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Muon flux and muon-induced neutron yield measurement at China Jinping underground laboratory

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China Jinping Underground Laboratory (CJPL) is ideal for carrying out MeV-scale neutrino experiments and searching for neutrinoless double-beta-decay. To understand the cosmogenic background, we analyzed 820.28 days of the dataset from a one-ton prototype detector and measured the cosmic-ray muon flux to be $(3.61 \pm 0.19_{\mathrm{stat.}} \pm 0.10_{\mathrm{sys.}}) \times 10^{-10}\mathrm{cm}^{-2}\mathrm{s}^{-1}$. From the detected cosmic-ray muon events, we also measured the muon-induced neutron yield in liquid scintillation, which is $(3.44 \pm 1.86_{\mathrm{stat.}} \pm 0.76_{\mathrm{sys.}}) \times 10^{-4}\mu^{-1}\mathrm{g}^{-1}\mathrm{cm}^{2}$ at 340 GeV average energy of muons. In addition, we performed a survey of muon fluxes at different laboratory locations globally, considering both those situated under mountains and those down mine shafts. Under the same vertical overburden, the former is generally (4 ± 2) times the latter due to the leakage through the mountain. Based on Jinping Mountain's terrain and the measurement in CJPL-I, we predicted cosmic-ray muons' energy and angle distributions and fluxes for the four halls at CJPL-II. We found the fluxes of Hall C and Hall D were about $2.3 \times 10^{-10}\mathrm{cm}^{-2}\mathrm{s}^{-1}$ and $2.5 \times 10^{-10}\mathrm{cm}^{-2}\mathrm{s}^{-1}$ respectively.

In-person participation

Yes

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