Yes / No)?

Yes

### Level for award;(Hons, MSc, PhD, N/A)?

PhD

**Primary authors:** MATHAHA, Thuso (School of Physics, University of the Witwatersrand); MELLADO, Bruce (University of the Witwatersrand); Dr KUMAR, Mukesh (University of the Witwatersrand)

**Presenter:** MATHAHA, Thuso (School of Physics, University of the Witwatersrand)

**Session Classification:** Nuclear, Particle and Radiation Physics

**Track Classification:** Track B - Nuclear, Particle and Radiation Physics