Searches for Long-Lived Particles using Displaced Vertices and Missing Transverse Energy at the ATLAS Detector

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Particles with a lifetime of more than 10 picoseconds, called Long Lived Particles, are predicted in many Beyond-Standard Model physics models. One such model is in R-parity-violating supersymmetry, where baryon and lepton number are no longer conserved. Based on current experimental results, the coupling of these predicted particles to Standard Model particles must be incredibly small. Being long-lived, these particles decay at away from the initial interaction point, which creates a Displaced Vertex.

This analysis will use Run 3 data collected from the ATLAS Detector at CERN to improve on a 2017 analysis [1] with over 5 times the integrated luminosity, and a new vertex algorithm, significantly increasing the sensitivity to these long-lived particle decays.

This talk will give an overview of both the 2017 analysis, and a recently completed Run 2 analysis of displaced vertices with jets [2], to highlight where missing energy with additional data may be more sensitive to SUSY signals, or to help set limits on supersymmetric particle masses.

[1] K. DiPetrillo et al, *Search for long-lived, heavy particles using displaced multi-track vertices in 13 TeV pp collisions*

[2] The ATLAS Collaboration, *Search for long-lived, massive particles in events with displaced vertices and multiple jets in pp collisions at $\sqrt{s}$ = 13 TeV with the ATLAS detector*