

nNNPDF3.0: Evidence for a modified partonic structure in heavy nuclei

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We present an updated determination of nuclear parton distributions (nPDFs) from a global NLO QCD analysis of hard processes in fixed-target lepton-nucleus and proton-nucleus together with collider proton-nucleus experiments. In addition to neutral- and charged-current deep-inelastic and Drell-Yan measurements on nuclear targets, we consider the information provided by the production of electroweak gauge bosons, isolated photons, jet pairs, and charmed mesons in proton-lead collisions at the LHC across centre-of-mass energies of 5.02 TeV (Run I) and 8.16 TeV (Run II). For the first time in a global nPDF analysis, the constraints from these various processes are accounted for both in the nuclear PDFs and in the free-proton PDF baseline. The extensive dataset underlying the nNNPDF3.0 determination, combined with its model-independent parametrisation, reveals strong evidence for nuclear-induced modifications of the partonic structure of heavy nuclei, specifically for the small- x shadowing of gluons and sea quarks, as well as the large- x anti-shadowing of gluons. As a representative phenomenological application, we provide predictions for ultra-high-energy neutrino-nucleon cross-sections, relevant for data interpretation at neutrino observatories. Our results provide key input for ongoing and future experimental programs, from that of heavy-ion collisions in controlled collider environments to the study of high-energy astrophysical processes.

Submitted on behalf of a Collaboration?

No

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