Contribution ID: **787** Type: **Poster Presentation**

System size scan of D meson R_{AA} and v_n using PbPb, XeXe, ArAr, and OO collisions at LHC

Monday 4 November 2019 17:40 (20 minutes)

Recent results at LHC and RHIC involving small collision systems have found evidence of collective flow behavior consistent with relativistic hydrodynamic expectations, which suggests the formation of tiny specks of quark-gluon plasma in these reactions. However, questions still remain about the nature of the matter formed in these minute systems. One of the main signatures of the quark-gluon plasma, i.e. the suppression of hard probes, has not yet been seen in small systems data. In fact, current experimental measurements indicate no suppression (e.g. $R_{\mathrm{pPb}} \sim 1$) in small systems. On the other hand, a surprisingly large D meson flow (though still suppressed compared to lighter hadrons) was measured in pPb collisions by the CMS collaboration. In order to reconcile these results we use Trento+v-USPhydro+DAB-MOD [1] to make predictions and propose a system size scan at the LHC involving ^{208}PbPb, ^{129}XeXe, ^{40}ArAr, and ^{16}OO collisions [2,3]. We find that the nuclear modification factor approaches unity as the system size is decreased, but nonetheless, in the 0–10% most central collisions $v_2\{2\}$ is roughly equivalent regardless of system size. Additionally we find that unlike in PbPb collisions the $v_3\{2\}$ gets a centrality dependence in smaller systems. These results arise from a rather non-trivial interplay between the shrinking path length in small systems and the enhancement of eccentricities in small systems at high multiplicity. Finally we also find a surprising sensitivity of D mesons $v_2\{2\}$ in 0–10% at $p_T = 2$–5 GeV to the slight deformation of ^{129}Xe recently found at LHC.

[1] R. Katz, C. Prado, J. Noronha-Hostler, J. Noronha and A. Suaide, ''DAB-MOD sensitivity study of heavy flavor R_{AA} and azimuthal anisotropies based on beam energy, initial conditions, hadronization, and suppression mechanisms" [arXiv:1906.10768 [nucl-th]].
[2] R. Katz, C. Prado, J. Noronha-Hostler and A. Suaide, ''System size scan of D meson R_{AA} and v_n using PbPb, XeXe, ArAr, and OO collisions at LHC" [please look for the paper on arXiv or Inspire].
[3] Z. Citron et al., ''Future physics opportunities for high-density QCD at the LHC with heavy-ion and proton beams," [arXiv:1812.06772].

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Session Classification: Poster Session

Track Classification: Heavy flavor and quarkonium