

Referee's report on the Habilitation thesis
"The structure of hadrons at high energy in QCD"
of Dr. Jesús Guillermo Contreras Nuño

Dr. Guillermo Contreras is internationally recognized well known expert in high energy e-p and heavy ion collisions. He has been working on the subject for more than 20 years. I did not collaborate with him in the past and therefore do not have any conflict of interest in expressing my opinion.

The habilitation thesis describes several major contributions to the structure of proton and lead nucleus made by the author as a member of the H1 experiment at HERA (appended publications [1-4], [7]) and the ALICE experiment at LHC (publications [12]-[16]), related phenomenological investigations (publications [8-11]) and an overview publication [17] written by Dr. Contreras with few co-authors.

Selected H1 experiment results on the measurement of the proton structure function published in papers [1-4] document the work of Dr. Contreras within the H1 collaboration. Dr. Contreras has defended his PhD thesis on the subject of forward jet physics and after his doctorate he was a major author of publication [7]. This part of the work is nicely presented in the Chapter 2 of the habilitation thesis.

The Chapter 3 illustrates several phenomenological contribution of Dr. Contreras to the understanding and interpretation of the HERA results. Appended publications about the Pomeron intercept are published by Dr. Contreras [8] and Dr. Contreras with two co-authors [9] in major journals Physics Letters B and Physical Review D. The other publication [10] deals with the scaling properties of the virtual photon-proton cross section. The paper [11] about the description of HERA data with so called running-coupling Balitsky-Kovchegov equation is under preparation for submission to JHEP.

The Chapter 4 and appended publications [12-18] describe contributions of Dr. Contreras to the ALICE detector construction as well as his main physics interests within the broad international team of the ALICE experiments at LHC. Publication [12] is about the performance of VZERO sub-detector that is the key element to trigger hadronic interactions in the ALICE detector and to measure the multiplicity of produced secondary particles. Dr. Contreras was a member of the Mexican group of the ALICE experiment with the responsibility to produce substantial part of the VZERO detector. In particular the VZERO sub-detector has been used to measure the cross section of proton-lead collisions by the technique of van der Meer scan (publication [13]).


Major physics interest of Dr. Contreras was the measurement of charmonium production in ultra-peripheral lead-lead and proton-lead collisions. Although the ALICE detector has not been designed to this type of measurements, Dr. Contreras and his collaborators succeeded to make such important measurements possible. The results on photo-production of charmonium in both lead-lead and proton-lead collisions are presented in three selected publications [14-16]. Dr. Contreras has lead the corresponding physics group of the ALICE collaboration. His decisive contribution to the investigation of ultra-peripheral collisions was recognized by the authorship of a review article [17] published in International Journal of Modern Physics A.

I have found the thesis very interesting, it is well and carefully written. I have noticed only small misprints: Čerencov instead of Čerenkov on page 43 and Balistky instead of Balitsky in the Abstract of reprinted arXiv paper [11] on page 166.

I have no specific questions to the subject of the thesis that is based on the publications that all passed the peer review process in international journals. During the habilitation presentation I will be very pleased to listen Dr. Contreras view of future development of the thesis subject.

In summary I am strongly convinced about significant and valuable contributions of Dr. Contreras to all publications selected in the thesis and with no doubt I recommend the thesis to the presentation in front of the Scientific Board of the Faculty of Nuclear Sciences and Engineering of the Czech Technical University. In my opinion Dr. Contreras fully deserves promotion to docent status at the Czech Technical University.

Prague 30. September 2015


Prof. RNDr. Rupert Leitner, DrSc.

ÚČJF MFF UK v Praze