PERCOLATION CLUSTER FORMATION AT ULTRARELATIVISTIC HEAVY ION COLLISIONS*

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We expect that the experimental study of percolation cluster formation and appearance of the critical transparency of the strongly interacting matter can give the information about the onset state of deconfinement.

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1. Introduction

The deconfinement in ultrarelativistic collisions is expected when the density of quarks and gluons becomes so high that due to strong overlap it no longer makes sense to partition them into colour-neutral hadrons. The clusters get much larger than hadrons, within which colour is not confined; deconfinement may be, therefore, related to cluster formation [1]. In Ref. [2] we have discussed that the regime change which is indicated in the behaviour of some characteristics of the particles production at ultrarelativistic heavy ion collisions as a function of centrality (*e.g.* [3]) could be explained with the cluster formation as a result of the nucleon and quark percolation [4]. Experimental observation of the effects connected with formation and decay of the percolation clusters in heavy ion collisions at ultrarelativistic energies and the study of correlation between these effects could provide the information about deconfinement of strongly interacting matter in clusters. To confirm the deconfinement in cluster it is necessary to study the centrality dependence in the behaviour of secondary particles yields and simultaneously, critical increase in transparency of the strongly interacting matter.

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Appearance of the critical transparency could change the absorption capability of the medium and we may observe a change in the heavy flavour suppression depending on their kinematical characteristics. So, study the centrality dependence of heavy flavour particle production with fixed kinematical characteristics could give the information on changing of absorption properties of medium depending on the kinematical characteristics of heavy flavour particles.

2. Experimental analysis

A comparison of yields in different ion systems by using nuclear modification factors such as $R_{\rm CP}$ (involving Central and Peripheral collisions *e.g.* for heavy flavour particles yields) could provide information on the properties of the nuclear matter. In such definition appearance of transparency could be identified and detected using the condition. Using some statistical and percolation models [5] and experimental data on the behaviour of the nuclear modification factors it is possible to get information on the appearance of the anomalous nuclear transparency as a signal of formation of the percolation cluster. Recent data obtained by STAR RHIC BNL [6] on the behaviour of the nuclear modification factors of the strange particles as a function of the centrality in Au+Au- and $p+p$-collisions at $\sqrt{s_{NN}} = 200$ GeV may help us to answer the questions: how the new phases of strongly interacting matter form? May we expect a signal on the formation of the intermediate nuclear system *e.g.* nuclear cluster? The strange particles could be formed as a result of quark coalescence in high density strongly interacting matter and on other hand they could be captured by this system intensively. Therefore, by increasing the centrality, yields of heavy flavours could decrease. The appearance of superconducting property of the strongly interacting matter [7] as a result of the formation of percolation cluster could stop decrease of yields of heavy flavours.

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