

Revival of deep inelastic transfer reactions for production of neutron-rich isotopes of heavy elements

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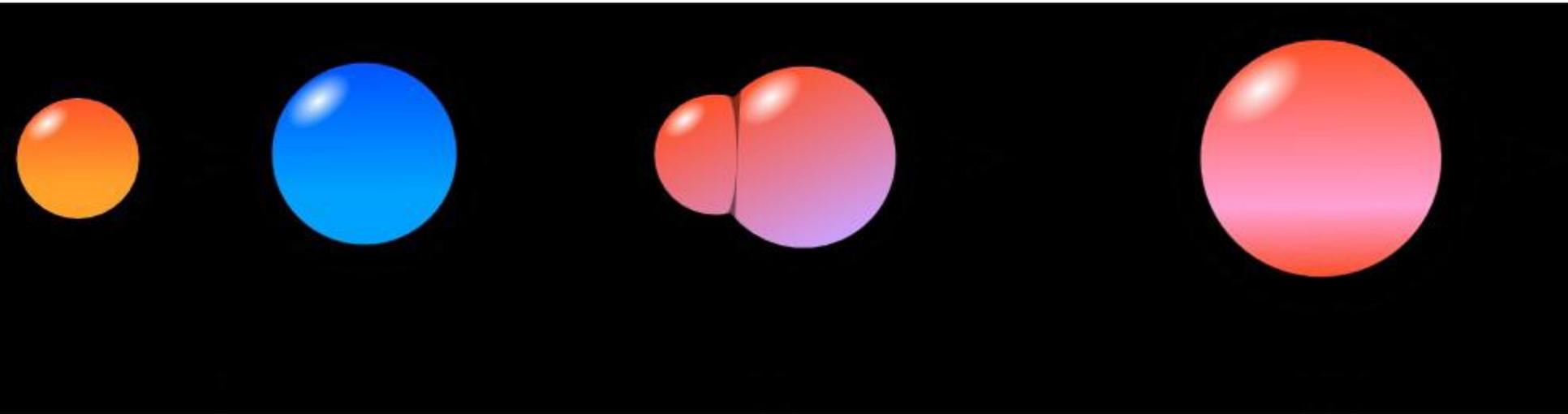
³ *Institut für Kernchemie, Universität Mainz, Germany*

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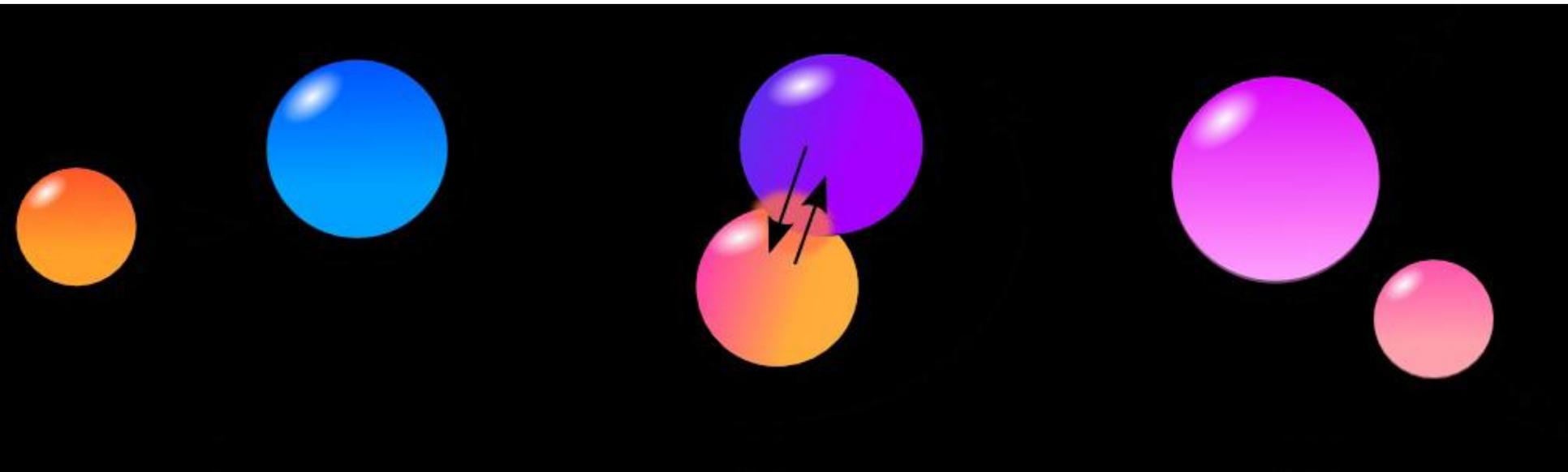
⁵ *Gesellschaft für Schwerionenforschung, Darmstadt, Germany*

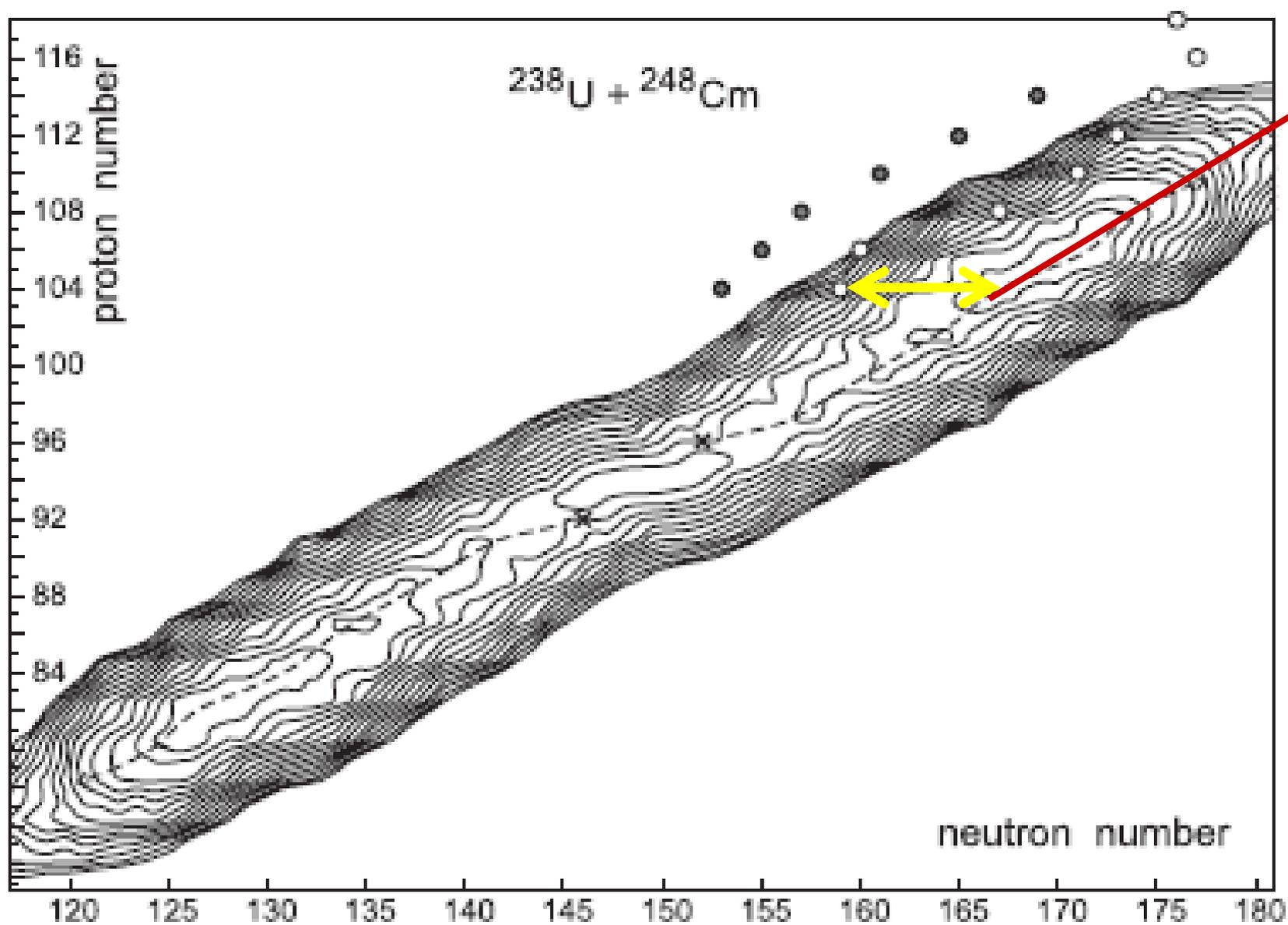
- Revival of nucleon transfer experiments for production of new neutron-rich heavy nuclides (V. Zagrebaev, W. Greiner)
- This talk: early nucleon transfer studies in very heavy systems@GSI

Fusion reactions

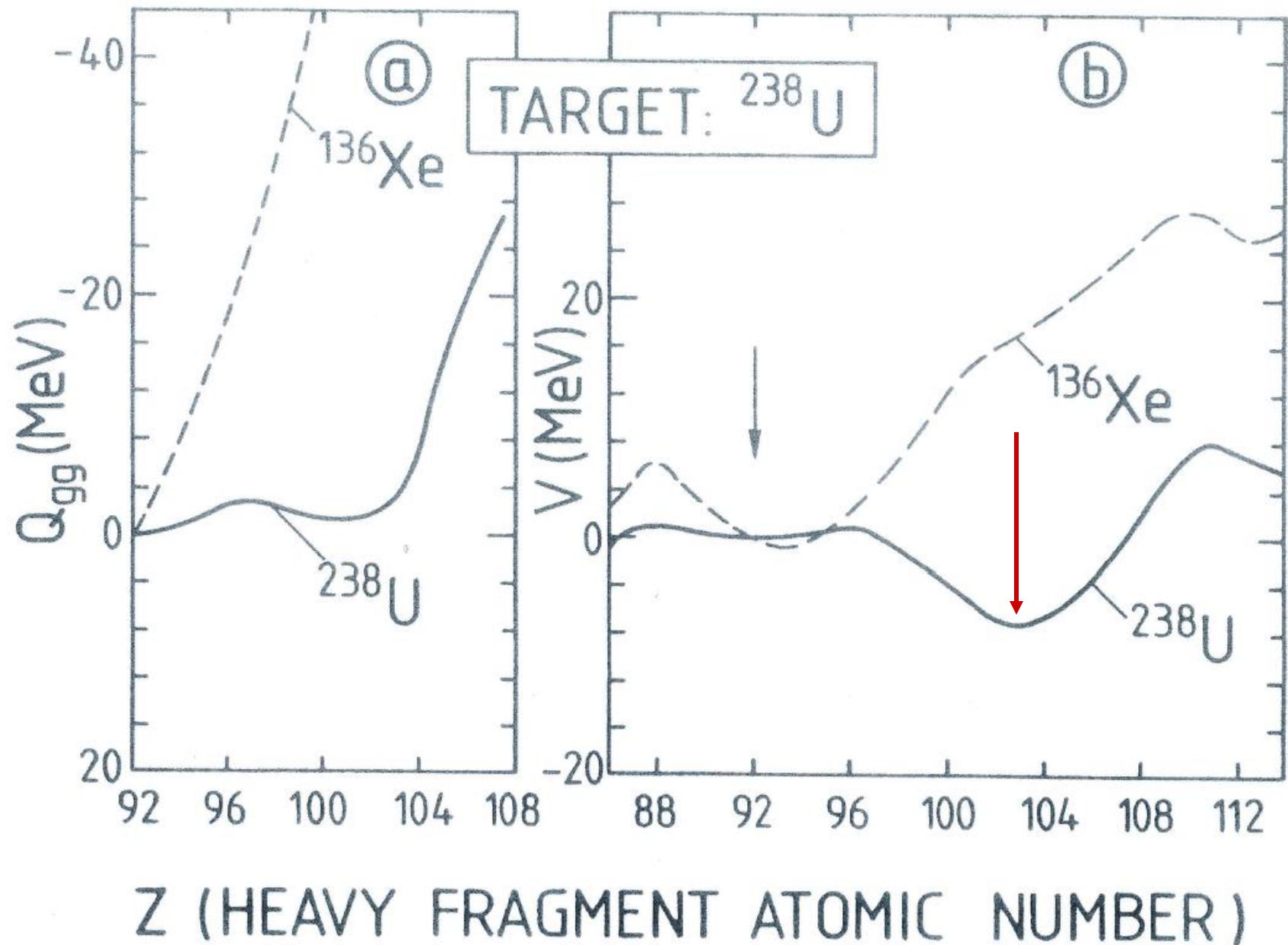


Deep inelastic reactions





V. Zagrebaev, W. Greiner, Phys. Rev. C **78** (2008)

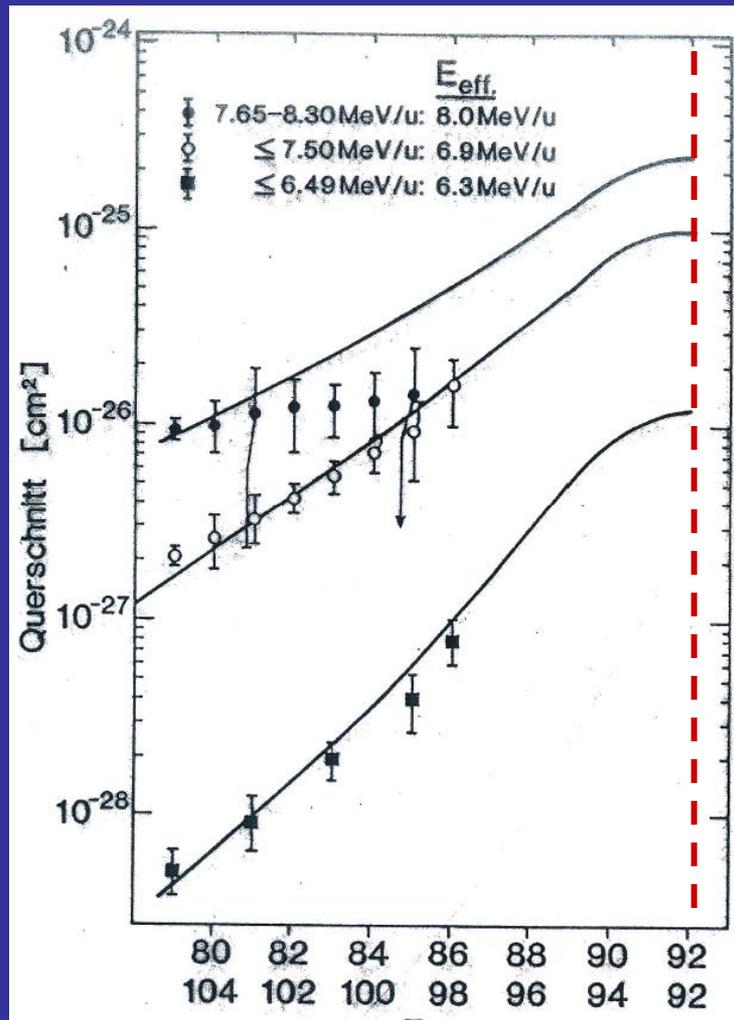


Study of nucleon transfer reactions by nuclear chemical methods@GSI

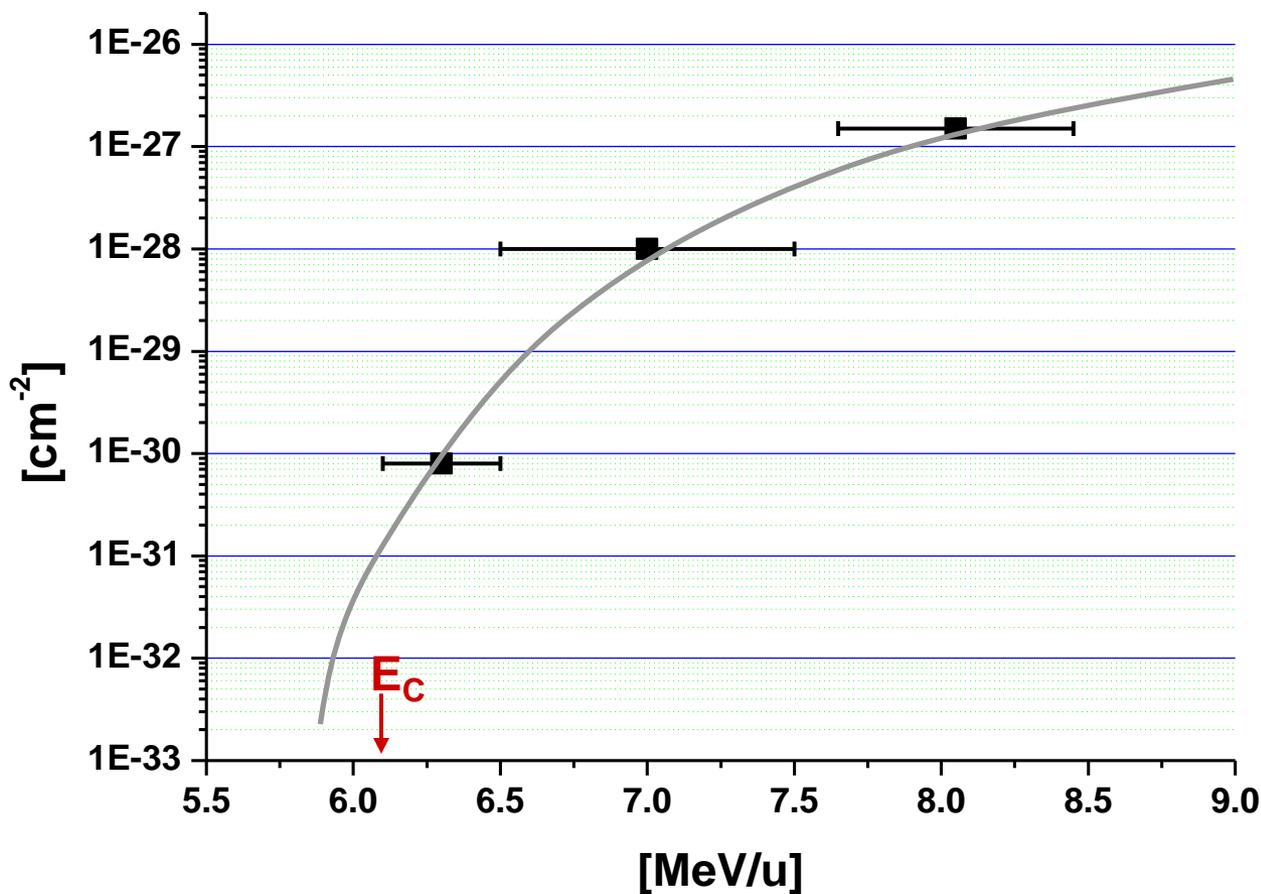
- Measured:

Excitation functions for isotopes of different
elements in the reaction $^{238}\text{U} + ^{238}\text{U}$

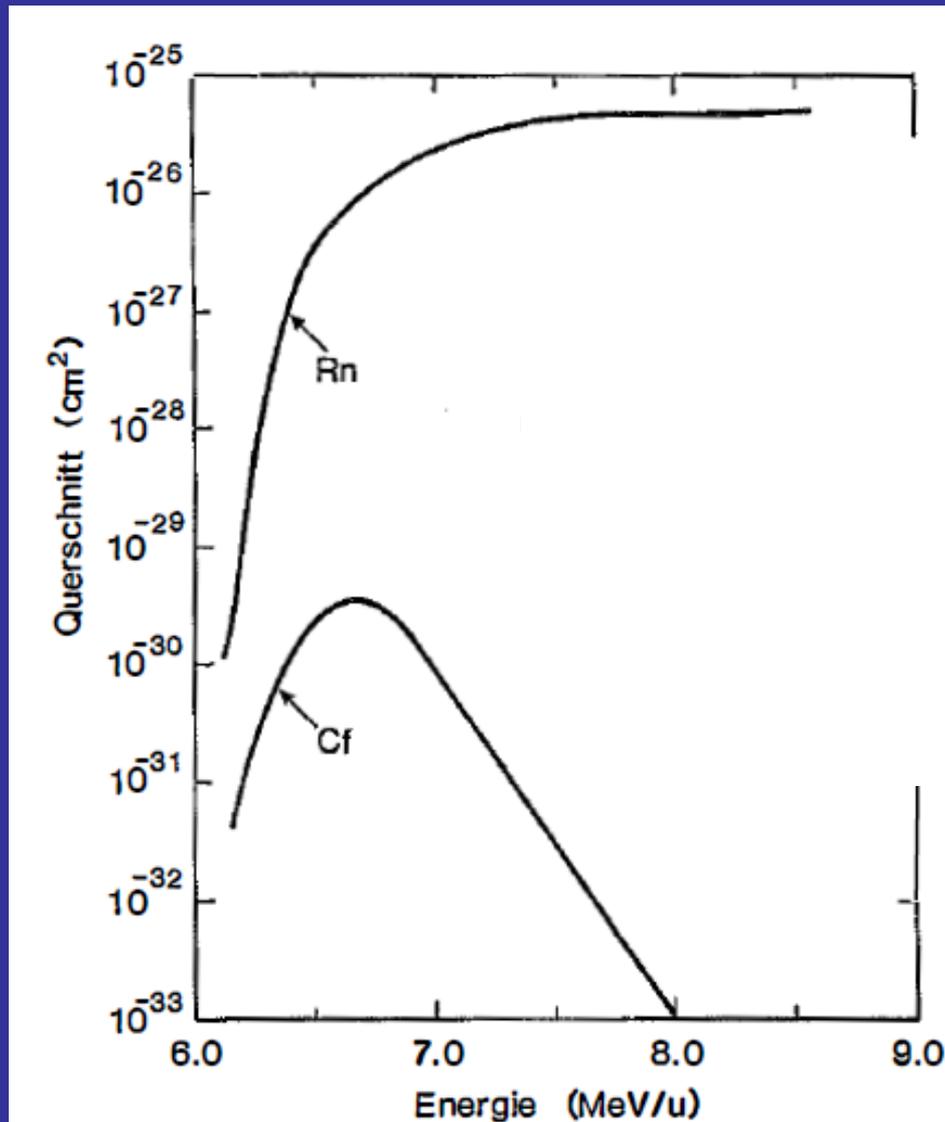
Below-target cross sections for element yields in the reaction $^{238}\text{U} + ^{238}\text{U}$ at three bombarding energies



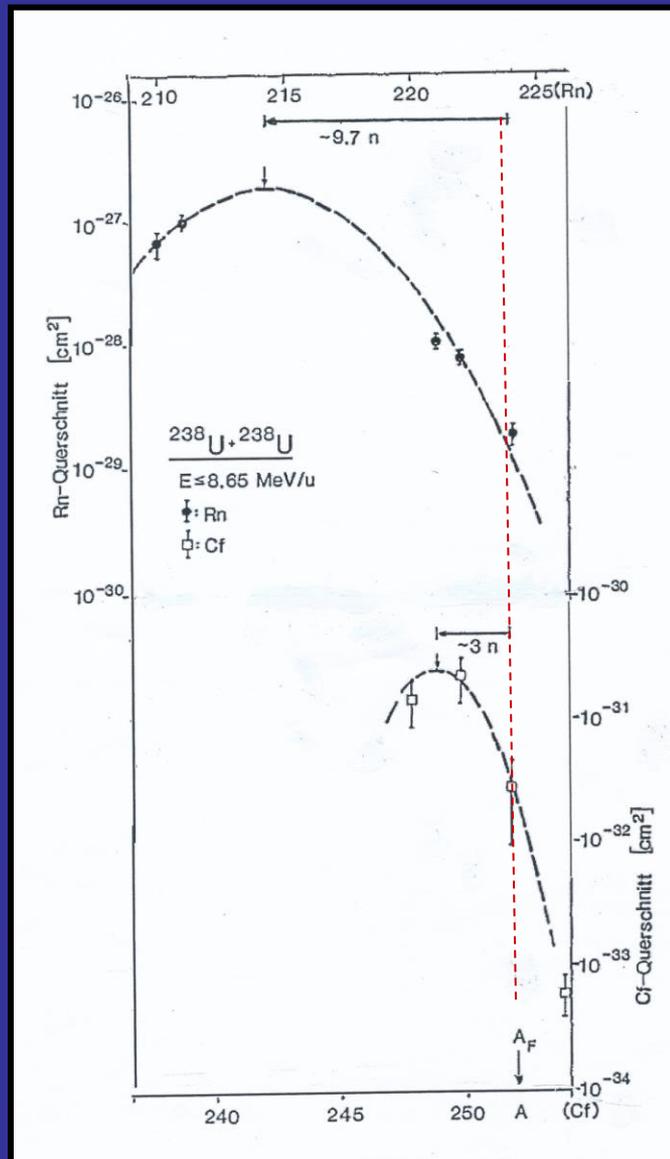
Excitation function for formation of elements 70/114 in $^{238}\text{U} + ^{238}\text{U}$ reaction



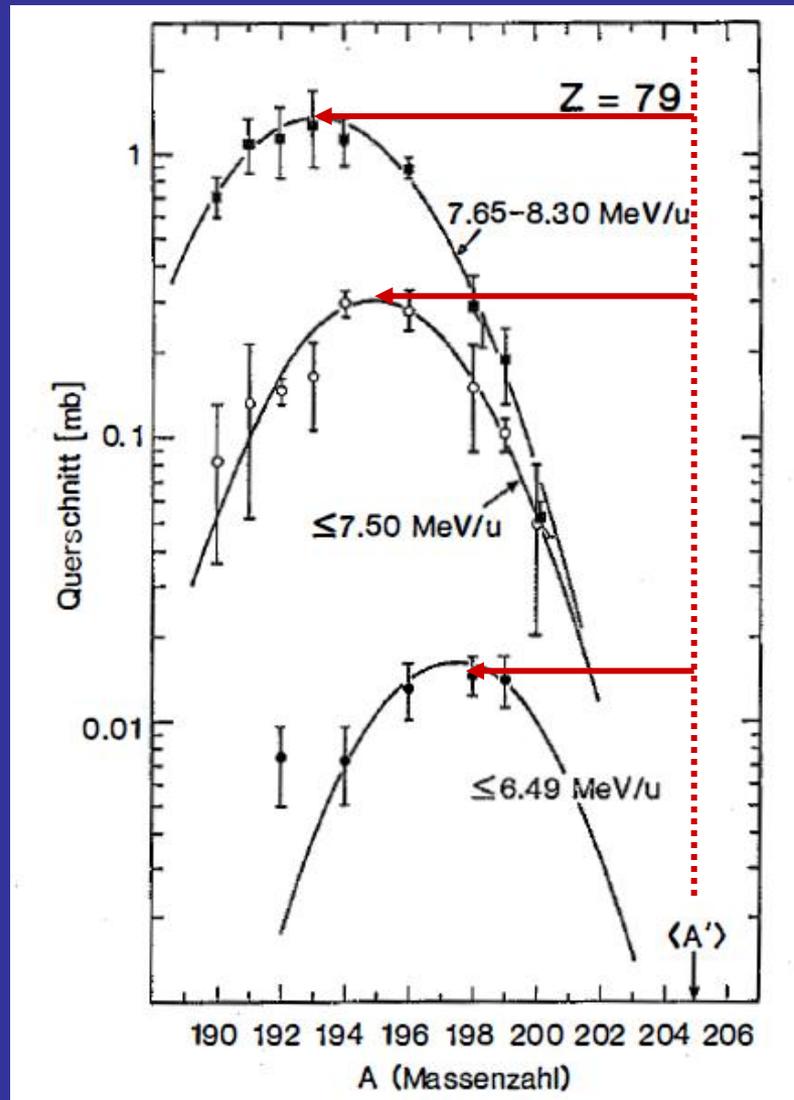
Excitation functions for complementary elements in $^{238}\text{U} + ^{238}\text{U}$ (6p transfer)



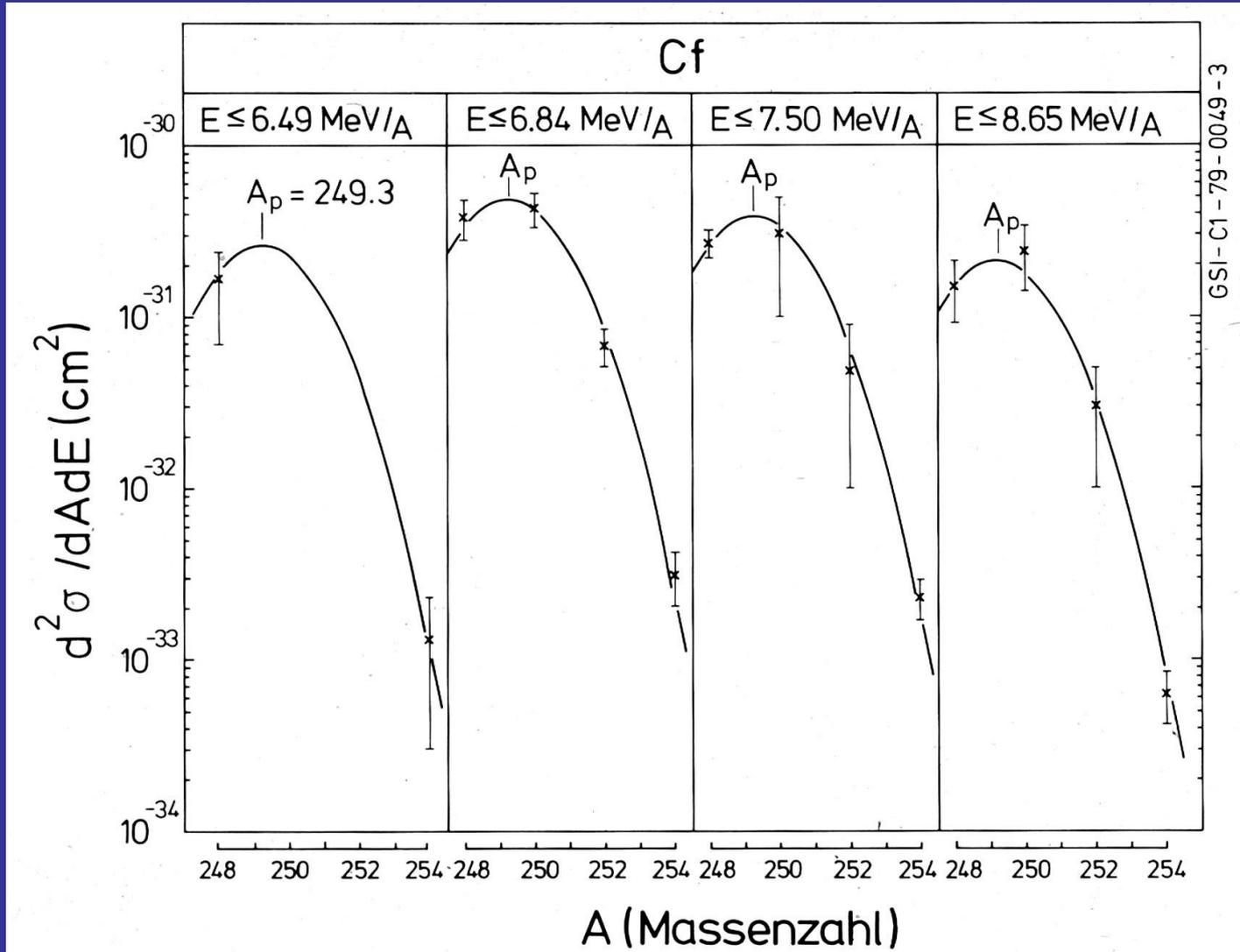
Isotope distribution for complementary elements in $^{238}\text{U} + ^{238}\text{U}$ (6p transfer)



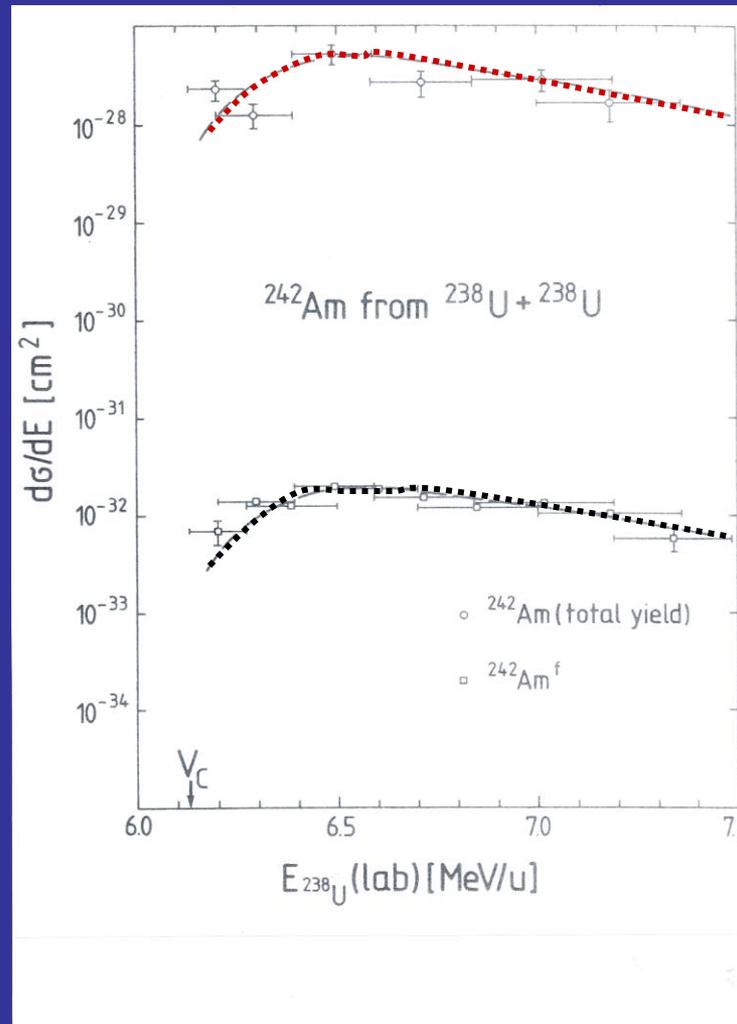
Shift of isotope distribution as function of bombarding energy for product (Au) with low fission probability



No shift of isotope distribution as function of bombarding energy for product with high fission probability

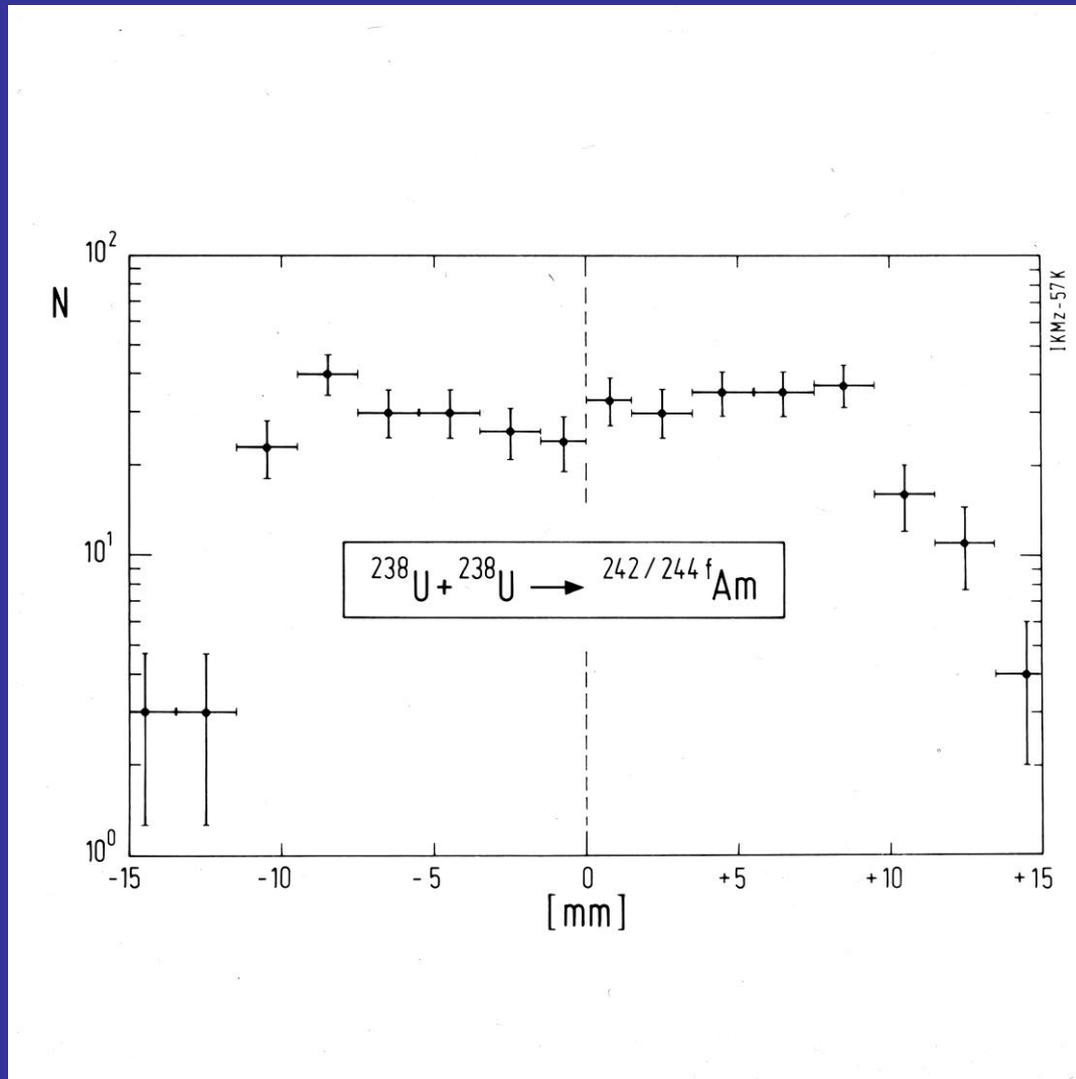


Excitation function for $^{242\text{mf}}\text{Am}$ and $^{242\text{g}}\text{Am}$ from $^{238}\text{U} + ^{238}\text{U}$

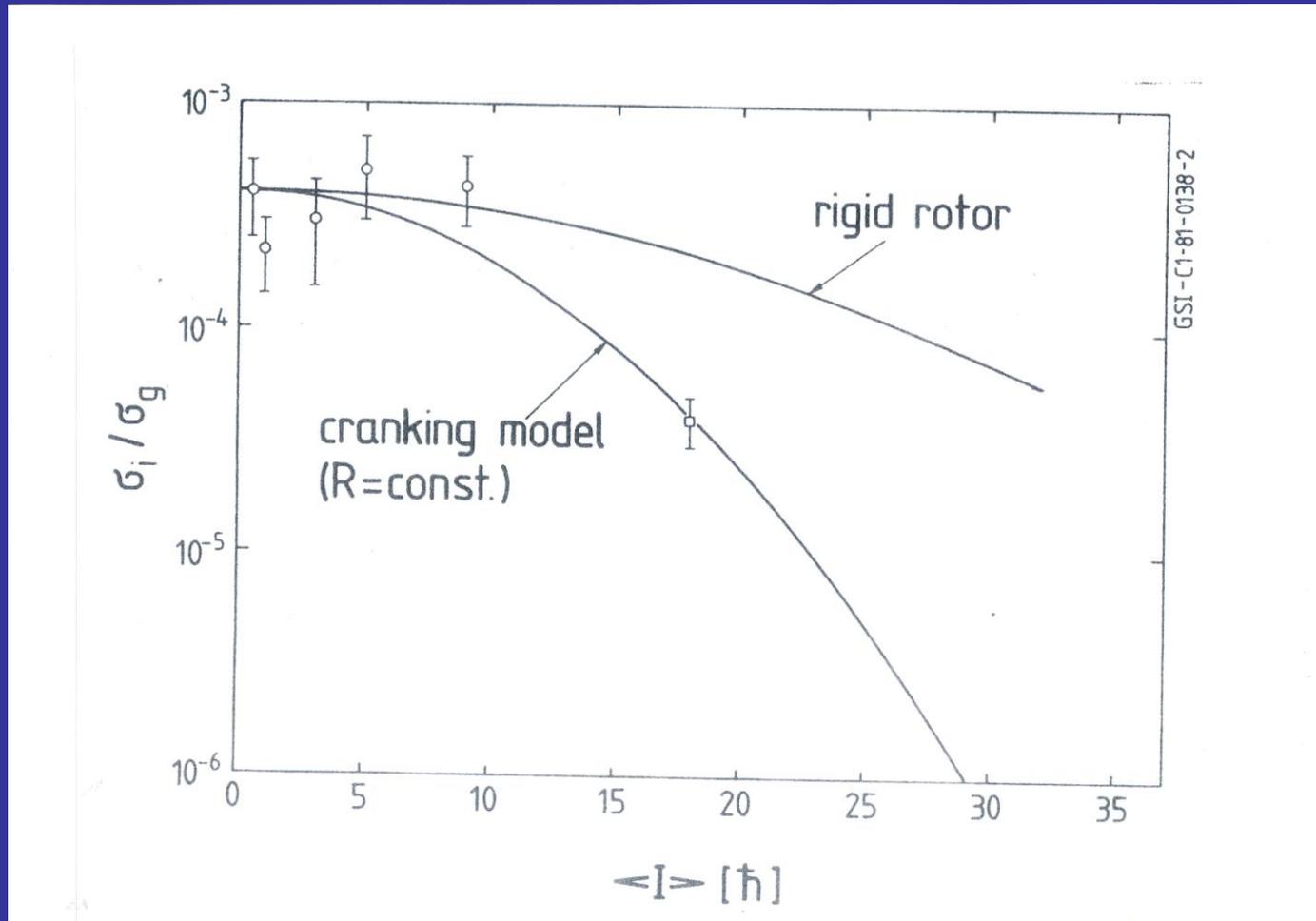


Ratio = 4×10^{-5} ,
independent of
bombarding
energy!

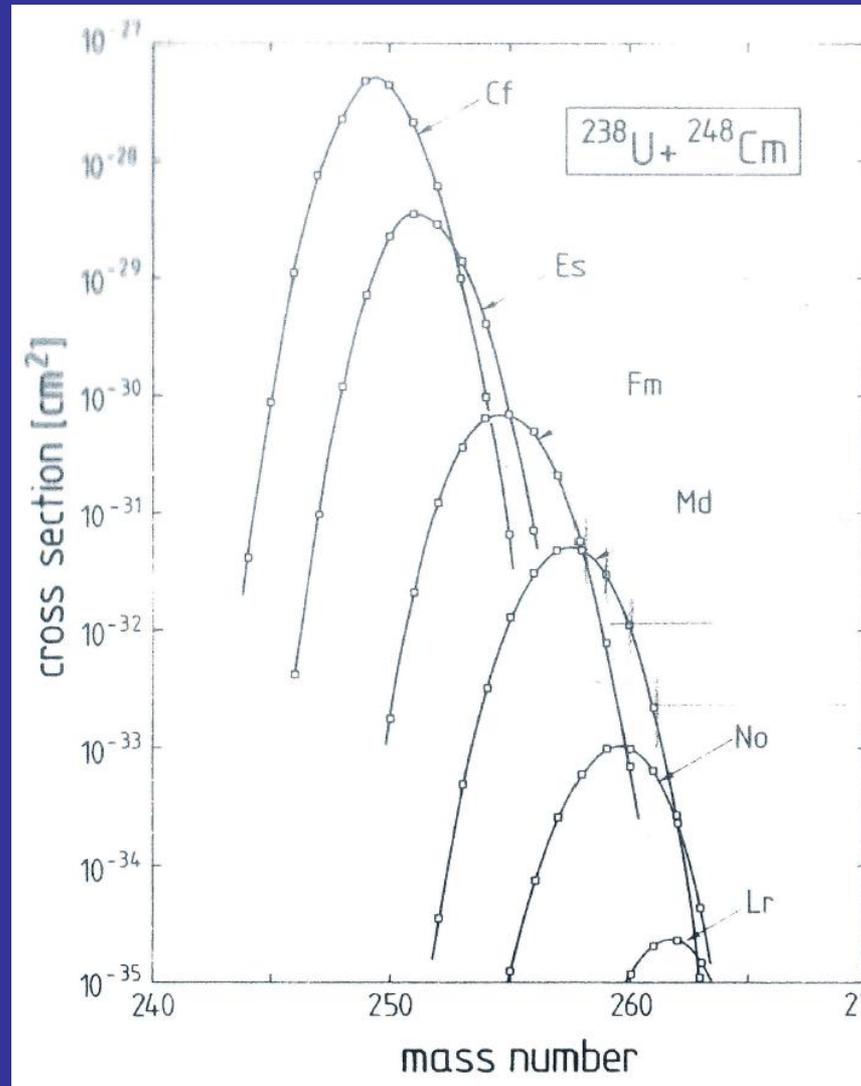
Angular distribution for $^{242\text{mf}}\text{Am}$ from $^{238}\text{U} + ^{238}\text{U}$



Shape-isomer to ground state ratio for ^{242}Am



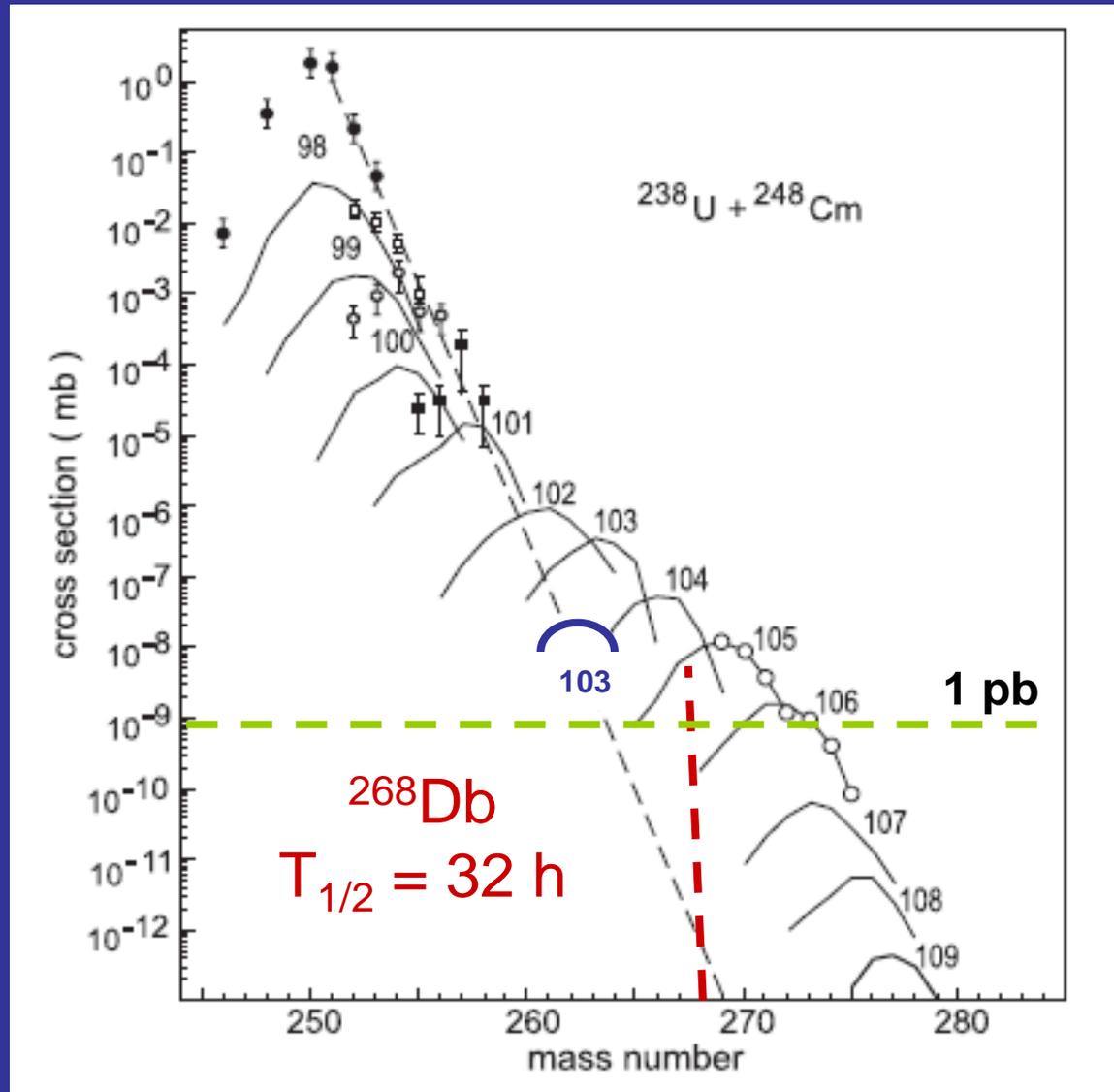
Predicted cross sections for $^{238}\text{U} + ^{248}\text{Cm}$



H. Gäggeler et al., *Proc. Nuclei far from Stability*, Helsingor, 1981, CERN 81-09 (1981)

Estimated total formation cross section for $Z = 114 \approx 10^{-39} \text{ cm}^2$

$^{238}\text{U} + ^{248}\text{Cm}$



V. Zagrebaev,
W. Greiner (2008)

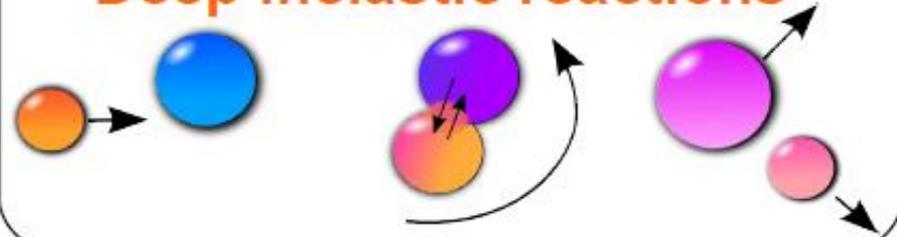
Fusion reactions



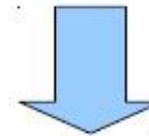
- GSI:
 - SHIP
 - TASCA
- Worldwide:
 - BGS
 - DGFRS
 - GARIS
 - ...



Deep inelastic reactions



- No devices



Let's build **IRiS**

IRiS
HEAVY ELEMENTS

Inelastic **R**eaction **I**sotope
Separator

J. Dvorak et al.

HYIG task

- Auxiliary systems – JGU / GSI / HIM
- New Helmholtz Young Investigator Group “IRiS”
→ Recoil separator – the heart of IRiS

