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16th July, 2021

Report on the habilitation thesis of Dr. Jana Bielčíková entitled "*Production of jets at RHIC and LHC*".

I have read with great interest the habilitation thesis of Dr. Jana Bielčíková entitled "*Production of jets at RHIC and LHC*". The thesis is based on a collection of scientific papers related to various properties of jets produced in high-energy proton-proton, proton-nucleus, and nucleus-nucleus collisions, where in the latter collision system creation of a new state of QCD matter, the quark-gluon plasma (QGP), is expected to occur. The thesis documents the scientific achievements of Dr. Bielčíková since her postdoctoral position at Yale University, when she joined the STAR collaboration at Brookhaven National Laboratory, till these days, when she is a senior research scientist at the Nuclear Physics Institute of the Czech Academy of Sciences and an active member of both the STAR collaboration and also the ALICE collaboration at the LHC at CERN.

The habilitation thesis is based on 14 scientific papers (1 Phys. Rev. Lett., 3 Phys. Lett. B, 3 Phys. Rev. D, and 7 Phys. Rev. C) published within large experimental collaborations STAR and ALICE, where for the thesis it is obvious that Dr. Bielčíková played a key role in the preparation of all these publications.

The thesis is very well structured and divided into five chapters. The first chapter introduces the reader to the field of heavy-ion collisions, which is studied in the regime of high temperature and energy density achievable at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory and the Large Hadron Collider (LHC) at CERN. The introduction is written in a balanced way with a natural focus on hard probes that play the central role in the rest of the habilitation thesis. The introduction gives also a good oversight of the most important topics which drive research in heavy-ion physics.

Chapter 2 contains an overview of Dr. Bielčíková's results on inclusive charged-particle jet spectra, fragmentation functions, and other jet properties measured in proton-proton collisions with the ALICE experiment at CERN. In the context of similar measurements performed by ATLAS and CMS experiments at the LHC, these results are unique because the ALICE detector allows to study jet properties down to very low jet transverse momentum (p_T) and the jets are reconstructed with a low-momentum cut-off on jet constituents. The investigation of jet properties down to very low p_T tests applicability of perturbative QCD calculations provides essential input to tuning of Monte-Carlo generators for particle physics and also serves as a baseline for similar measurements in heavy-ion collisions aiming to quantify effects of QGP on jet properties.

The next chapter, Chapter 3, is dedicated to studies of di-hadron correlations. Di-hadron correlations were, besides the inclusive spectra of hadrons at large p_T, the complementary observable which proved the effect of jet quenching in hot and dense nuclear matter produced in Au+Au collisions at the top RHIC energy of 200 GeV. Dr. Bielčíková joined these early experimental efforts in 2004 as a postdoc at Yale University and significantly contributed to studies of di-hadron correlations using both identified particles (strange particles, direct photons) and studies of (at that time) novel long-range pseudorapidity correlations, so-called ridge. The theoretical explanation of the ridge phenomenon puzzled the whole heavy-ion community for many years, and it was thus essential to collect as much as possible experimental information of this unique phenomenon. The ridge phenomenon brought new surprises at the

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LHC, where it was confirmed in Pb+Pb collisions but surprisingly also observed in small collision systems such as proton-proton or proton-Pb collisions, where no QGP is expected to be produced, and thus its origin could differ from that in large collision systems. Although Dr. Bielčíková's research focus with ALICE at the LHC moved from di-hadron correlations to fully reconstructed jets, she also significantly contributed to the research of di-hadron correlation as documented in Chapter 3.

Finally, Chapter 4 gives an overview of the most recent research activities of Dr. Bielčíková, studies of fully reconstructed jets in heavy-ion collisions. In this area, Dr. Bielčíková significantly contributed to studies of nuclear modification factors and hadron+jet correlations in the STAR experiment and baryon-to-meson ratios of strange particles in jets and jet radial profiles in ALICE. Although jets are theoretically considered to be a well-controlled observable, for experimentalists the full reconstruction of jets in the environment of large fluctuating background poses a challenge. At RHIC energies, this situation is even more complicated by a small jet production cross-section. Therefore, the most valuable results presented in Chapter 4 are the measurements of nuclear modification factors of charged-particle jets and hadron+jet correlations in Au+Au collisions at RHIC. These are the first pioneering measurements of this kind at the RHIC energy and provide essential input and constraints on theoretical models of jet quenching.

The thesis is concluded with a summary and outlook to future research directions of Dr. Bielčíková, which will also include exploration of jet substructure observables in heavy-ion collisions via grooming jet techniques and application of machine learning techniques for heavy-flavor tagging in jets. These research directions will assure that Dr. Bielčíková and her team will remain among the world's leading groups exploring jet quenching.

In addition to the research documented in the thesis, Dr. Bielčíková also contributed to the research of particle correlations and jets in a larger scope, because she served for several years as a convener of related physics working groups in both the STAR and ALICE collaborations. Dr. Bielčíková is also well recognized beyond the STAR and ALICE collaborations and belongs to respected scientists in the field of heavy-ion physics in general. This can be documented by invited plenary talks at the top conferences in the field, such as the EPS-HEP 2015 conference or recently Hard Probes 2020 conference. Additionally, for several years, Dr. Bielčíková was one of the main organizers of the Hot Quarks international workshop for young scientists. Last but not least, I also found impressive the number of supervised undergraduate and graduate students listed at the end of the habilitation thesis, which proves the pedagogical skills of Dr. Bielčíková. In this context, I would like to highlight that two of Dr. Bielčíková's doctoral students were awarded the prestigious ALICE Thesis Award (V. Kučera, 2017) and RHIC/AGS Thesis Award (J. Rusňák, 2018).

In summary, Dr. Jana Bielčíková is a well-experienced researcher with a significant impact in the field of heavy-ion physics. Her habilitation thesis, scientific and pedagogical achievements are impressive, and I believe that she meets the requirements necessary for habilitation at the Czech Technical University in Prague.

Please, do not hesitate to contact me should you need any further clarification.

Sincerely,

Magdalena Djordjevic