

# Nuclear-structure effects deduced from the number of bound states

Systematic studies of global nuclear properties of isotopically separated nuclei have been extremely successful

Established global observables:

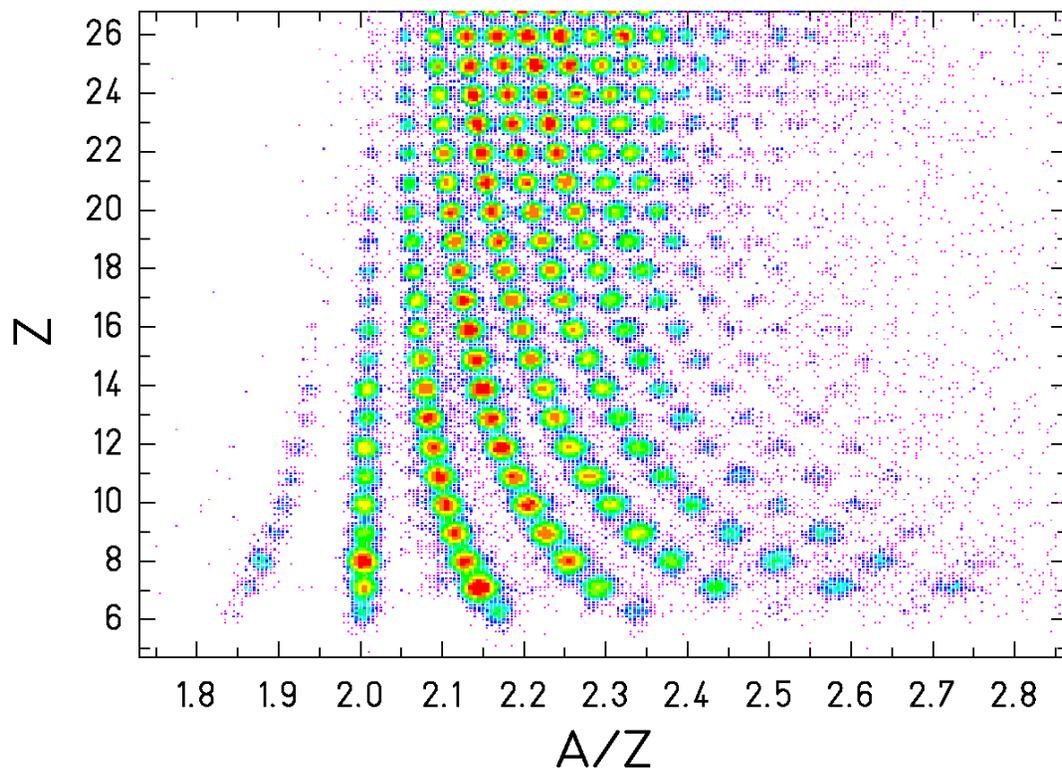
- masses → pairing correlations and shell effects
- total interaction cross sections → halo nuclei

New global observable:

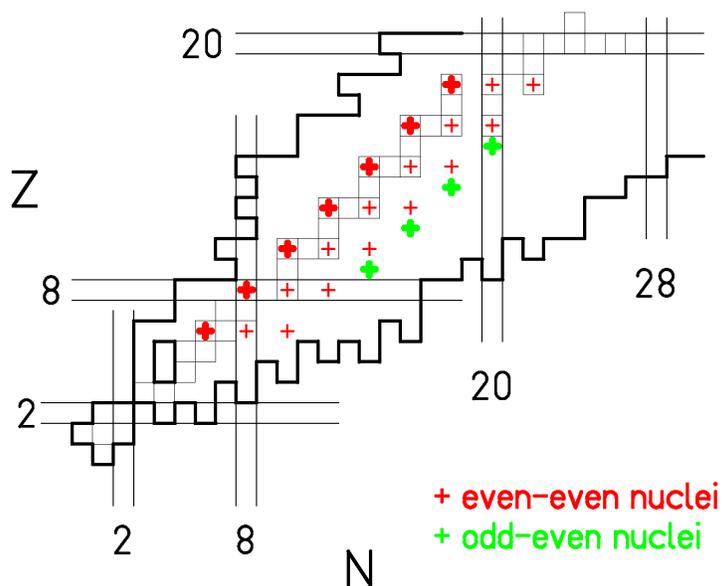
- nuclide production cross-sections in nucleus-nucleus collisions → complex phenomena of nuclear structure

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

# 1 A GeV $^{238}\text{U}$ on titanium



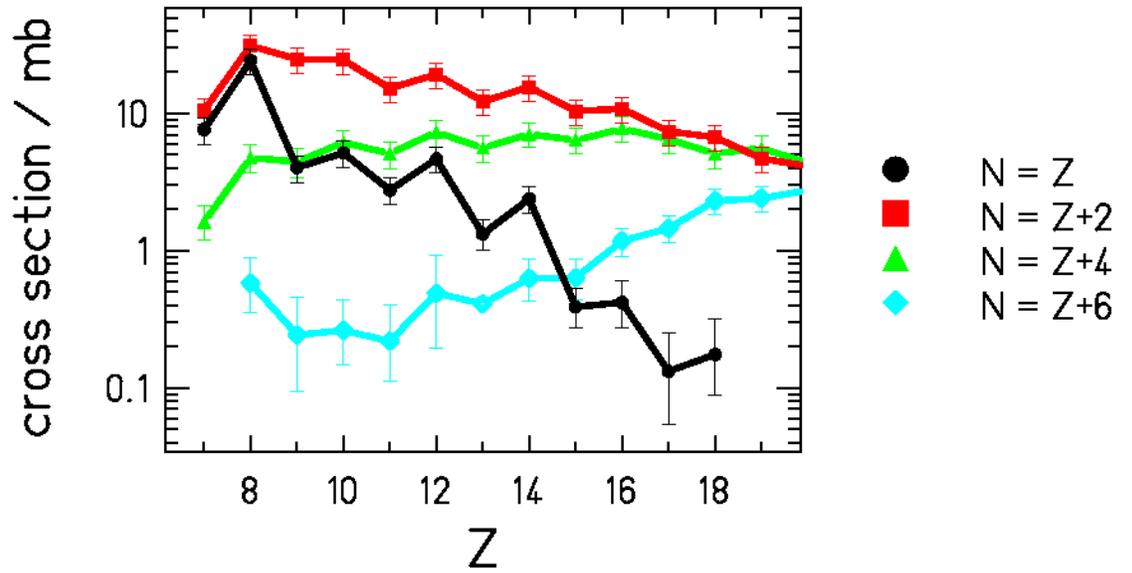
## Nuclei with enhanced production



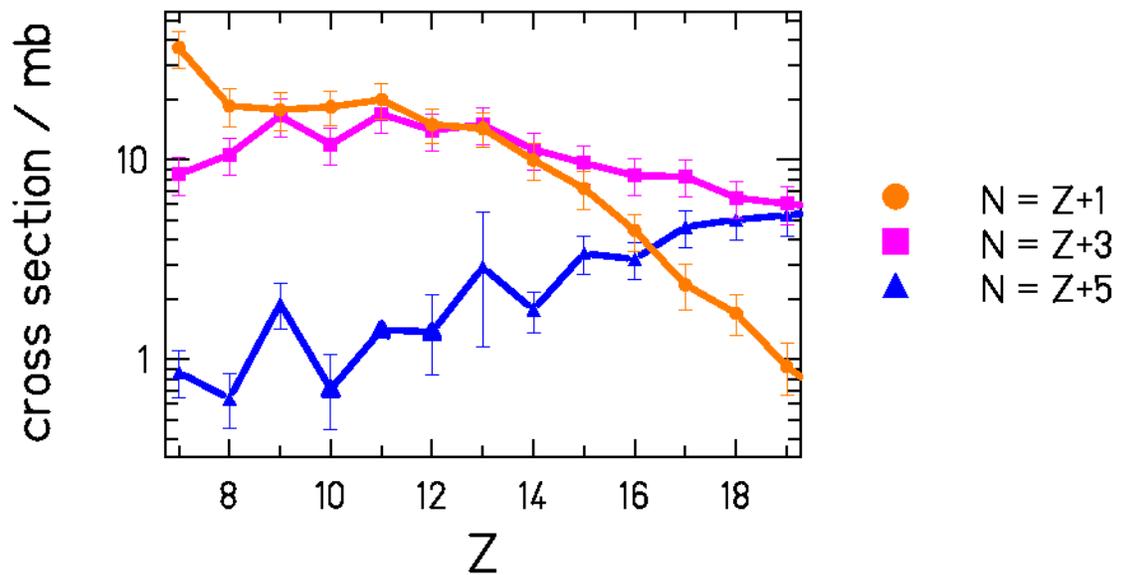
# EXPERIMENT

PhD Thesis M.V. Ricciardi

### Even-mass nuclei



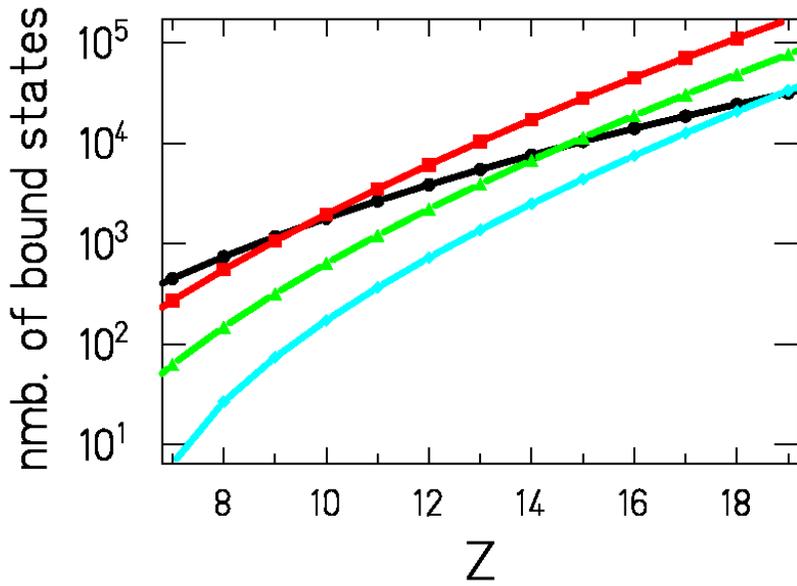
### Odd-mass nuclei



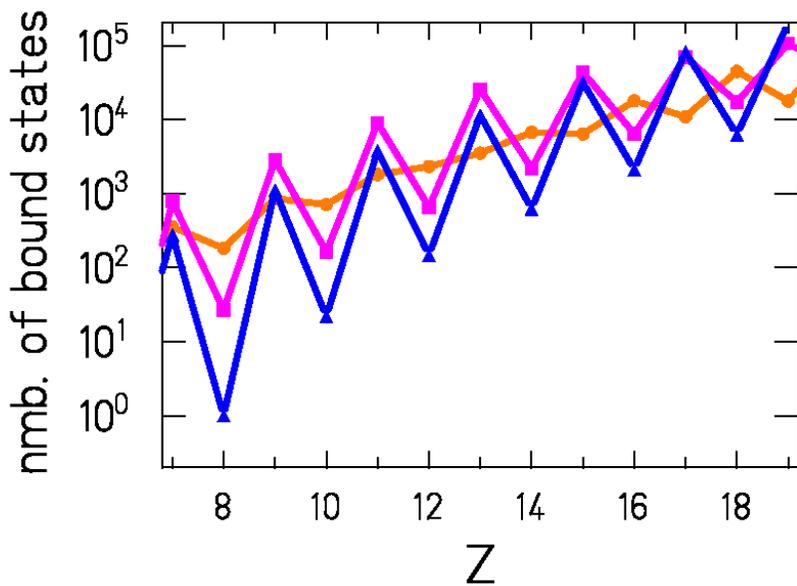
# CALCULATION

$$\mathbf{M} = \mathbf{M}_{LD} - \delta$$
$$\rho \sim \exp\left(2\sqrt{a(E - \delta)}\right) \quad \begin{cases} \delta_{oo} = 0 \\ \delta_{oe} = \delta_{eo} = \Delta \\ \delta_{ee} = 2\Delta \end{cases}$$

Even-mass nuclei



Odd-mass nuclei



## OUTLOOK

- ❖ even-odd structure of even-mass nuclei reveals higher-order structural effects:
  - mean-field contribution to pairing effect
  - alpha clustering
  - neutron-proton pairing

The yield from highly excited nuclei  
reflecting the number of bound states  
is a new global observable  
probing complex nuclear structure phenomena