Contribution ID: **7** Type: **Poster**

Search for Heavy Neutral Leptons from heavy mesons at ATLAS/SND

Friday, 25 March 2022 16:05 (1h 40m)

What is Dark matter? Why is there an asymmetry between matter and anti-matter? Why do neutrinos have mass? These three critical questions cannot be answered by the Standard Model of particle physics, despite it's overwhelming success in describing the results of high-energy experiments at subatomic scales. They play a pivotal role in forming our understanding of the universe from its earliest epochs to its ultimate fate, at all levels from quarks to quasars. We thus require an extension of the current model to describe the phenomena that appears in beyond Standard Model physics, such as the ones that could blossom from the aforementioned questions.

One of the simplest such extensions possibly addressing all of these, is the introduction of heavy/sterile neutrinos: close cousins of neutrinos, but far heavier. These hypothesized particles do not interact directly with any known force of the Standard Model, it is thus impossible to detect this particle directly. However, the heavy neutrino can decay to particles that can be detected directly, and thus if one were to know exactly how this decay would look - one could find evidence of it's existence.

The thesis is thus concerned with finding possible decay processes (search strategies) that one could look for at the Large Hadron Collider at CERN to verify the existence of this heavy neutrino, which, if found, could shed light on many problems both in and beyond the Standard Model.

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Field of study

Quantum Physics

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Session Classification: Poster session