

Study of low energy cosmic-ray muons with a spin spectroscopy array

Cosmic-ray muons represent secondary particles produced by high-energy cosmic rays interacting with the Earth's atmosphere. Cosmic-ray muons as a natural source of muons with a wide energy range, and their polarization is an important feature. Muon spin spectroscopy, known as muon spin rotation/relaxation/resonance (μ SR), allows for accurate measurement of muon polarization. The research group at Sun Yat-sen University (SYSU) develop a prototype Cosmic-Ray Muon Spin Spectroscopy (CRmuSR), aiming to measure the polarization of cosmic-ray muons. The system is instrumented with plastic scintillators coupled with SiPM readout by 512-channel electronics. The first round of tests exhibits a time resolution of better than 2ns. CRmuSR has achieved stable operation for a cumulative time exceeding 500 hours. Meanwhile, the Geant4 simulation and analysis tool is ready. Preliminary results will be reported in the talk. CRmuSR can help us measure the cosmic-ray muon polarization and explore the feasibility of constructing μ SR apparatus. In the future, we wish that CRmuSR could be deployed in an array and potentially aid in the assessment of low-energy cosmic-ray muon properties. Combined analysis with atmospheric neutrinos can be expected.

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