



MEETING OF THE AMERICAN PHYSICAL SOCIETY DIVISION OF PARTICLES AND FIELDS

Contribution ID: 435

Type: **Poster**

Seasonal Variations of multiple-muons in NOvA

Monday, 31 July 2017 19:10 (1 minute)

Seasonal variations of cosmic ray muons have been well-measured by a number of underground experiments at a variety of overburdens and it has been found that the rate of muons increases in the summer and decreases in the winter. This is understood from the properties of the atmosphere as the temperature varies. But with large statistics the seasonal variation of multiple muons was measured in the MINOS ND (225 mwe) and the MINOS FD (2100 mwe). The rates increase in the winter and decrease in the summer, opposite to the result for single muons. Several hypotheses for this unexpected result were considered, but the effect is not currently explained. New data from the NOvA ND (225 mwe) will be used to study the situation further.

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Session Classification: Poster Session and Reception

Track Classification: Cosmology and Astrophysics