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Studying neutrinos at the LHC-FASER ~ its impact to the cosmic-ray physics

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Studies of high energy proton interactions have been basic inputs to understand the cosmic-ray spectra observed on the earth. Yet, the experimental knowledge with controlled beams has been limited. In fact, uncertainties of the forward hadron production are very large due to the lack of experimental data. The FASER experiment is proposed to measure particles, such as neutrinos and hypothetical dark-sector particles, at the forward location of the 14 TeV proton-proton collisions at the LHC. As it corresponds to 100-PeV proton interactions in fixed target mode, a precise measurement by FASER would provide information relevant for PeV-scale cosmic rays. By studying three flavor neutrinos with the dedicated neutrino detector (FASERnu), FASER will lead to a quantitative understanding of prompt neutrinos, which is an important background towards the astrophysical neutrino observation by neutrino telescopes such as IceCube. In particular, the electron and tau neutrinos have strong links with charmed hadron production. And, the FASER measurements may also shed light on the unresolved muon excess at the high energy. FASER is going to start taking data in 2022. We expect about 8000 numu, 1300 nue and 20 nutau CC interactions at the TeV energy scale during Run 3 of the LHC operation (2022-2024) with a 1.1 tons emulsion-based neutrino detector. We report here the overview and prospect of the FASER experiment in relation to the cosmic-ray physics, together with the first LHC neutrino candidates that we caught in the pilot run held in 2018.

Keywords

LHC, high energy neutrinos, prompt neutrinos, muon, tau neutrino

Collaboration

other Collaboration

FASER

Subcategory

Experimental Methods & Instrumentation

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