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What did we learn so far from event shape studies in ultra relativistic collisions at the LHC?

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Recent measurements of high multiplicity pp collisions at LHC energies have revealed that these systems exhibit features similar to quark-gluon plasma, such as presence of radial and elliptic flow, and strangeness enhancement, traditionally believed to be only achievable in heavy nucleus-nucleus collisions at high energy. To pinpoint the origin of these phenomena and to bring all collision systems in equal footings, along with charged-particle multiplicity, lately several event shape observables such as transverse activity classifier and transverse spherocity has been used extensively in experiments as well as in the phenomenological front.

In this contribution, we will summarise our phenomenological explorations [1-6] and compare with experimental results from LHC to conclude our learning so far from these studies. We observe that the event shape observables successfully differentiate the events based on soft and hard physics, however, obtaining these observables presents experimental challenges due to biases from detectors. In such a scenario, we propose to use machine learning methods for the determination of such observables in a dense environment like heavy-ion collisions. We will also provide a future outlook in view of Run 3 at the LHC.

The contribution would be based on our recent publications:
1. Phys. Rev. D107 (2023) 7, 074011
2. Phys. Rev. D107 (2023) 7, 076012
3. Phys. Rev. D103 (2021) 9, 094031
4. Sci. Rep. 12 (2022) 1, 3917
5. Eur. Phys. J. C82 (2022) 6, 524
6. J. Phys. G48 (2021) 4, 045104

Collaboration / Activity

QGP Phenomenology

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