Mass-Independent Nature of Participant Matter & its Usefulness in Disappearance of Flow

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The knowledge of the hot and dense matter formed during a heavy-ion collision may allow one to extract information about the nuclear matter equation of state. Experimentally, the hot and dense matter can be divided in terms of different rapidity distributions defining the *spectator* and *participant matter*. Alternately, nucleons with at least one collision can be categorized as participant matter. We here show that the participant matter can also act as a barometer for the measurement of *balance energy* (E_{bal}) (i.e. the energy at which the flow disappears).

Using the quantum molecular dynamics (qmd) model [1], we study the symmetric reactions of C+C, Ne+Ne, Ca+Ca, Ni+Ni, Nb+Nb, Xe+Xe, Er+Er, Au+Au and U+U at their corresponding E_{bal} using a hard eos with momentum dependent interactions (mdi) (labeled as HMD) and without mdi (labeled as Hard) along with cross-section of 55 mb.

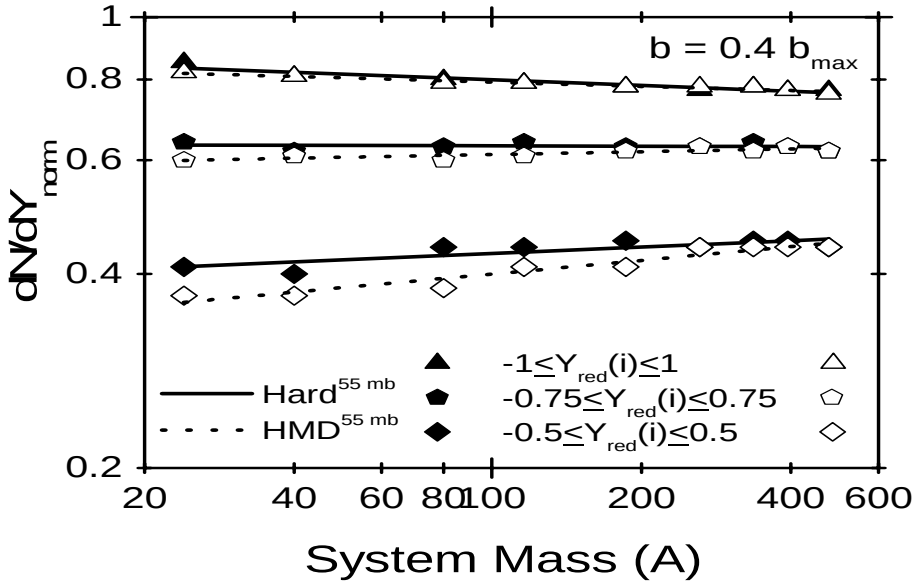

Figure 1. Participant Matter Defined in Terms of Different Rapidity Cuts.

In fig. 1, we display the participant matter obtained by dividing the matter into different rapidity bins. The lines in the figure are the power law fits of the form $c.A^{\tau}$. Solid lines represent Hard whereas dotted lines represent HMD. Interestingly, we see a nearly mass independent behavior of the participant matter for both the HMD and Hard. This also indicates that the repulsive and attractive forces balance in such a way that the net participant matter remains the same in all the cases. Interestingly, in spite of different E_{bal} and colliding masses, the participant matter remains the same for both the Hard and HMD. This picture is model ingredient independent and hence can act as a barometer for the measurement of balance energy [2].

[1] J. Aichelin, Phys. Rep. **202,** 233 (1991).
[2] A.D. Sood and R.K. Puri, Phys. Rev. C- to be submitted.