Posudek školitele na doktorskou disertační práci

Doctorand:
Marek Matas
Title of dissertation:
Phenomenological studies of QCD at high energies
Supervisor:
prof. Jesús Guillermo Contreras Nuño, Ph. D
Supervisor specialist:
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Recommendation:
The work fulfils all the requirements to be presented as a doctoral thesis

This dissertation presents several studies on the behaviour of QCD at high energies. The findings reported on the thesis are of interest both from the purely theoretical point of view, but also as phenomenological studies relevant for current experiments at the LHC as well as planned facilities as the EIC recently approved for construction in USA.

The main contribution of the work is the solution of Balistsky-Kovchegov equation with the inclusion of the impact-parameter dependence. Past studies were not able to obtain reasonable solutions due to the appearance of Coulomb tails and the problems were ascribed to confinement effects outside the reach of a perturbative approach. Marek demonstrated that using a kernel which includes logarithmic resummations and an appropriate initial condition, the problem of Coulomb tails was suppressed, at least for energies to be reached in current and future facilities. This opens the door to a better description of the hadronic targets on the impact-parameter plane: before one had to assume a completely homogeneous structure and now one can use a more realistic description.

The dissertation is structured as follows: a short introduction to set up the stage is followed by a general chapter on deep inelastic scattering. The next two chapters describe the studies performed during the doctoral studies. Then a brief summary is presented. The work is complemented with the text of the articles that were produced during the thesis as well as the corresponding proceedings. Three articles are already published and other three have been submitted for publication. Four contributions to conference proceedings are reported.

The student developed by himself all the tools needed to obtain the results presented in the dissertation. He proposed the correct form of the boundary condition that allowed for a successful description of experimental data. He was also involved in the design of the articles themselves and in writing them. He submitted some of the articles and interacted with the journal and external referees.

Guillermo Contreras
Školitel
Prague, July 10, 2020.