

# Long Lived Particles (LLPs) And Large Language Models (LLMs): Two Stories

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Searches for long-lived particles (LLPs) continue to open new frontiers in collider physics, probing signatures that have traditionally been inaccessible to standard analyses. LLPs arise naturally in a wide range of theoretical frameworks—from extensions of the Standard Model and supersymmetry to hidden-sector models—and offer a powerful avenue to explore physics beyond the electroweak scale. This talk presents recent results from an ATLAS search targeting low-mass LLPs decaying within the calorimeter, motivated by hidden-sector scenarios with light mediator particles. The analysis expands the scope of previous work by incorporating novel production modes, including associated production with electroweak bosons, and by addressing LLP decays with low boosts that yield spatially separated jets. Axion-like particles (ALPs) are also included as part of an extended signal model set. In the second part of the talk, I will discuss recent developments in leveraging large language models (LLMs) for physics workflows—specifically, the automated generation of analysis code and plots directly from natural-language requests—highlighting their potential to accelerate and democratize data exploration in high-energy physics.