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Searches for ultra long-lived particles with MATHUSLA

The observation of neutral long-lived particles at the LHC would reveal physics beyond the Standard Model and could account for the many open issues in our understanding of our universe. Long-lived particle signatures are well motivated and can appear in many theoretical constructs that address the Hierarchy Problem, Dark Matter, Neutrino Masses and the Baryon Asymmetry of the Universe.

With the current experiments at the particle accelerators, no search strategy will be able to observe the decay of neutral long-lived particles with masses above ˜GeV and lifetimes at the limit set by Big Bang Nucleosynthesis (BBN), cτ ~ 107-108 m. The MATHUSLA detector concept (MAssive Timing Hodoscope for Ultra-Stable neutraL pArticles) will be presented. It can be implemented on the surface above ATLAS or CMS detectors in time for the high-luminosity LHC operations, to search for neutral long-lived particles with lifetimes up to the BBN limit. The large area of the detector allows MATHUSLA to make important contributions also to cosmic-ray physics. We will also report on the analysis of data collected by the test stand installed on the surface above the ATLAS detector, the on-going background studies, and plans for the MATHUSLA detector.

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