Electroproduction of vector mesons on nuclei

Vector meson (V=ρ,ω,φ,J/ψ etc) production is the dominant channel of photon interaction with nuclei at high energies [1]. Experimental opportunities to study such processes with virtual photons already exist at JLab at the electron beam energies up to 12 GeV and will be possible at much higher energies at the Electron-Ion Collider. The project is related with training the student to develop a simple model to describe such a process. It includes the combination of the vector dominance model of γ*V coupling with the generalized eikonal approximation (GEA) method (c.f. [2] and refs. therein) to describe inter-nuclear interactions of V.

It is suggested, first, to reproduce within the GEA the known results [3,4] for incoherent production on heavy nuclei obtained within the Glauber model. Then, the model will be applied to the case of the deuteron target where the wave function is well known. The focus of the study will be on the effects of photon shadowing and color transparency.

[1] T.H. Bauer, R.D. Spital, D.R. Yennie, and F.M. Pipkin, “The Hadronic Properties of the Photon in High-Energy Interactions", Rev. Mod. Phys. **50**, 261 (1978).

[2] A.B. Larionov, M. Strikman, and M. Bleicher, “Polarized χ_{c2}-charmonium production in antiproton-nucleus interactions”, Phys. Rev. C **89**, 014621 (2014).

[3] L. Frankfurt, G.A. Miller, and M. Strikman, “Color Transparency in Semi-Inclusive Electroproduction of rho Mesons", Phys. Rev. C **78**, 015208 (2008).

[4] J. Hufner, B. Kopeliovich, and J. Nemchik, “Glauber multiple scattering theory for the photoproduction of vector mesons off nuclei and the role of the coherence length”, Phys. Lett. B **383**, 362 (1996).

Requirements to the student

It is expected that the student already knows the basics of quantum mechanics and quantum field theory (tree-level Feynman diagrams). It is also expected the knowledge of programming languages (preferably FORTRAN-90, but C++ or similar also possible).

Project supervisor

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