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nuSpaceSim: A Comprehensive Simulation Package for Modeling the Measurement of Cosmic Neutrinos using the Earth as the Neutrino Target and Space-based Detectors

nuSpaceSim is a highly-efficient (e.g. fast) module-based, end-to-end simulation package that models the physical processes of cosmic neutrino interactions in the Earth, the subsequent extensive air showers induced by the Earth-emergent leptons, the EAS optical Cherenkov and radio emission, signal attenuation, and the detector response to determine the sensitivity to both the diffuse cosmic neutrinos and transient neutrino sources. Using the Earth as a tau neutrino target and the atmosphere as the signal generator effectively forms a detector with a mega-gigaton mass. Furthermore, tau-lepton decays and neutrino neutral-current interactions within the Earth (re)generates a flux of lower energy tau neutrinos that can also interact in the Earth thus enhancing the detection probability. NuSpaceSim provides a tool to both understand the data from recent experiments such as EUSO-SPB2 as well as design/understand the performance the next generation of balloon- and space-based experiments and upcoming experiments including POEMMA Balloon with Radio (PBR) and the Payload for Ultrahigh Energy Observations (PUEO). In this poster the nuSpaceSim software, physics modeling, and the cosmic neutrino measurement capabilities of example sub-orbital and space-based experimental configurations will be presented as well as status of planned modeling upgrades.

Collaboration(s)

nuSpaceSim

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