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MATHUSLA: A Proposed Detector for Long-Lived Particles at High-Luminosity LHC

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Long-Lived Particles (LLPs) beyond the Standard Model appear in many theoretical frameworks that address fundamental questions such as the hierarchy problem, dark matter, neutrino masses, and the baryon asymmetry of the universe. The LHC may in fact be producing copious numbers of neutral LLPs with masses above a GeV, only to have these sneaky particles escape the main detectors without being spotted. To fill this gap, we have proposed the MATHUSLA detector (MAssive Timing Hodoscope for Ultra-Stable neutraL pArticles), which would be constructed on the surface above CMS and would take data during High-Luminosity LHC operations. The detector would be composed of several layers of solid plastic scintillator, with wavelength-shifting fibers connected to silicon photomultipliers, monitoring an empty air-filled decay volume. In this talk, we will show a new, smaller MATHUSLA design that could be accommodated by available funding envelopes, while still providing world-leading LLP reach. We will also report on background studies for rare Standard Model processes, and the construction of "demonstrator modules" at the University of Victoria and the University of Toronto.

Keyword-1

particle detectors

Keyword-2

Beyond the Standard Model

Keyword-3

high-luminosity LHC

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