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LLNL Perspective on Pu-239 Evaluation

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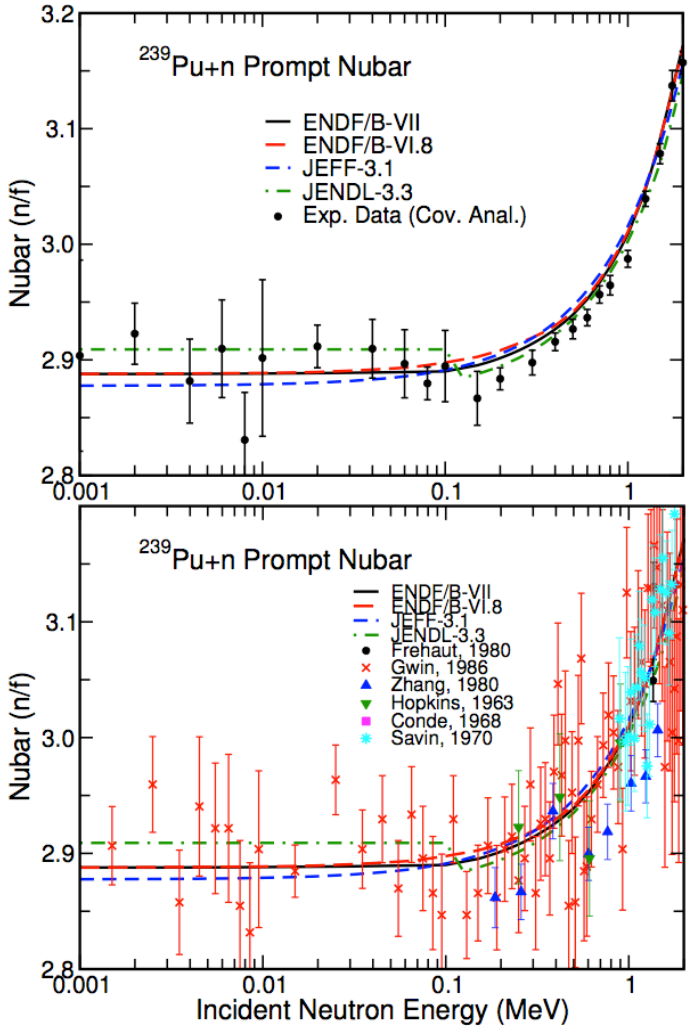
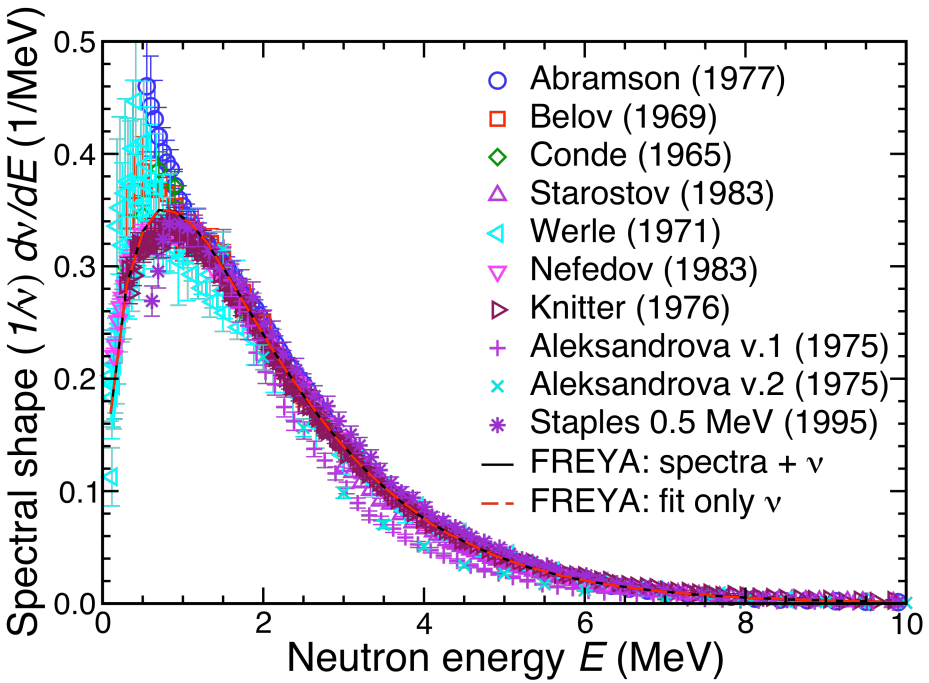
Issues with <ν>

- ENDF/B-VII evaluated <ν> data (black points) do not agree well with ENDF/B-VII evaluation (black curve), sometimes by more than 1σ in range E > 0.1 MeV
- <ν> covariance matches data, not evaluation, clear energy-energy correlations in data
- Evaluation tuned to agree with Jezebel critical assembly but region of disagreement, 0.1 < E < 2 MeV, is in region important for matching Jezebel
- Most recent <ν> data are from 1980 – is it possible to get new data on <ν>?



Issues with spectra

- Spectral data are often inconsistent with each other
- Data are of poor quality and have large uncertainties in both the low and high energy parts of the spectrum
- New experiments with modern detectors both planned and in progress could improve the situation tremendously



Issues with Evaluated Data Tweaked to Critical Assemblies

- Jezebel depends mainly on 3 parts of the evaluation
  - cross section
  - prompt fission neutron spectrum
  - nubar
- Evaluation has been tweaked to get Jezebel “right”
- Any new evaluation of σ(n,f)/PFNS/nubar individually will “break” Jezebel agreement
- Need to re-evaluate all 3 simultaneously
  - fitted to the best data available and with the best physics models to see where we stand
- Event-by-event simulations of assemblies would improve physics modeling
  - New critical assembly data from NTS should be modeled with better physics models

Elastic/Inelastic scattering

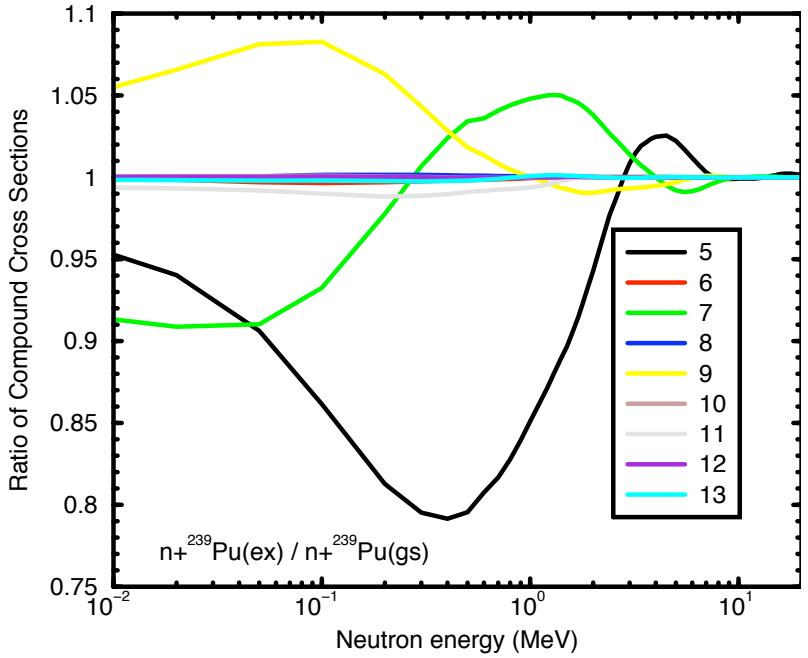
Deformed Optical Potentials

States in the ground state rotational band:

- Can be rapidly excited by incident neutrons
- Rotational mechanisms known: use coupled channels

Results of Calculations:

- CN production cross section (almost) the same for all g.s. and excited states
  - (very slight variation from finite excitation energies)
- Convergence is astonishingly slow for neutron energies up to 5 MeV: need 12-14 states for odd nuclei.
- Averaging transmission coefficients over target spins is shown to be very accurate for heavy nuclei.



Refitting the Optical Potentials

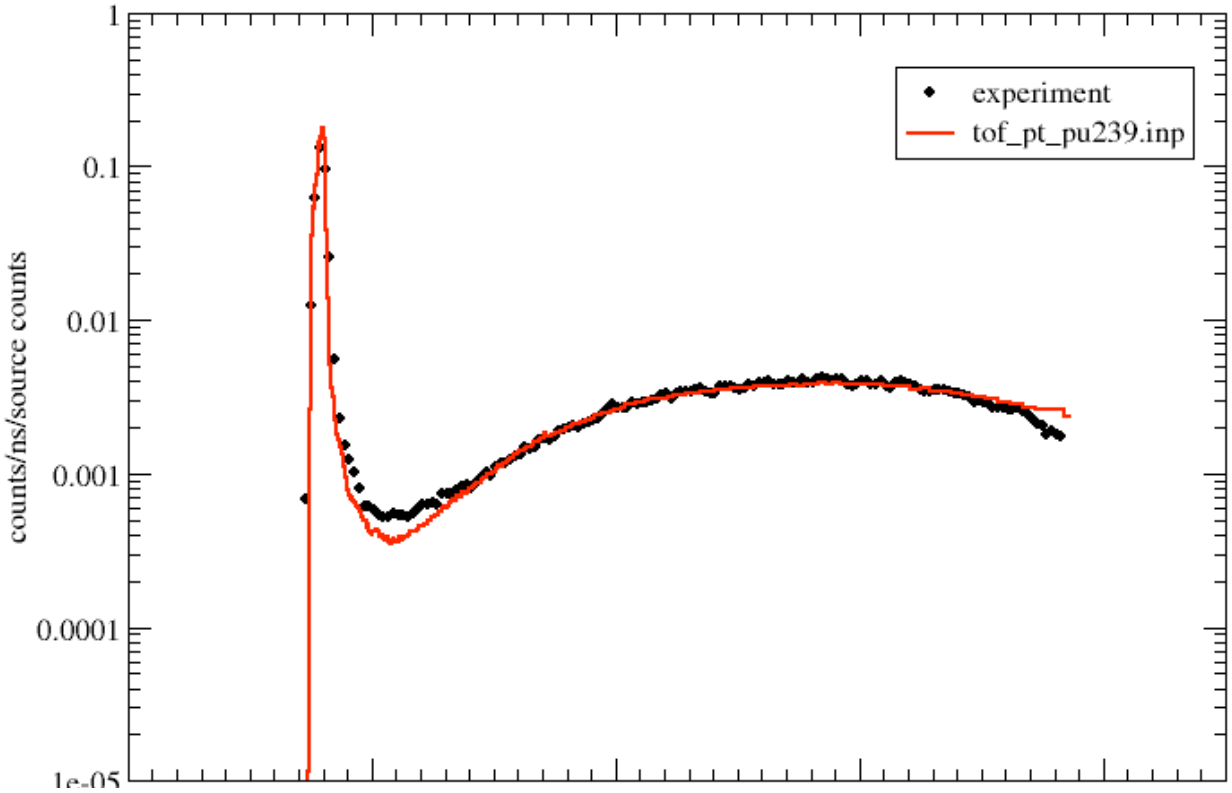
Previous optical models used insufficient levels:

- Cross sections not converged!
- Soukhovitskii, Maslov, FLAP potentials can be improved.

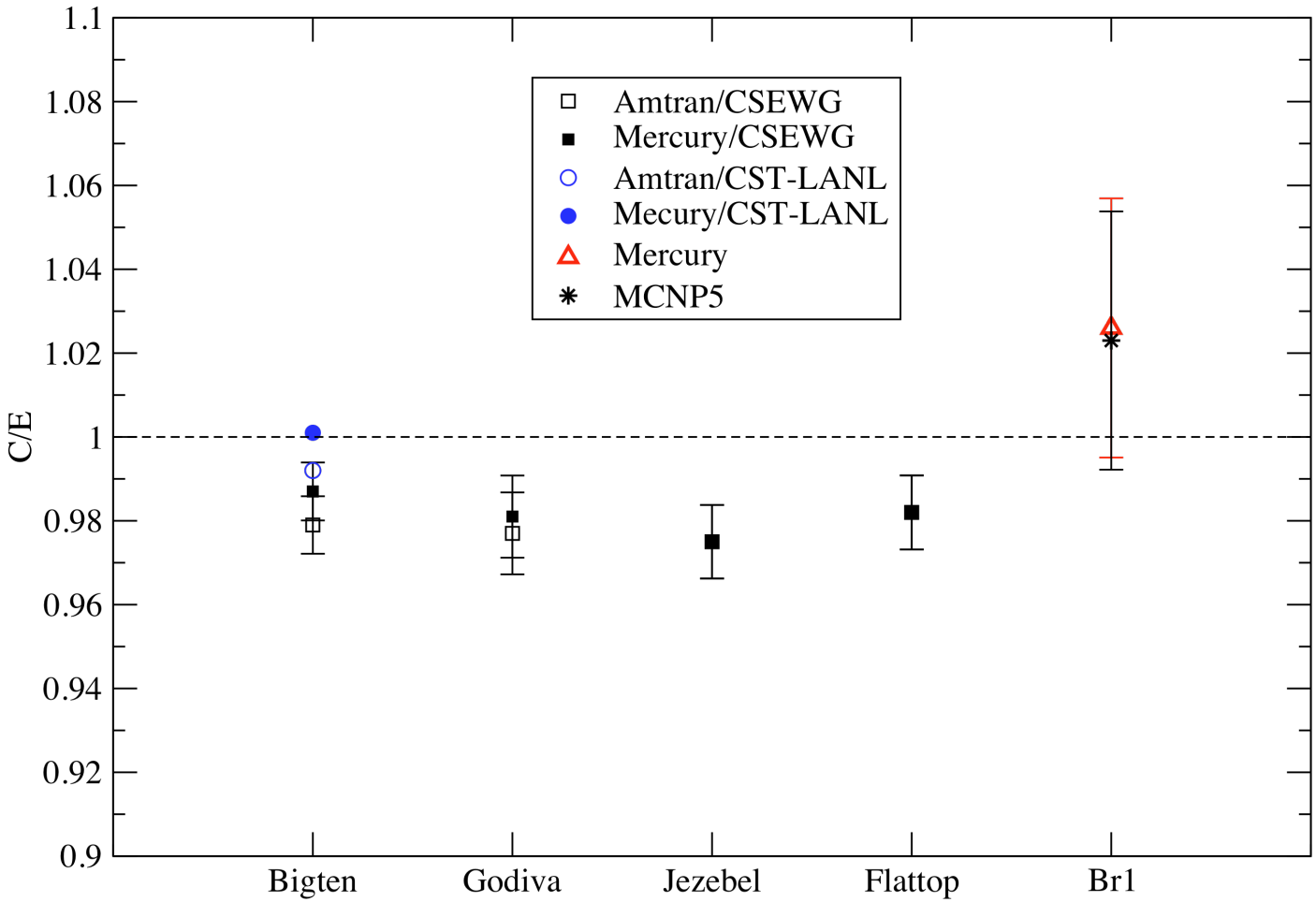
Proposed LLNL Activity:

- Refit optical potentials to known data (elastic, total)
- Find regional actinide potential
- Convergence can be improved for odd nuclei by approximating by a 0^+ band with same couplings
  - We find that this is an excellent approximation!
  - Cross sections to actual levels from a simple remix formula.
  - Calculates the same transmission factors after averaging.

^{239}Pu: LLNL Pulsed Sphere



^{239}Pu: Reaction Ratios



^{239}Pu: Critical Assemblies