Project for the JINR University Center

Title

QCD analysis of the DIS structure functions based on inverse Mellin transform

Description of the project

The investigation of deep inelastic scattering (DIS) of leptons on the nucleon is an important tool to get fundamental information on the internal structure of the nucleon (see [1, 2]). The QCD predictions for the Q^2- evolution of the structure function are presented usually in the terms of Mellin moments of the structure function. Inverse Mellin transform is a precise method to calculate the x-dependence of the structure function. The experimental data for structure function produced in the x-space. The QCD analysis of the DIS structure functions involves a lot of parameters of the x-shape of the structure function winch should be determine from the fitting of the huge number of experimental points. That is why the inverse Mellin transform should works very fast.

The purpose of the project research is to develop the efficient numerical methods of the inverse Mellin transform in order to apply it to the QCD analysis of the experimental DIS data.

Students shall possess knowledge of the theoretical analysis of experimental DIS data; the practical calculations in the space of the complex values of the Mellin moments will be in the focus of out studies.

Description of the work for students:

Study of the methods of the description of Q^2-evolution of the structure functions, numerical methods for the inverse Mellin transform.

Results of the project will be presented in the form of the report and could be consider as a basis of the scientific publication.

Acceptance criteria

The student assumes a basic knowledge of quantum field theory, programming skills, the Maple, LaTeX, and Origin packages.

Recommended literature

1. F.J. Indurain, ``*The Theory of Quark and Gluon Interactions"* (Springer-Verlag Berlin Heidelberg 1993, 1999, 2006).

2. R.G. Roberts, ``*The Structure of the Proton: Deep Inelastic Scattering"* (Cambridge Univ. Press, Cambridge, 1990).
3. H. Georgi, H.D. Politzer, ``*Freedom at Moderate Energies: Masses in Color Dynamics"*, Phys. Rev. D **14**, 1829 (1976).
4. A. Vogt, ``*Efficient evolution of unpolarized and polarized parton distributions with QCD-PEGASUS*," Comput. Phys. Commun. **170**, 65 (2005).
5. A.V. Sidorov and O.P. Solovtsova, ``*QCD analysis of the F_3 structure function based on inverse Mellin transform in analytic perturbation theory*," Phys. Part. Nucl. Lett. **14**, no. 1, 1 (2017).
6. E. Leader, A.V. Sidorov and D.B. Stamenov, ``*On the role of higher twist in polarized deep inelastic scattering*, "Phys. Rev. **D 67**, 074017 (2003).

The expected number of participants of the project

The number of the participants is 2-3 students in the period from 08 September to the 26th of September.

The project coordinators from the JINR

Bogoliubov Laboratory of Theoretical Physics, **``Theory of Fundamental Interactions''**

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