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Mechanisms for deuteron production in HICs with PHQMD transport approach

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The Parton-Hadron-Quantum-Molecular Dynamics (PHQMD) is a microscopic transport approach designed to describe the dynamical formation of clusters in HICs [1]. Within this framework we discuss the production of deuterons by two different mechanisms. The first one is the 'kinetic' formation of deuterons by inelastic $NNN \rightarrow Nd$ and $\pi NN \rightarrow \pi d$ scattering processes which we implement by means of the covariant rate formalism [2]. Moreover, we investigate within these reactions the inclusion of finite-size effects modeled on the deuteron quantum wave function.
The second mechanism accounts for the formation of deuteron by the 'potential' interaction among nucleons. To recognize those baryons which gather together into clusters, we employ the Minimum-Spanning-Tree (MST) algorithm which looks for correlations of nucleons in coordinate space during the PHQMD evolution of the expanding matter [3]. Finally, we show that the combination of the two mechanisms provides a good description of the available experimental measurements in a large HICs energy range.

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[3] S. Gläßel, V. Kireyeu, V. Voronyuk, J. Aichelin, C. Blume, E. Bratkovskaya, G. Coci, V. Kolesnikov and M. Winn, "Cluster and hypercluster production in relativistic heavy-ion collisions within the parton-hadron-quantum-molecular-dynamics approach", Phys. Rev. C 105 (2022) no.1, 014908.

Authors: BLUME, Christoph (Goethe University Frankfurt (DE)); BRATKOVSKAYA, Elena; COCI, Gabriele (HFHF & Goethe University, Frankfurt); AICHELIN, Joerg (SUBATECH); GLÄSSEL, Susanne; KOLESNIKOV, Vadim; VORONYUK, Vadim; KIREYEU, Viktar (Joint Institute for Nuclear Research (RU))

Presenter: COCI, Gabriele (HFHF & Goethe University, Frankfurt)

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