Using (d,p γ) reactions as a surrogate for neutron capture

U.S. DEPARTMENT OF ENERGY | Office of Science

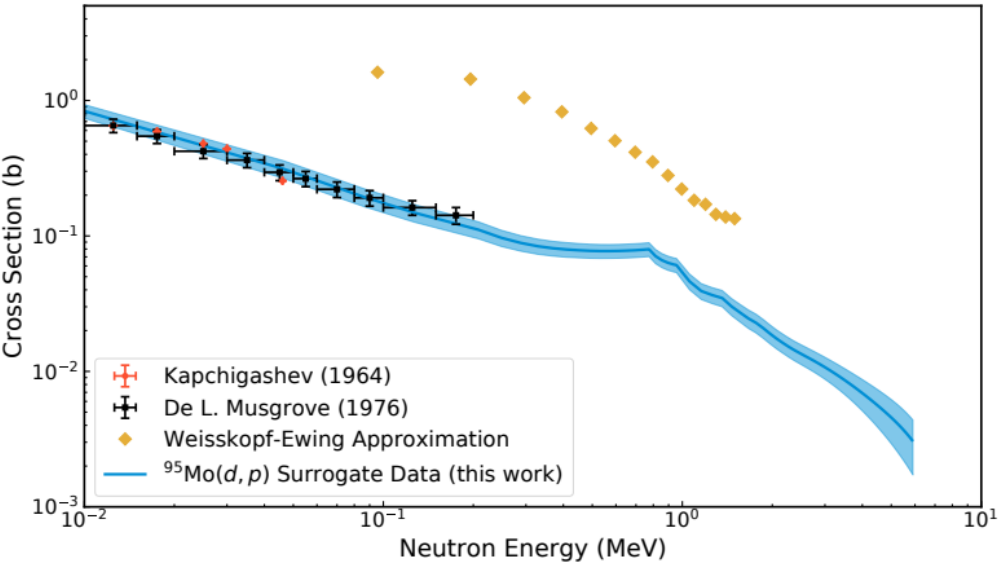
Theory Alliance
FACILITY FOR RARE ISOTOPE BEAMS

Objectives

- Neutron capture rates are an essential ingredient for the description of nucleosynthesis in astrophysical environments.
- A direct (n, γ) measurement on unstable isotopes of interest is impossible.
- The use of alternative surrogate reactions such as (d,p γ) calls for reaction theory developments.

Impact

- A theoretical framework enabling the prediction of the spin-parity distribution of compound nuclei populated in (d,p) reactions has been implemented.
- In a benchmark ^{95}Mo(d,p γ) experiment, the neutron capture rate on the stable nucleus ^{95}Mo was extracted. The surrogate result showed excellent agreement with direct ^{95}Mo(n, γ) measurements.



Accomplishments

- Publications:

A. Ratkiewicz et al., Phys. Rev. Lett. **122**, 052502 (2019). G. Potel et al., EPJA **53**, 178 (2017)

^{95}Mo(n, γ) cross section extracted from the ^{95}Mo(d,p γ) surrogate experiment (blue line) compared with the direct ^{95}Mo(n, γ) measurement (black and red crosses).