Contribution ID: **203** Type: **Oral presentation**

Bayesian inference of the fluctuating proton shape

Wednesday 6 April 2022 10:00 (20 minutes)

Determining the multi dimensional structure of protons and nuclei at high energy is one central goal of the future Electron-Ion Collider. This fundamental information is a crucial input for models describing the initial state of heavy ion collisions. In particular the event-by-event fluctuating proton geometry should have a strong effect on the flow and multiplicity distribution in high multiplicity proton-proton and proton-nucleus collisions [1], assuming that a strongly interacting medium is formed in these events. Understanding the subnucleon structure to a high degree of precision is thus a prerequisite of determining whether quark gluon plasma is created in small system collisions.

In order to extract the proton shape fluctuations (see [2]) from HERA exclusive vector meson production data in a statistically rigorous manner, we apply Bayesian inference[3]. This approach enables us to extract likelihood distributions for the non-perturbative parameters describing the proton fluctuating profile, including their correlations. The resulting posterior distributions allow for a systematic propagation of uncertainties when simulating for example high-multiplicity proton-proton and proton-nucleus collisions.

We determine how accurately the HERA data can constrain the proton fluctuating shape, and illustrate how high multiplicity proton-proton collisions can provide complementary input to exclusive scattering data.

[1] H. Mäntysaari, B. Schenke, C. Shen, Phys. Lett. B 772 (2017) 681-686, arXiv:1705.03177 [nucl-th]
[2] H. Mäntysaari, B. Schenke, Phys. Rev. Lett. 117 (2016) 052301, arXiv:1603.04349 [hep-ph], H. Mäntysaari, Rep. Prog. Phys. 83 (2020), 082201, arXiv:2001.10705 [hep-ph]
[3] H. Mäntysaari, B. Schenke, C. Shen, W. Zhao, arXiv:2201.xxxxx, in preparation

Author: Dr MÄNTYSAARI, Heikki (University of Jyväskylä)

Co-authors: SCHENKE, Bjoern (Brookhaven National Lab); SHEN, Chun (Wayne State University); ZHAO, Wenbin (Wayne state)

Presenter: Dr MÄNTYSAARI, Heikki (University of Jyväskylä)

Session Classification: Parallel Session T01: Initial state physics and approach to thermal equilibrium

Track Classification: Initial state physics and approach to thermal equilibrium