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Investigating hadronisation and light-nuclei formation in vacuum and dense environments

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Hadronisation is the complex process through which hadrons form from partons. Given its non-perturbative nature, an exact theoretical description is unavailable, necessitating phenomenological assumptions.

In the first part of my presentation, I will discuss novel observables that differentiate between models with distinct hadronisation mechanisms and examine current models limitations. Specifically, I will discuss how correlations between ϕ mesons and (multi-)strange hadrons are able to distinguish between EPOS 4 and PYTHIA 8.3 predictions. EPOS 4 is based on core-corona separation between a vacuum phase and a QGP phase, while PYTHIA 8.3 relies on microscopic interactions between Lund strings.

Next, I will present a comprehensive tuning of the PYTHIA 8.3 rope-hadronisation model using the Professor tool. This reveals that simultaneous reproduction of strange and non-strange light-flavour hadrons is not possible. This indicates significant model limitations that have also consequences on the modelling of heavy-flavour yields.

Finally, I will focus on deuteron and Helium-3 formation in PYTHIA 8.3, a process occurring after the hadronisation. Light-nuclei formation is crucial for dark matter searches and cosmic ray interactions in our galaxy. I will present novel predictions for He-3 formation probabilities within and outside jets, using nuclear reactions with parameterised, energy-dependent cross sections tuned to data.

Category

Theory

Collaboration

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