A NEW PERSPECTIVE ON THE SPECTATORS

L. Shi, P. Danielewicz, R. Lacey

Within a transport model, the dynamical evolution of the spectators is investigated. The spectator transverse momentum, \( \langle P_x \rangle \), and the change in the net average momentum per nucleon, \( \Delta \langle P/A \rangle \), are found to be sensitive to the nuclear equation of state. Acceleration of the spectator is observed in a heavy system.

Spectator properties have been much investigated in the context of search for the liquid-gas phase transition \(^1\). The result has been a detailed assessment of the statistical decay of the spectators (see \(^2\) for a comprehensive review). A particularly impressive finding was that of the universal behavior of spectator multifragmentation \(^3\). With relatively few exceptions, the neglected aspect of the reactions has been the dynamical evolution of spectators during the violent reaction stage. With that respect, Danielewicz remarked \(^4\) on the formation of a shock wave inside the spectator matter and stressed \(^5\) the importance of the participant-spectator interaction in the generation of participant elliptic flow. An experimental investigation of the transverse momentum delivered to a spectator was done by Bogdanov et al.\(^6\), \(^7\).

In this work, we explore \(^8\) the dynamical development of the spectators, in the context of a nuclear transport model \(^9\). We examine which of the emerging spectator characteristics reflect the violent reaction stage.

Figure 1 shows contour plots of three different quantities within the reaction plane from the transport simulations of a \(^{134}\)Sn + \(^{134}\)Sn reaction, at the beam energy of \( T_{\text{lab}} = 800 \text{ MeV/nucleon} \) and the impact parameter of \( b = 5 \text{ fm} \), carried out utilizing a soft momentum-dependent (MD) mean field (MF).