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TeV-PeV neutrino-nucleon cross section measurement with 5 years' IceCube data

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IceCube is a 1 cubic kilometer size neutrino detector located at the South Pole. It is capable of detecting all-sky neutrinos of all flavors from GeV to EeV energies. After detector completion, it discovered and measured the flux of extraterrestrial neutrinos in the TeV - PeV energy range, alongside with flux of neutrinos of known atmospheric origin. In this talk we will present a novel analysis method and the preliminary result of the neutrino-nucleon Deep Inelastic Scattering (DIS) cross section measurement as a function of neutrino energy in the TeV –10 PeV energy range utilizing neutrino absorption by the Earth.

We analyzed five years of data collected with complete IceCube detector from May 2011 to May 2016. This analysis focuses on electromagnetic and hadronic showers (cascades) mostly induced by electron and tau neutrinos. The applied event selection features high background rejection (<10% background contamination below 60TeV, background free above 60TeV) in rejecting atmospheric muons and high signal efficiency (˜80%). The final neutrino sample consists of about 5600 events, with about 420 events above 10TeV reconstructed energy. An unfolding method was applied to enable the mapping from reconstructed cascade parameters such as neutrino energy and zenith to true neutrino variables. The analysis was performed assuming isotropic astrophysical neutrino flux, in in seven energy bins, and in two zenith bins ("down-going"from the south-hemisphere and "up-going"from the north-hemisphere). The ratio of down-going events and up-going events (absorbed by the Earth at large energies) is sensitive to the neutrino-nucleon DIS cross section and is insensitive to the dominant neutrino flux uncertainties.

The neutrino-nucleon DIS cross section preliminary result will be compared with the Standard Model theoretical calculation.

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