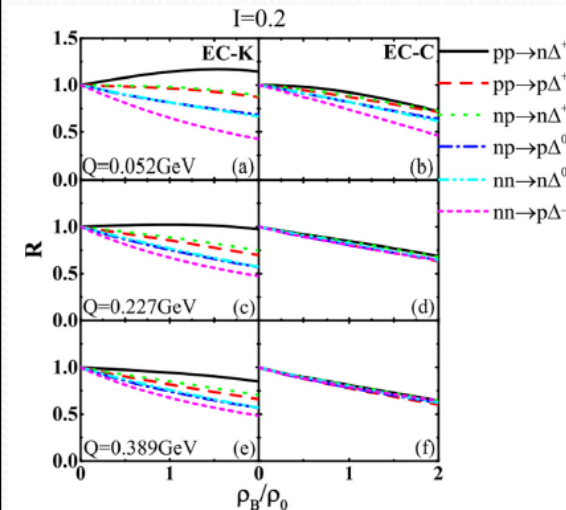


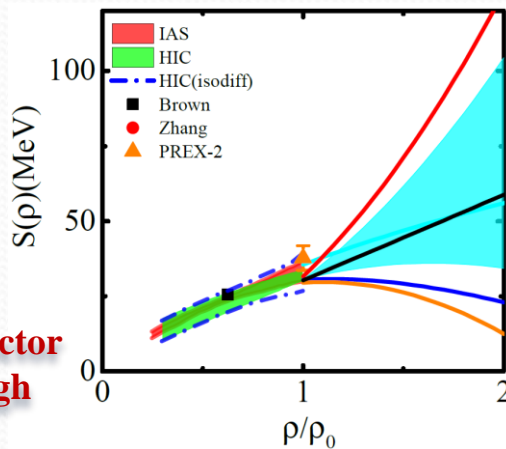
Study on the isospin asymmetric nuclear and in-medium pion production

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1. In-medium $NN \rightarrow N\Delta$ cross section with energy conservation

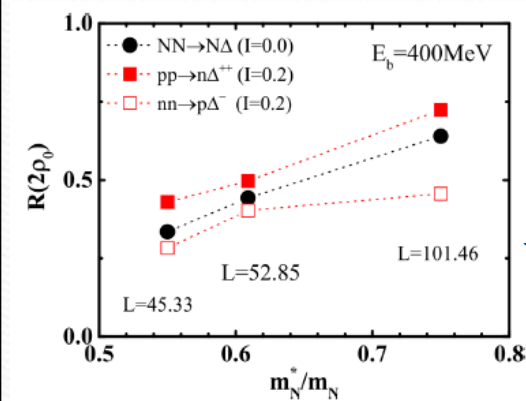


In medium pion related ($NN \leftrightarrow N\Delta$ and $N\Delta \leftrightarrow \pi$) cross sections are the key ingredients of pion-loop in heavy ion collision simulations. The isospin effects on all of these facts can lead to more precise transport models. It will help reduce the theoretical uncertainty.

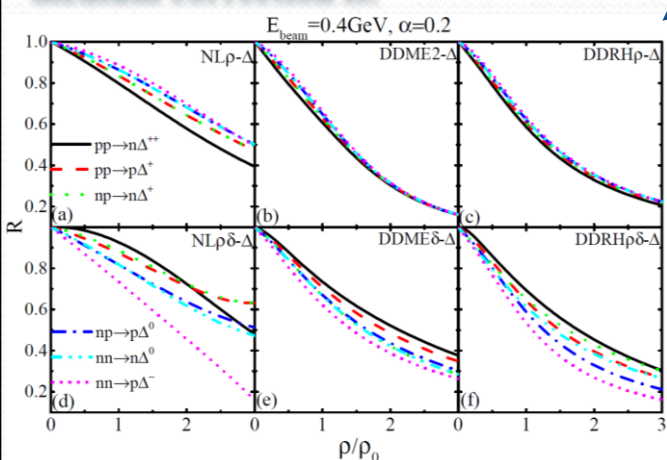


Isospin splitting of medium correction factor $R = \sigma_{NN \rightarrow N\Delta}^* / \sigma_{NN \rightarrow N\Delta}^{\text{free}}$ becomes weak at high beam energies.

2. Correlation between R and EOS

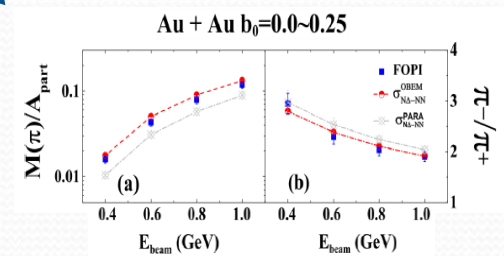
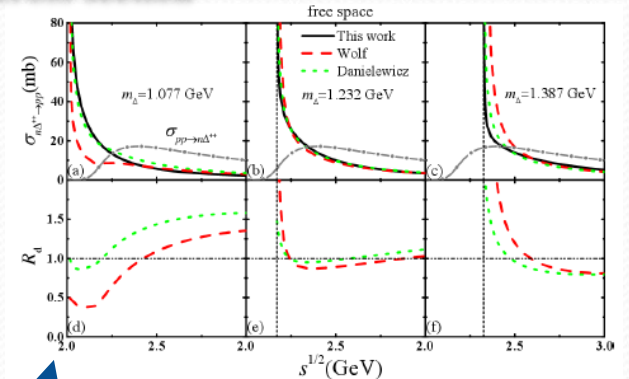


Larger effective mass is, the weaker medium correction is.



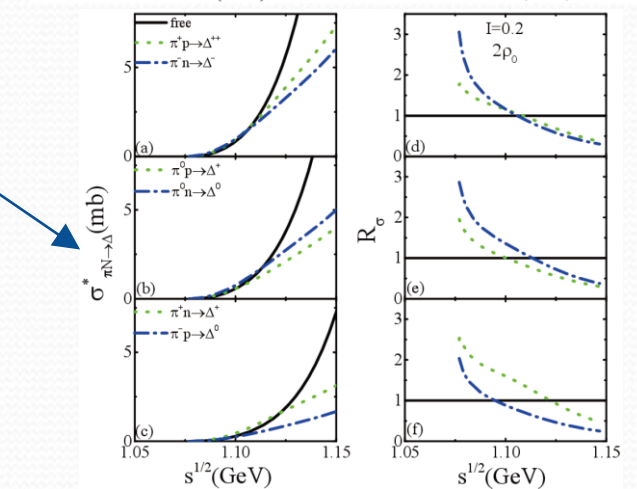
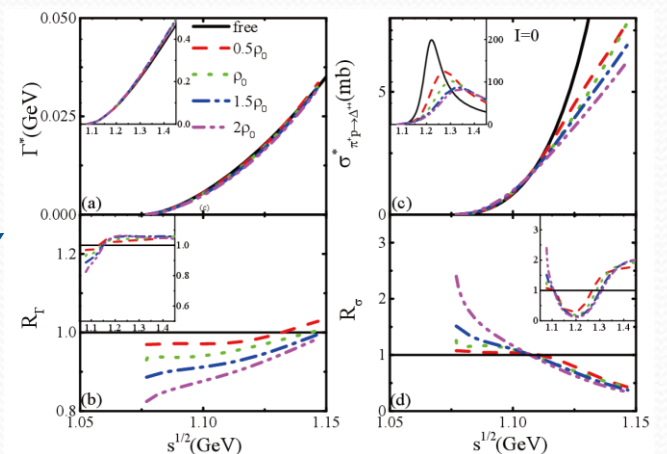
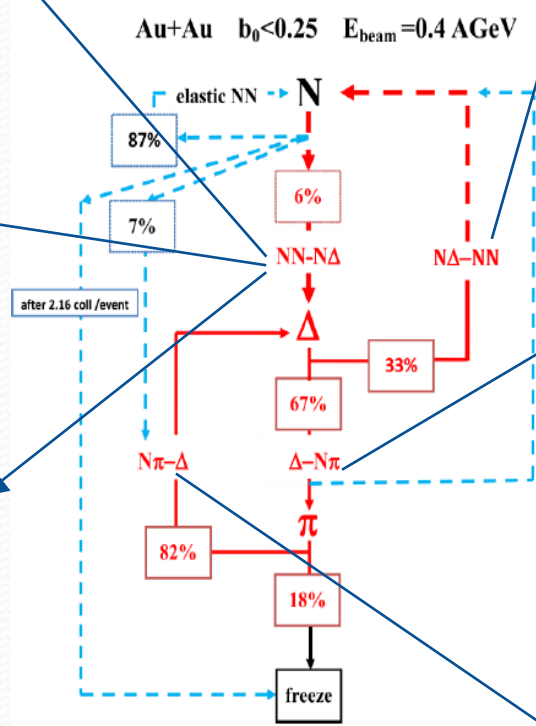
The order of $R_{NN \rightarrow N\Delta}$ may change the ratio of charged yields π^-/π^+ in HIC.

3. The m_Δ dependence of $|p_{N\Delta}|$ and M-matrix effects on the calculations of $N\Delta \rightarrow NN$ cross section



The high precise $N\Delta \rightarrow NN$ cross section can solve the low multiplicity of pions.

4. $N\pi \rightarrow \Delta$ cross section and $\Delta \rightarrow N\pi$ decay width



The in-medium $N\pi \rightarrow \Delta$ cross sections are enhanced at $s^{1/2} < 1.11$ GeV in nuclear matter.