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Perturbative charm production and the prompt atmospheric neutrino flux in light of RHIC and LHC

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We evaluate the high energy prompt atmospheric neutrino flux using three different frameworks for calculating the heavy quark production cross section in QCD: NLO perturbative QCD, k_T factorization including low- x resummation, and the dipole model including parton saturation. We determine QCD parameters, such as the charm quark mass, factorization and renormalization scales that provide the best description of the total charm cross section measured at fixed target experiments, at RHIC and at LHC as well as the best description of the differential cross sections for charm and bottom production compared with the latest data on forward charm meson production from LHCb at 7 TeV and at 13 TeV. We include nuclear effects and we find the reduction of the flux due to nuclear effects to range from 10% to 50% at the highest energies. Finally, we compare our results with the IceCube limit on the prompt neutrino flux, which is already providing valuable information about some of the QCD models.

Primary author: Prof. SARCEVIC, INA (UNIVERSITY OF ARIZONA)

Presenter: Prof. SARCEVIC, INA (UNIVERSITY OF ARIZONA)

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