MEETING OF THE AMERICAN PHYSICAL SOCIETY DIVISION OF PARTICLES AND FIELDS

Contribution ID: **82** Type: **Presentation**

Ultra long-lived particles searches with MATHUSLA

Monday, 31 July 2017 11:03 (18 minutes)

Many extensions of the Standard Model (SM) include particles that are neutral, weakly coupled, and long-lived that can decay to final states containing several hadronic jets. Long-lived particles (LLPs) can be detected as displaced decays from the interaction point, or missing energy if they escape. ATLAS and CMS have performed searches at the LHC and significant limits have been set in recent years.
However, the current searches performed at colliders have limitations. A LLP does not interact with the detector and it is only visible once it decays. Unfortunately, no existing or proposed search strategy will be able to observe the decay of non-hadronic electrically neutral LLPs with masses above ~ GeV and lifetimes near the limit set by Big Bang Nucleosynthesis ($c\tau$ ~ 107-108 m). Therefore, ultra-long-lived particles (ULLPs) produced at the LHC will escape the main detector with extremely high probability.
In this talk we describe the concept of the MATHUSLA surface detector (MAssive Timing Hodoscope for Ultra Stable neutraL pArticles), which can be implemented with existing technology and in time for the high luminosity LHC upgrade to find such ultra-long-lived particles, whether produced in exotic Higgs decays or more general production modes. The MATHUSLA detector will consist of resistive plate chambers (RPC) and scintillators with a total sensitive area of 200x200 m square. It will be installed on the surface, close to the ATLAS or CMS detectors.
A small-scale test detector (~ 6 m square) is going to be installed on the surface above ATLAS in June 2017. It will consist of three layers of RPCs used for tracking and two layers of scintillators for timing measurements. It will be placed above the ATLAS interaction point to estimate cosmic backgrounds and proton-proton backgrounds coming from ATLAS during nominal LHC operations. We will report on the status of the test detector, on the on-going background studies, and plans for the main detector.

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Session Classification: Particle Detectors

Track Classification: Particle Detectors