Contribution ID: **28** Type: **Oral**

Nuclear effects on longitudinal-transverse structure function ratio

It has been assumed that nuclear modification does not exist in the longitudinal-transverse structure function ratio $R_N = F_L^N/(2xF_1^N)$ in lepton deep inelastic scattering. This assumption is widely used in obtaining structure functions of the "nucleon" from nuclear data such as the deuteron ones. However, nuclear modifications do exist theoretically at least at medium- and large-x regions because nucleons in a nucleus move in any direction, which is not necessary the longitudinal direction of the virtual-photon or weak-boson momentum in lepton scattering. Because of this transverse motion, the nucleon's transverse and longitudinal structure functions should mix with each other in nuclei with the mixture probability proportional to the nucleon's transverse momentum squared $\vec{p}_T^{\,2}/Q^2$. In this work [1], numerical results are explicitly shown on such nuclear modifications in the deuteron. These nuclear modifications are important for determining precise structure functions of the nucleon. Furthermore, modifications of R_N should be investigated also at small x by the future electron-ion collider to find interesting gluon dynamics in nuclei. Hopefully, this nuclear effect on R_N could be found by future experimental measurements at lepton accelerator facilities.

Reference
[1] S. Kumano, arXiv:2506.18305.

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Session Classification: Parallel

Track Classification: Spin physics in nuclear reactions and nuclei