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Searches for ultra long-lived particles with MATHUSLA

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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), $c\tau \sim 10^7$-10^8 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.
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.

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