Contribution ID: **8** Type: **Talk**

Understanding the energy dependence of B_2 in heavy ion collisions: Interplay of volume and space-momentum correlations

Wednesday 2 December 2020 11:20 (20 minutes)

The deuteron coalescence parameter B_2 in proton+proton and nucleus+nucleus collisions in the energy range of $\sqrt{s_{NN}} = 900$ - 7000 GeV for proton+proton and $\sqrt{s_{NN}} = 2$ - 2760 GeV for nucleus+nucleus collisions is analyzed with the Ultrarelativistic Quantum Molecular Dynamics (UrQMD) transport model, supplemented by an event-by-event phase space coalescence model for deuteron and anti-deuteron production. The results are compared to data by the E866, E877, PHENIX, STAR and ALICE experiments. The B_2 values are calculated from the final spectra of protons and deuterons. At lower energies, $\sqrt{s_{NN}} \leq 20$ GeV, B_2 drops drastically with increasing energy. The calculations confirm that this is due to the increasing freeze-out volume reflected in $B_2 \sim 1/V$. At higher energies, $\sqrt{s_{NN}} \geq 20$ GeV, B_2 saturates at a constant level. This qualitative change and the vanishing of the volume suppression is shown to be due to the development of strong radial flow with increasing energy. The flow leads to strong space-momentum correlations which counteract the volume effect.

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