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Nuclear parton distribution functions (nPDFs) and their uncertainties in the LHC Era

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We have performed a next-to-next-to-leading order (NNLO) QCD analysis of nuclear parton distribution functions (nPDFs) [**Phys. Rev. D 93 (2016) 014026, arXiv:1601.00939 [hep-ph]**] using all available neutral current charged-lepton ($\ell^{\pm}$ + nucleus) deeply inelastic scattering (DIS) data and Drell-Yan (DY) cross-section ratios $\sigma^{A}_{DY}/\sigma^{A'}_{\rm DY}$ for several nuclear targets. We have studied in detail the parametrizations and the atomic mass (A) dependence of the nuclear PDFs at this order. Our nuclear PDFs (KA15) provides a complete set of nuclear PDFs, $f_i^{(A,Z)}(x,Q^2)$, with a full functional dependence on x, A, $\rm Q^2$. The uncertainties of the obtained nuclear modification factors for each parton flavour are estimated using the well-known Hessian method. The nuclear charm quark distributions are also added into the analysis. We compare the parametrization results with the available data and the results of other nuclear PDFs groups. We have found that our nuclear PDFs to be in reasonably good agreement with them. The estimates of errors provided by our global analysis (KA15) are rather smaller than those of other groups.

In this talk, we will briefly review the recent LHC heavy-ion collisions data including the first experimental data from the LHC proton+lead and lead+lead run which can be used in the global fits of nuclear PDFs. We highlight different aspects of the high luminosity Pb–Pb and p–Pb data which have been recorded by the CMS Collaboration. The first experimental results published by the ALICE and CMS collaborations for the proton-lead (p–Pb) collisions at a nucleon–nucleon center–of–mass energy of $\sqrt{s_{\rm NN}}$ = 5.02 TeV and the data recorded by CMS in Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 2.76 TeV will be summarized in details.

Primary author(s) : Dr. KHANPOUR, Hamzeh (University of Science and Technology of Mazandaran, Behshahr, IRAN)

Co-author(s) : Dr. ATASHBAR, Shahin (Independent researcher, P.O. Box 1149-8834413, Tehran, Iran)

Presenter(s) : Dr. KHANPOUR, Hamzeh (University of Science and Technology of Mazandaran, Behshahr, IRAN)

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