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Production asymmetry of open charm mesons within unfavoured fragmentaton scenario

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Abstract content

We consider unfavoured light quark/antiquark to D meson fragmentation. We discuss nonperturbative effects for small transverse momenta. The asymmetry for D^+ and D^- production measured by the LHCb collaboration provides natural constraints on the parton (quark/antiquark) fragmentation functions. We find that already a fraction of $q/\bar{q} \to D$ fragmentation probability is sufficient to account for the measured asymmetry. We make predictions for similar asymmetry for neutral D mesons. Large D-meson production asymmetries are found for large x_F which is related to dominance of light quark/antiquark $q/\bar{q} \to D$ fragmentation over the standard $c \to D$ fragmentation. As a consequence, prompt atmospheric neutrino flux at high neutrino energies can be much larger than for the conventional $c \to D$ fragmentation. The latter can constitute a sizeable background for the cosmic neutrinos claimed to be observed recently by the IceCube Observatory. Large rapidity-dependent D^+/D^- and $D^0/\bar{D}^0$ asymmetries are predicted for low ($\sqrt{s}$ = 20 - 100 GeV) energies. The $q/\bar{q} \to D$ fragmentation leads to enhanced production of D mesons at low energies. At $\sqrt{s} = 20$ GeV the enhancement factor with respect to the conventional contribution is larger than a factor of five. In the considered picture the large-x_F D mesons are produced dominantly via fragmentation of light quarks/antiquarks. Predictions for fixed target $p + {}^4$He collisions relevant for a fixed target LHCb experiment are presented.

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