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Next generation proton PDFs with deuteron and nuclear uncertainties

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As data become more precise, estimating theoretical uncertainties in global PDF determinations is likely to become increasingly necessary to obtain correspondingly precise PDFs. Here we present a next generation of global proton PDFs (NNPDF4.0) that include theoretical uncertainties due to the use of heavy nuclear and deuteron data in the fit. We estimate these uncertainties by comparing
the values of the nuclear observables computed with the nuclear PDFs against those computed with proton PDFs. For heavy nuclear PDFs we use the nuclear nNNPDF2.0 set, while for deuteron PDFs we develop an iterative procedure to determine proton and deuteron PDFs simultaneously, each including the uncertainties in the other. Accounting for nuclear uncertainties resolves some of the tensions in the global fit of the proton PDFs, especially those between the nuclear data and the extended LHC data set used in NNPDF4.0.

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