Effects of nuclear structure in residual-nuclei production

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OUTLOOK

1) Experiment: $^{238}$U $\rightarrow$ Ti at 1 A·GeV at the FRS (GSI)

2) Results: production cross section of residual nuclides

3) Data reveal complex structural effects

4) Analysis of the results with the statistical model

5) Conclusions
THE EXPERIMENT AT THE FRAGMENT SEPARATOR

1 A GeV $^{238}$U beam into a thin Ti target

identification of $Z$ from IC: $\Delta E \propto Z^2$

identification of $A/Z$ from time and position:

$$\frac{A}{Z} = \frac{e}{m_0} \frac{B\rho}{c\beta\gamma} \quad \beta = \frac{v}{c} \quad \text{with} \quad v = \frac{s}{ToF}$$
NUMBER OF FINAL STATES

STATISTICAL MODEL with the simplest description of pairing:

- in the masses: $M = M_{LD} - \delta$  
  $\delta_{oo} = 0$, $\delta_{oe} = \Delta$, $\delta_{ee} = 2\Delta$

- in level density: $\rho \propto \exp(2\sqrt{a(E - \delta)})$
Conclusions

Experiment: light nuclides of 1A·GeV $^{238}$U+Ti
FRS allows full (A, Z) identification
$\rightarrow$ formation cross section for every isotope

Results:
complex structure of nuclei produced in rather violent collisions

Explanation:
1) the statistical model explains the structure of odd-mass nuclei as the most prominent manifestation of pairing
$\rightarrow$ independence of the reaction mechanisms

2) even-odd structure of even-mass nuclei could be related to higher-order structural effects in the level density
$\rightarrow$ yields from highly excited nuclei are a rich source of information on nuclear structure.