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Probing cold nuclear medium effect with W^\pm/Z^0 at NLO and NNLO in heavy-ion collisions

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The production of massive vector boson (W^\pm/Z^0), is an excellent probe of the cold nuclear medium effect, and can provide useful constraints on the nuclear parton distribution (nPDFs), in heavy-ion collisions at the LHC and the future colliders with much higher energies.

Within the framework of perturbative QCD, we systematically study the vector boson production in p+Pb and Pb+Pb collisions at the LHC and future colliders at NLO and at NNLO. Theoretical predictions with parametrization nPDFs sets, EPS09 and DSSZ, give good descriptions of the recent data on boson rapidity and transverse momentum distributions at the LHC. Differences between the predictions with several nPDFs sets are observed, and a detailed analysis of nuclear modification at partonic level is performed.

Furthermore, with a semi-microscopic KP model of nPDFs, in which several nuclear effects (e.g. Fermi motion and nuclear binding, the off-shell correction, the nuclear coherent correction, and the nuclear meson correction) are included, we study the vector boson rapidity distribution in p+Pb collisions at the LHC, and a very good agreement with the latest data is found.

Summary

We systematically study the W^\pm/Z^0 boson production at NLO and NNLO in p+Pb and Pb+Pb collisions as a probe of cold nuclear medium effects and nuclear parton distributions. The theoretical predictions with the semi-microscopic KP model of nuclear parton distribution give a good agreement with latest LHC p+Pb data.

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