Contribution ID : **594** Type : **Oral talk**

Exploring the lifetime and cosmic frontier with the proposed MATHUSLA detector

Tuesday, 6 October 2020 18:25 (20)

Observation of neutral long-lived particle (LLP) can be the first sign for physics beyond the Standard Model at the LHC. These particles are invisible until they decay into detectable Standard Model particles some macroscopic distance away from the collision. Their existence is theoretically well motivated and can provide explanations to known unexplained phenomena such as Dark Matter, the Baryon Asymmetry of the universe, neutrino masses, and the Hierarchy Problem. The current LHC search programs focus mostly on energetic final states produced promptly within subatomic distances of the proton collision. These searches are largely insensitive to neutral LLPs. An LLP surface detector may be the only way of discovering new physics and, by that, solving fundamental puzzles of the incomplete Standard Model. These considerations prompt the MATHUSLA experiment (MAssive Timing Hodoscope for Ultra-Stable neutraL pArticles), which opens a new avenue for discovery of Physics Beyond the Standard Model at the LHC. The large-volume detector will be placed above the CMS experiment with O(100) m of rock separation from the LHC interaction point. It is instrumented with a tracking system to observe LLP decays inside its empty volume. The experiment is composed of a modular array of detectors covering together (100 × 100) m^2 × 25 m high. It is planned in time for the high luminosity LHC runs.

MATHUSLA, with a large detection area and good granularity tracking system, is also an efficient cosmic-ray Extensive Air Shower (EAS) detector. It could reach a very good time, spatial and angular resolution, and the several tracking layers might allow performing very precise cosmic-ray measurements up to the PeV scale.

We will describe the detector concept and layout, the current status of the project, the on-going cosmic ray studies, as well as the future plans. We will also report on the recently published results of the background measurements made by the test stand installed above the ATLAS detector in 2018. The ability to improve significantly cosmic ray studies in the 100 TeV - 100 PeV energy range by adding a 10^4 m^2 layer of RPCs with both digital and analogue readout will also be discussed with a focus on large zenith angle EAS.

Primary author(s) : ALPIGIANI, Cristiano (University of Washington, Seattle)

Presenter(s) : ALPIGIANI, Cristiano (University of Washington, Seattle)

Session Classification : High Energy Physics

Track Classification : High energy physics