

The 158th HENPIC seminar by Dr. Yi-Lun Du, University of Oslo, Feb. 10th, Thursday, 15:00 (Beijing time)

TITLE: Deep learning jet modifications in heavy-ion collisions

ABSTRACT: Jet interactions in a hot QCD medium created in heavy-ion collisions are conventionally assessed by measuring the modification of the distributions of jet observables with respect to the proton-proton baseline. However, the steeply falling production spectrum introduces a strong bias toward small energy losses that obfuscates a direct interpretation of the impact of medium effects in the measured jet ensemble. In this talk, we will discuss employing a convolutional neural network to extract the energy loss ratio from jet images on a jet-by-jet basis using the hybrid strong/weak coupling model. The angular distribution of soft particles in the jet cone is found to contain significant discriminating power. With a well-predicted energy loss ratio, we study a set of jet observables to estimate their sensitivity to bias effects and reveal their medium modifications. We show how this new technique provides unique access to the initial configuration of jets over the transverse plane of the nuclear collision, both with respect to their production points and initial orientations. As a relevant example, we demonstrate the capability of our method to locate with precision the production point of a dijet pair in the nuclear overlap region, in what constitutes an important step forward towards the long term quest of using jets as tomographic probes of the quark-gluon plasma. Finally, we also discuss the classification task of quark- versus gluon-initiated jets in heavy ion collisions with deep learning.

[1] Yi-Lun Du, Daniel Pablos, Konrad Tywoniuk, Deep learning jet modifications in heavy-ion collisions, *JHEP*. 2021, 206 (2021)

[2] Yi-Lun Du, Daniel Pablos, Konrad Tywoniuk, Jet tomography in heavy ion collisions with deep learning, *Phys. Rev. Lett.* 128, 012301 (2022)

[3] Yi-Lun Du, Daniel Pablos, Konrad Tywoniuk, Classification of quark and gluon jets in hot QCD medium with deep learning, arXiv: 2112.00681 [hep-ph]

ABOUT THE SPEAKER: Dr. Yi-Lun Du is currently a postdoc at University of Oslo. After long-term visits to Central China Normal University and Frankfurt Institute of Advanced Studies, he obtained his PhD from Nanjing University in late 2018. Then he worked as a postdoc at FIAS and University of Bergen. His research focuses on understanding the QCD phase transition and studying jet-medium interactions to probe QCD medium properties. Theoretical tools and machine learning techniques are employed in his studies.