Laboratory Tests of Low Density Astrophysical Equations of State

JOSEPH NATOWITZ, Texas A&M University — Clustering in low density nuclear matter has been investigated using the NIMROD multi-detector at Texas A&M University. Thermal coalescence models were employed to extract densities, $\rho$, and temperatures, $T$, for evolving systems formed in collisions of 47A MeV $^{40}$Ar + $^{112}$Sn, $^{124}$Sn and $^{64}$Zn + $^{112}$Sn, $^{124}$Sn. The yields of d, t, $^3$He and $^4$He have been determined at $\rho = 0.002$ to $0.032$ nucleons/fm$^3$ and $T = 5$ to $10$ MeV. Symmetry energy coefficients and equilibrium constants for alpha production have been derived from these data. The data provide an important constraint on astrophysical equation of state models at low density.