Competition between ICF and Binary reactions induced by proton rich beams

M.Papa, G.Cardella and EXOCHIM collaboration

Data from, the Limitng experiment **^{40}Ca+ ^{48}Ca, ^{46}Ti, ^{40}Ca at 25 MeV/A**

For same selection criteria the ICF yield changes for the different system

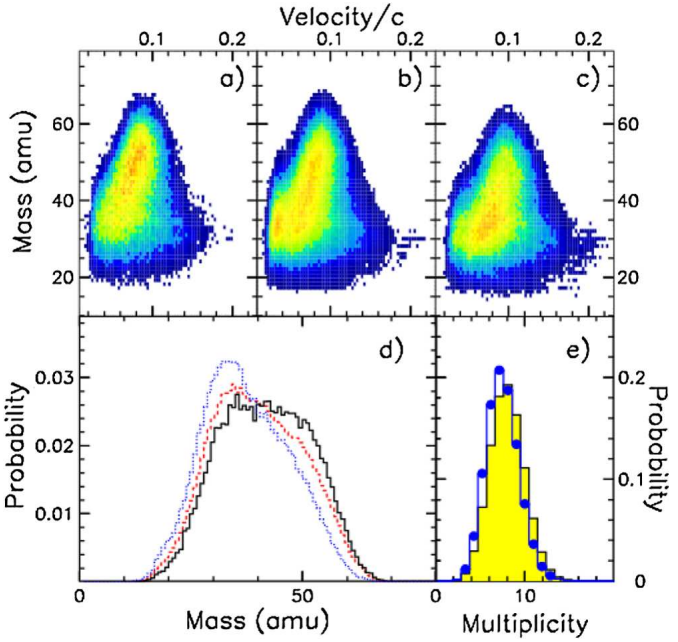

FIG. 1 Mass mB_l versus velocity vB_l of the largest fragment detected in the ^{40}Ca +^{48}Ca (a), ^{40}Ca + ^{46}Ti (b), and ^{40}Ca + ^{40}Ca (c) reactions. (d) Projections on the mass axis for ^{48}Ca target (full line) ^{46}Ti target (dashed line), and ^{40}Ca target (dotted line).

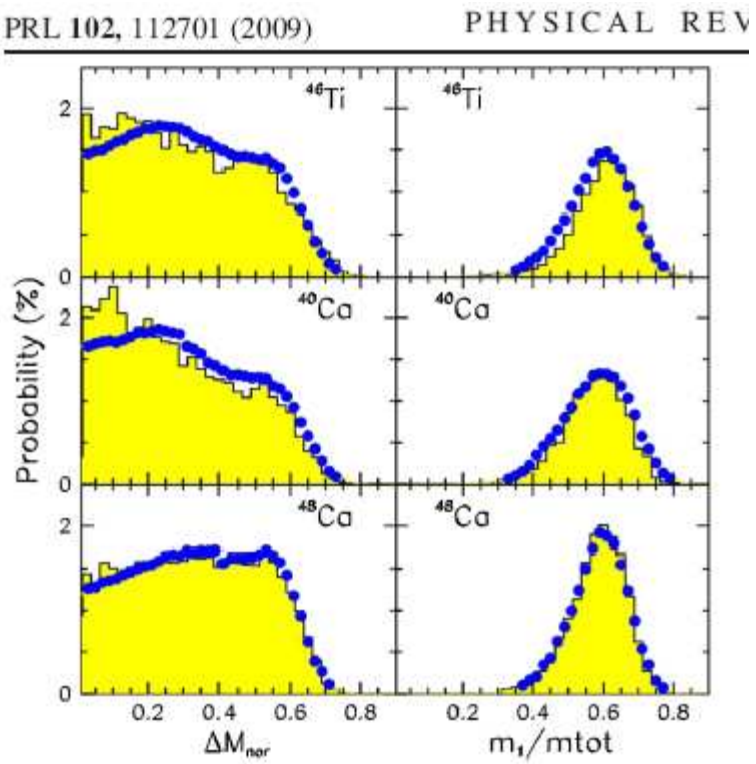

FIG. 2 (color online). Dot histograms: Probability plots of $m_1 - m_2$ and m_1 normalized to the total mass for the studied reactions. Shaded histogram: CoMD-II + GEMINI calculations. See text for details.

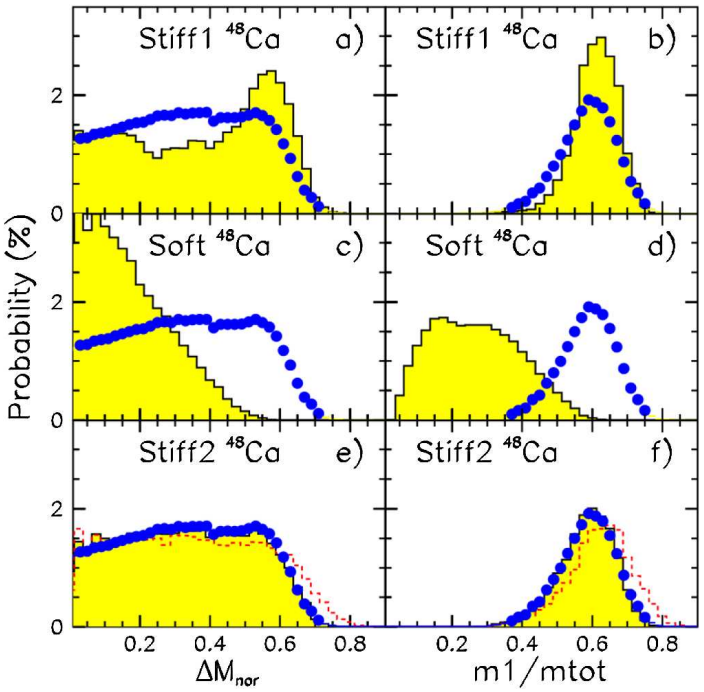

FIG. 2 Dot histograms: Probability plots of m1 - m2 and m1 normalized to the total mass for the reaction on ^{48}Ca target. Shaded histogram: CoMD-II + GEMINI calculations.

Many-body calculations based on ComD-II model show also that the balance between ICF processes and the binary one strongly depends on the Functional form of the Form Factors which describe the iso-vectorial interaction

This sensitivity is largely due to many-body correlations which make the average overlap Integral per couple of nucleons different for n-n, p-p, n-p couples

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$$U^{eff} = U^{IS} + U^{C} + U^{T}$$

$$U^{T}_{NL} = \frac{a}{2s_{g.s}} F'(s)(N^2 \hat{\rho}^{nn} + Z^2 \hat{\rho}^{pp} - 2NZ\hat{\rho}^{np})$$

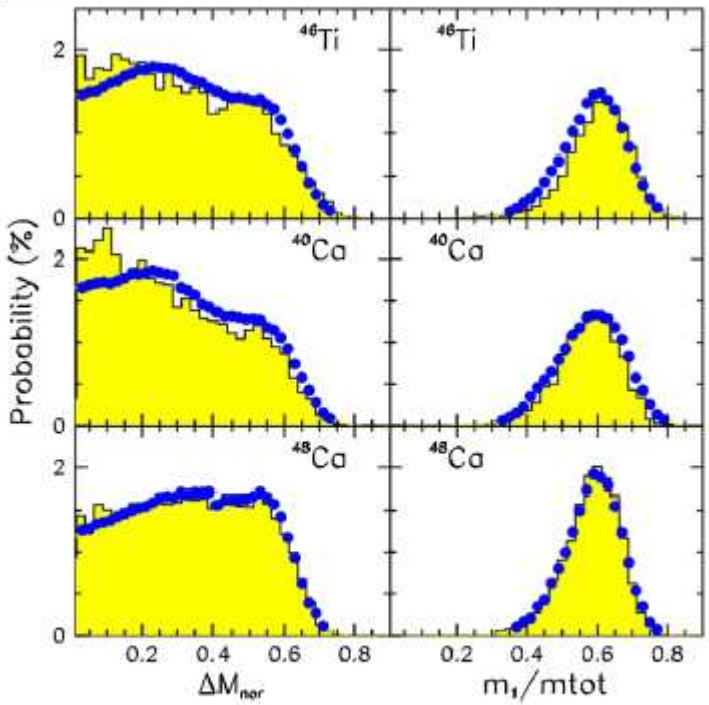
$$U^{c} = \frac{1}{2}\sum_{i \neq j} \frac{e^2}{|r_i - r_j|} \mathrm{erfc}\left(\frac{r_i - r_j}{2\sigma^2}\right)$$

For a fixed A and mass asymmetry
The change from $\beta=(N-Z)/A$ to $-\beta$
strongly affects U^c and U^T

Isopin 1 $^{48}Ca+ ^{48}Ca$, and $^{42}Ca + ^{54}Fe$ at 25 MeV/A

Perspective with FRIBS upgrade

With the FRIBS foreseen upgrading many beams rather proton rich will be available with intensities of the order of 10-100 kHz. For instance using a 100W primary beam of ^{36}Ar on a 1mm ^{9}Be target, with today FRIBS system, LISE calculations predict a production rate from few to some kHz for nuclei as ^{31}Cl, $^{32,33}Ar$, ^{35}K at the proton drip line. Therefore for all these beams 10-100 kHz intensities can be expected after the upgrading. These beam intensities, with a 4π detector like CHIMERA are enough to study competition between binary and incomplete fusion reactions, and also to extract calorimetric information about the populated systems. We expect in fact cross sections of the order of some hundreds of mbarn for ICF events. Therefore, using targets thickness of the order of 10 mg/cm^2, one should collect around 500 ev/h for such kind of reactions. Statistics of the order of 10^5 events could be obtained within 10 days.



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