Isospin Mixing
&
Isospin Diffusion

To study the asymmetry energy

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Central Collisions – 2 reactions differ only in isospin comp.

**Isospin fractionation**

**Isospin mixing**
Factorization of isotope yields

\[ \frac{Y(N,Z)}{Y^{112+112}(N,Z)} = [C \cdot (\rho_n)^N \cdot (\rho_p)^Z] \]

Reduce data into 3 parameters:

- \( C \)
- \( \rho_n \)
- \( \rho_p \)
Isomixing -- Mixed systems give similar results
Peripheral Collisions

Symmetric system

Mixed system

Isospin diffusion

No isospin gradient, no diffusion
Experimental results

\[ \frac{Y(N,Z)}{Y^{112+112}(N,Z)} = [C \cdot (\hat{\rho}_n)^N \cdot (\hat{\rho}_p)^Z] \]

Assume \( Z_0 = 50 \)

\( A_0 = 124 \)

3 nucleons exchange between 112 and 124

(equilibrium = 6 nucleons)
BUU predictions

\[ E(\rho, \beta) = E(\rho, 0) + S_{\text{sym}}(\rho) \beta^2 \]

Experimental results agree better with predictions using more stiff symmetry terms.
Summary

• Density dependence of symmetry energy can be examined experimentally. ➔ Existence of isoscaling relations

• Isospin mixing: Conclusions from multi-fragmentation work are model dependent:
  – SMM favors $\rho^2$ dependence of $S(\rho)$.
  – EES favors $\rho^{2/3}$ dependence of $S(\rho)$.

• Isospin diffusion from projectile fragmentation data – test the transport model parameters
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\[ B = a_v A - a_s A^{2/3} + \delta - a_c \frac{Z(Z-1)}{A^{1/3}} - a_{sym} \frac{(A-2Z)^2}{A} \]