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Neutrinos from charm production in the atmosphere

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Atmospheric neutrinos are produced in interactions of cosmic rays with Earth's atmosphere. At very high energy, the contribution from semi-leptonic decays of charmed hadrons, known as the prompt neutrino flux, dominates over the conventional flux from pion and kaon decays. This is due to the very short lifetime of the charmed hadrons, which therefore do not lose energy before they decay. The calculation of this process is difficult because the Bjorken-x at which the parton distribution functions are evaluated is very small. This is a region where QCD is not well understood, and large logaritms must be resummed. Available parton distribution functions are not known for such small x and extrapolations must be made. Theoretically, the fast rise of the structure functions for small x ultimately leads to parton saturation.

We have previously (Enberg, Reno and Sarcevic, 2008) calculated the prompt flux including parton saturation effects in the QCD production cross section of charm quarks. This calculation has been used by e.g. the IceCube collaboration as a standard background. We are now updating this calculation to take into account the recent LHC data on the charm cross section, as well as recent theoretical developments in QCD. In this talk I will describe this update and some of the issues involved.

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