Contribution ID: **1435** Type: **Oral**

Cluster formation near midrapidity – can the mechanism be identified experimentally?

Monday 30 October 2023 15:05 (15 minutes)

The formation of weakly bound clusters and hypernuclei in the hot and dense environment at midrapidity is one of the surprising phenomena observed experimentally in heavy-ion collisions from low SIS to ultra-relativistic LHC energies. This is also known as the 'ice in a fire' puzzle. Three approaches have been advanced to describe the formation of clusters: cluster formation during the entire heavy-ion collision by potential interactions between nucleons ('potential mechanism') and deuteron production by catalytic hadronic reactions ('kinetic mechanism') as well as by coalescence at kinetic freeze-out.

We present here results from PHQMD, a novel microscopic n-body transport model based on the QMD propagation of the baryonic degrees of freedom with density dependent 2-body potential interactions. The clusters, formed via 'potential' mechanism, are recognized by the Minimum Spanning Tree (MST) algorithm which is identifying bound clusters by correlations of baryons in coordinate space.
The PHQMD approach allows for studying in the same framework the two above mentioned mechanisms, to investigate how and when clusters are formed and finally for comparing the results with present data from GSI to RHIC energies.

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Session Classification: Mathematical Modeling and Computational Physics

Track Classification: Mathematical Modeling and Computational Physics