

## The role of parton distribution functions in the $\phi$ meson production in relativistic ion collisions

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Lattice gauge QCD calculations predict phase transition from hadronic matter to deconfined state of quarks and gluons - quark-gluon plasma (QGP) - at a high temperature and energy density [1]. Minimal conditions of the QCD phase transition and QGP matter formation are studied in relativistic small-system collisions [2]. One of the ways to investigate QGP properties in experiment is to measure the peculiarities of particles production [2]. Due to its characteristics, the vector  $\phi$  meson is considered as a good probe of the partonic matter formed in relativistic ion collisions [3].

The cross section of particle production in hard processes in the leading order QCD at the parton level is determined using nuclear parton distribution functions (nPDFs) [4-6]. These functions characterize the probability of a parton to have a certain fraction of the nucleon momentum inside the ion at any scale of the square of the momentum transfer in the interaction. The distributions are extracted from comprehensive global analysis of hard scattering data from variety of fix-target and collider experiments in framework of pQCD. The implementing of various sets of nPDF parameterizations [4-6] may help to interpret the experimental results on particle production.

This report presents the comparison of  $\phi$  meson production in  $p+Al$ ,  $p+Au$ ,  $d+Au$ , and  $^3He+Au$  collisions at  $\sqrt{s_{NN}} = 200$  GeV at midrapidity ( $|\eta| < 0.35$ ), measured at PHENIX [1], to PYTHIA/Angantyr, PYTHIA+EPPS16, and PYTHIA+nCTEQ15 nPDFs calculations. Model calculations are consistent with experimental data within uncertainties. However, at intermediate transverse momentum range, PYTHIA/Angantyr, PYTHIA+EPPS16, and PYTHIA+nCTEQ15 calculations do not predict the ordering of  $\phi$  meson production with the collision system size, observed in the experiment. Therefore,  $\phi$  meson production in  $p/d/^3He+Au$  collisions at  $\sqrt{s_{NN}} = 200$  GeV might be driven by mechanisms additional to nPDF.

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### The speaker is a student or young scientist

Yes

### Section

1. Intermediate and high energies, heavy ion collisions

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