

NuInt12 : Eighth International Workshop on Neutrino-Nucleus Interactions in the Few-GeV Region



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A-dependence of weak nuclear structure functions

Thursday, 25 October 2012 18:00 (1h 30m)

We shall present the results for the ratio of weak nuclear structure functions $\frac{F_2^A}{F_2^{proton}}$ and $\frac{F_3^A}{F_3^{proton}}$, where A is the different nuclear targets like 2_1D , CH, H_2O , ${}^{56}Fe$ and ${}^{208}Pb$ which are being used in the ongoing Minerva experiment at Fermilab.

We have studied these nuclear structure functions using relativistic nuclear spectral function which incorporate Fermi motion, nuclear binding, and nucleon correlations. We have also included the pion and rho meson cloud contributions calculated from a microscopic model for meson-nucleus self-energies. Shadowing and anti-shadowing effects have also been taken into account.

The deuteron structure functions have been calculated using the same formulas as used for the weak nuclear structure functions, but performing the convolution with the deuteron wave function squared instead of the spectral function. For the numerical calculations, parton distribution functions for the nucleons have been taken from the parametrization of CTEQ Collaboration (CTEQ6.6) and we have performed the calculations at LO as well as at NLO.

The details of the model are given in Refs.

1. $\nu(\bar{\nu})$ -208Pb deep inelastic scattering.
H. Haider, I. Ruiz Simo and M. Sajjad Athar
Phys. Rev. C 85 (2012) 055201.
2. Nuclear medium effects in $\nu(\bar{\nu})$ -nucleus deep inelastic scattering.
H. Haider, I. Ruiz Simo, M. Sajjad Athar and M. J. Vicente Vacas
Phys. Rev. C 84 (2011) 054610

Summary

We find that the nuclear medium effects like Fermi motion and binding energy corrections are the same in F_2 and F_3 nuclear structure functions which have been incorporated by using the spectral function obtained for nuclear matter and implemented in nuclei using the local-density approximation. The differences in our results for F_2 and F_3 are due to the meson cloud contributions in the F_2 structure function whereas in the F_3 structure function they are absent. We have observed that the effect of meson clouds are large at low and intermediate x . Furthermore, the shadowing effects in F_2 and F_3 structure functions are different. Thus it is not appropriate to take the same correction factor for the F_2 and the F_3 nuclear structure functions. The ratios of structure functions for different nuclei are not the same. This study may be useful in understanding the medium effects in the nuclear structure functions when the results from Minerva would come up. Also this study is important in the incorporation of medium correction for the deep inelastic scattering presently considered in the Neutrino Monte Carlo event generators.

Primary author: Ms HAIDER, Huma (Aligarh Muslim University)

Co-authors: Dr RUIZ SIMO, I. (Departamento de Física Atómica Molecular y Nuclear, Universidad de Granada, E-18071 Granada, Spain); Prof. ATHAR, M.Sajjad (Aligarh Muslim University)

Presenters: Ms HAIDER, Huma (Aligarh Muslim University); Prof. ATHAR, M.Sajjad (Aligarh Muslim University)

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