



Contribution ID: 454

Type: Poster

The puzzling relation between the R_{AA} and the v_2 for heavy mesons in a Boltzmann and in a Langevin approach

Tuesday 20 May 2014 16:30 (2 hours)

The heavy quarks constitutes a unique probe of the quark-gluon plasma properties. Both at RHIC and LHC energies it has been observed a puzzling correlation between the nuclear modification factor R_{AA} and the elliptic flow v_2 that has challenged all the existing models, especially for D mesons. We discuss how the treatment of the charm quark dynamics according to a Boltzmann or a Langevin dynamics can be responsible for a large part of such a puzzle. In particular, we see that depending on the angular and temperature dependence of the scattering matrix the v_2 can be quite different. In particular, once one reproduces the R_{AA} with both a Boltzmann and/or a Langevin approach the $v_2(p_T)$ that is build-up can be as different as a 50-80%. This together with a coalescence hadronization mechanism strongly quenches the puzzling R_{AA} and v_2 observation.

Differences between Boltzmann and Langevin dynamics can be traced back to the fact that especially for large screening mass (nearly isotropic scatterings) the transferred momentum is not small but comparable with the charm mass as well as to the average momentum of the bulk. On the other hand such differences disappear for bottom quarks which are predicted to be free of the ambiguities coming from the difference between a Boltzmann or a Langevin approach, and should more properly considered as heavy quarks as regards their transport in the QGP. Our study allows also to shed lights on the different predictions of several models currently compared with the first data at LHC on D mesons.

Reference:

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Authors: GRECO, Vincenzo (University of Catania); SCARDINA, francesco (INFN Catania)

Co-authors: PLUMARI, Salvatore (University of Catania (Italy)); DAS, Santosh Kumar (University of Catania, Italy)

Presenter: SCARDINA, francesco (INFN Catania)

Session Classification: Poster session

Track Classification: Open Heavy Flavour and Quarkonia