HIGH QUALITY (N,P) AND (N,A) DATA USING LENZ AT LANSCE
MICROSCOPIC E,J,π-DEPENDENT LEVEL DENSITIES FOR APPLICATIONS AND BASIC SCIENCE.

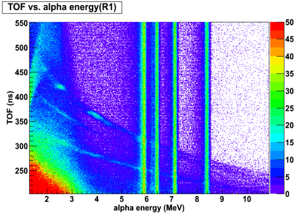
WANDA, 2019

G. Perdikakis

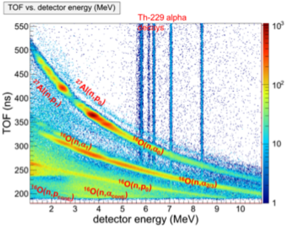
(n,p) and (n,α) reaction study using Low Energy NZ (LENZ) instrument at LANSCE

(H.Y. Lee, S. Kuvin, L. Zavorka, A. Georgiadou @ LANL)

LENZ data on Ta_2O_5 target



MCNP6 simulations



- LENZ provides good Q-value resolutions for discrete-level cross sections and angular distributions by annular silicon strip detectors
- High-quality double differential data are crucial for better understanding of nuclear modeling for applications
- LANSCE with Isotope Production Facility enables to perform neutron-induced nuclear reaction studies directly on "short-lived" radioactive nuclei
- Extending experimental capability to unstable nuclei certainly enhance our reach to benefit nuclear astrophysics, radiochemistry diagnostics, nuclear forensics, etc.
- Currently working on improving neutron-induced charged particle reaction nuclear data library (using EDNF V.III.0), by modeling the LENZ reaction setup with LANSCE beams in GEANT4 and MCNP6®

Basic problems with phenomenological level densities

- limited extrapolation capabilities
- inaccurate spin distributions for isomeric state populations
- artificial parity dependence
- require normalization with data.

Benefits from shell-model+moments method level densities

- number of levels based on shell-model calculations-no normalization needed
- no phenomenological spin cut-off
- explicit J,π dependence of level numbers
- experimentally verified constant temperature character retained for each J,π
- can be implemented in TALYS, EMPIRE, CoH, etc.

Towards a microscopic E,J,π - dependent level density for (n,x) -and other- applications

The shell model + moments method level density

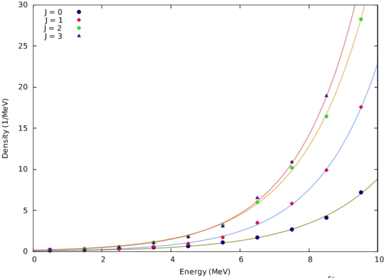
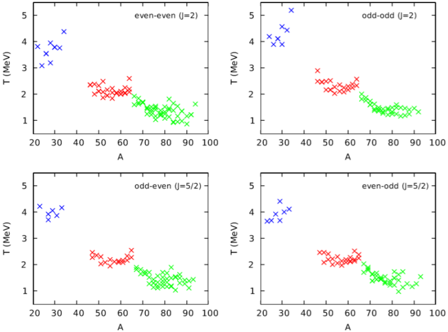


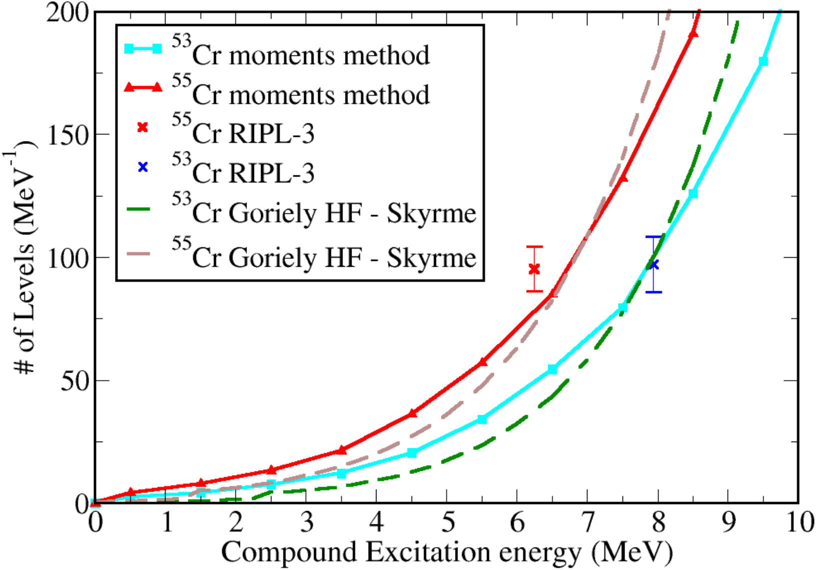
Figure 3.2. Constant temperature formula fit for the Moments NLD for ^{56}Ni.



figures from MS Thesis of Jayani Dissanayake, Central Michigan University, 2018

$\Delta l=1$ neutron capture on ^{52}Cr and ^{54}Cr

Comparison of level densitites



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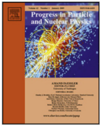

Review

Nuclear level density, thermalization, chaos, and collectivity

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The knowledge of the level density is necessary for understanding nuclear reactions involving excited nuclear states. In particular, it is an important element in description of astrophysical processes and in technological applications. This review article explains

THE END