Present Status of JENDL-4

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Contents

- Purpose of JENDL-4
- Code development for JENDL-4
- Evaluation work for FP nuclei
  - JNDC FP Nuclear Data Evaluation WG
- Evaluation work for light and medium nuclei
- Time schedule
- Issues probably carried over after JENDL-4

Purposes of JENDL-4

- *Ad Hoc* Committee on Next JENDL under JNDC
  - Interviews with specialists in various fields
    - LWR, FBR, Shielding, ADS, Fusion, Criticality Safety, Radiation Damage, Medical Use, Astrophysics *etc.*
- Reported by the Committee in May, 2003
  - Development of innovative reactors
  - High burn-up and use of MOX fuel for LWR
  - Criticality safety with burn-up credit
  - Medical use, Astrophysics

A library with high quality and reasonable quantity
JENDL-4

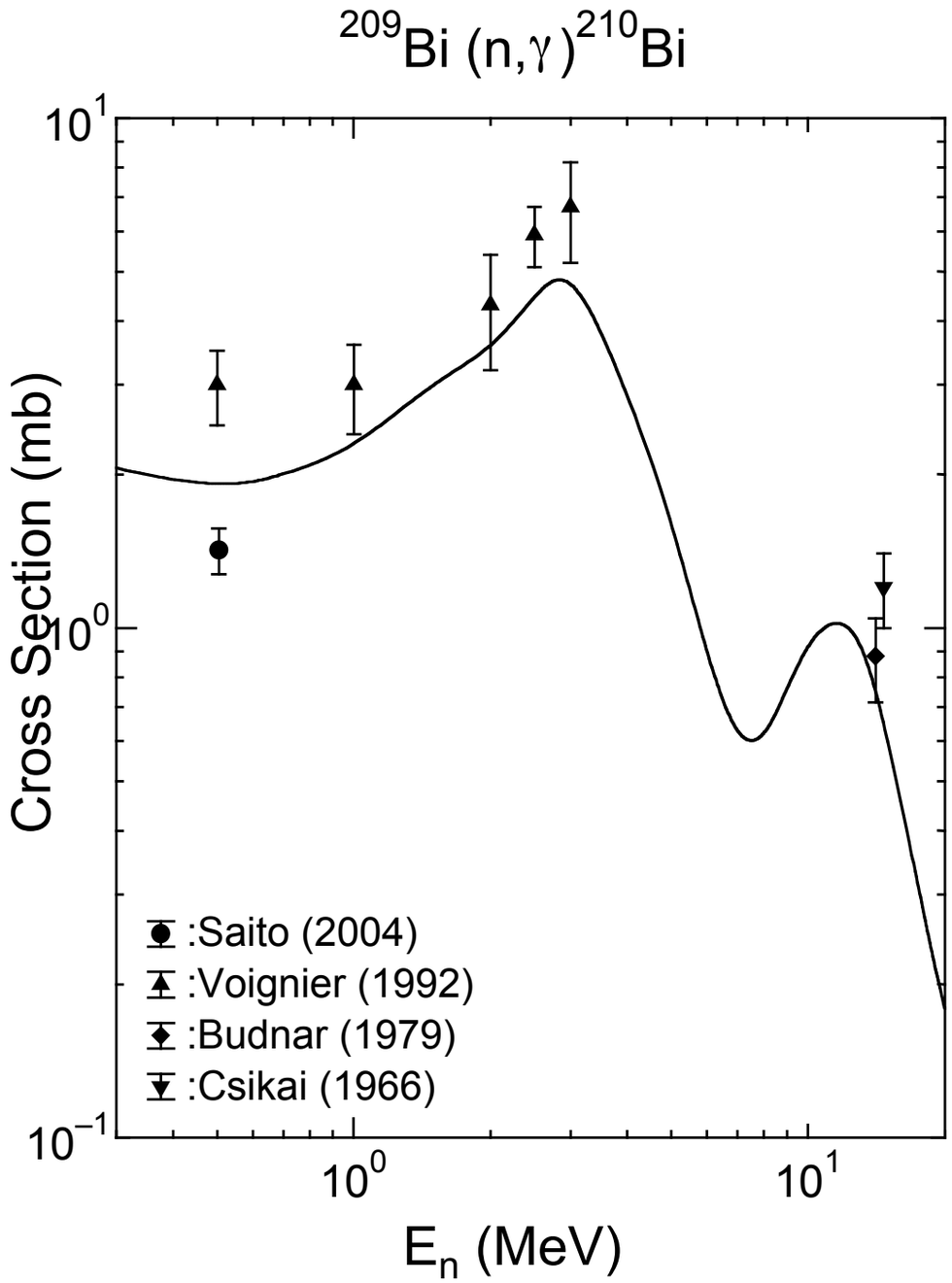
Key Subjects for JENDL-4

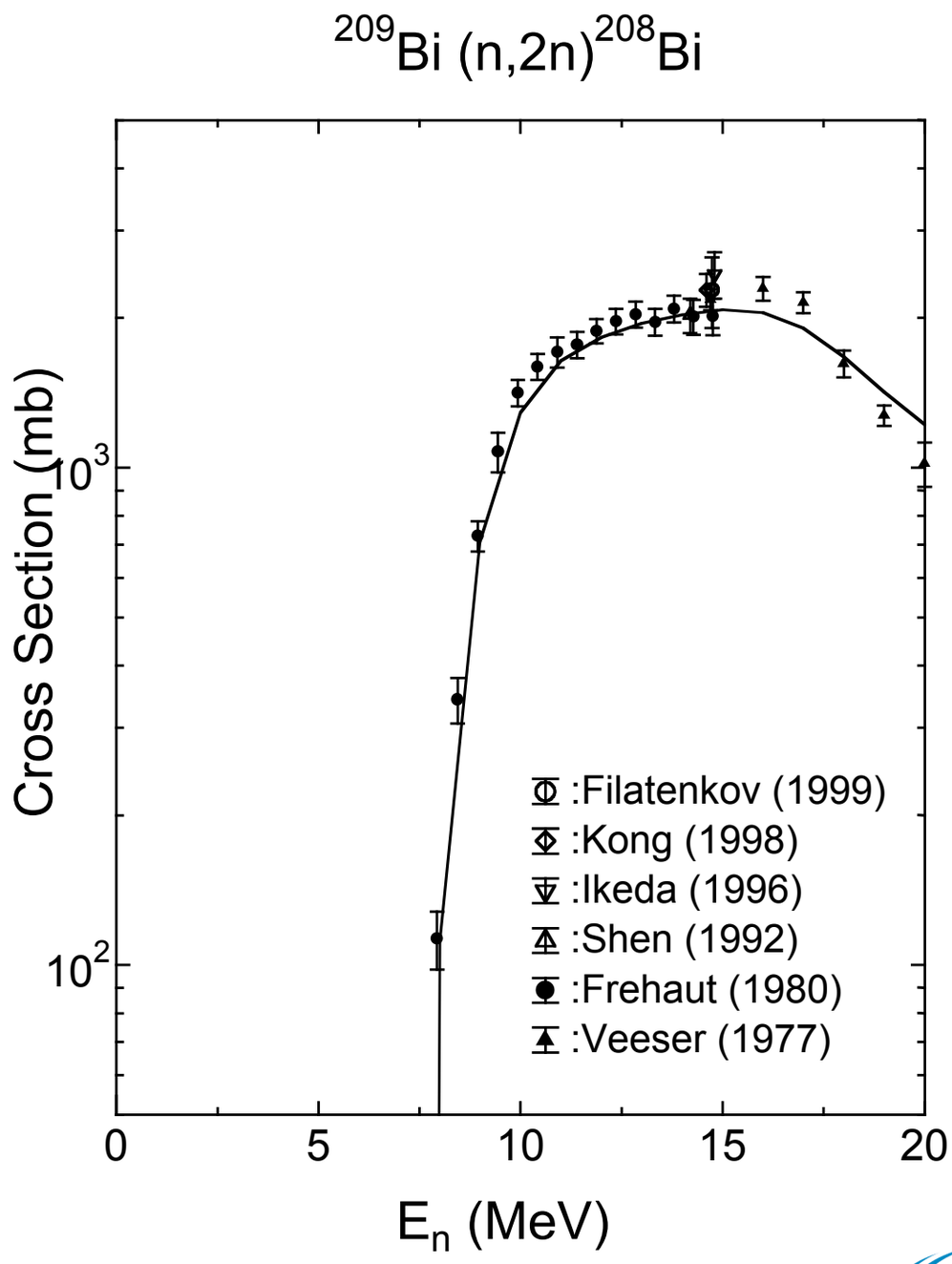
- To resolve open problems with JENDL-3.3
- Improvements of FP and MA data
- Covariances
- Gamma-ray production data
- FP yields
- Various benchmarks
- Quality assurance
- Reactor constants

Nuclear Model Code Development

- POD coded (Fortran) by A. Ichihara
  - Optical model, DWBA, exciton model, statistical model for evaluation of FP
  - A report was published, but the code is still under development
- CCONE coded (C++) by O. Iwamoto
  - Coupled-channel optical model, DWBA, exciton model, statistical model for evaluation of actinides
  - The code is still under development.

Example of POD Results





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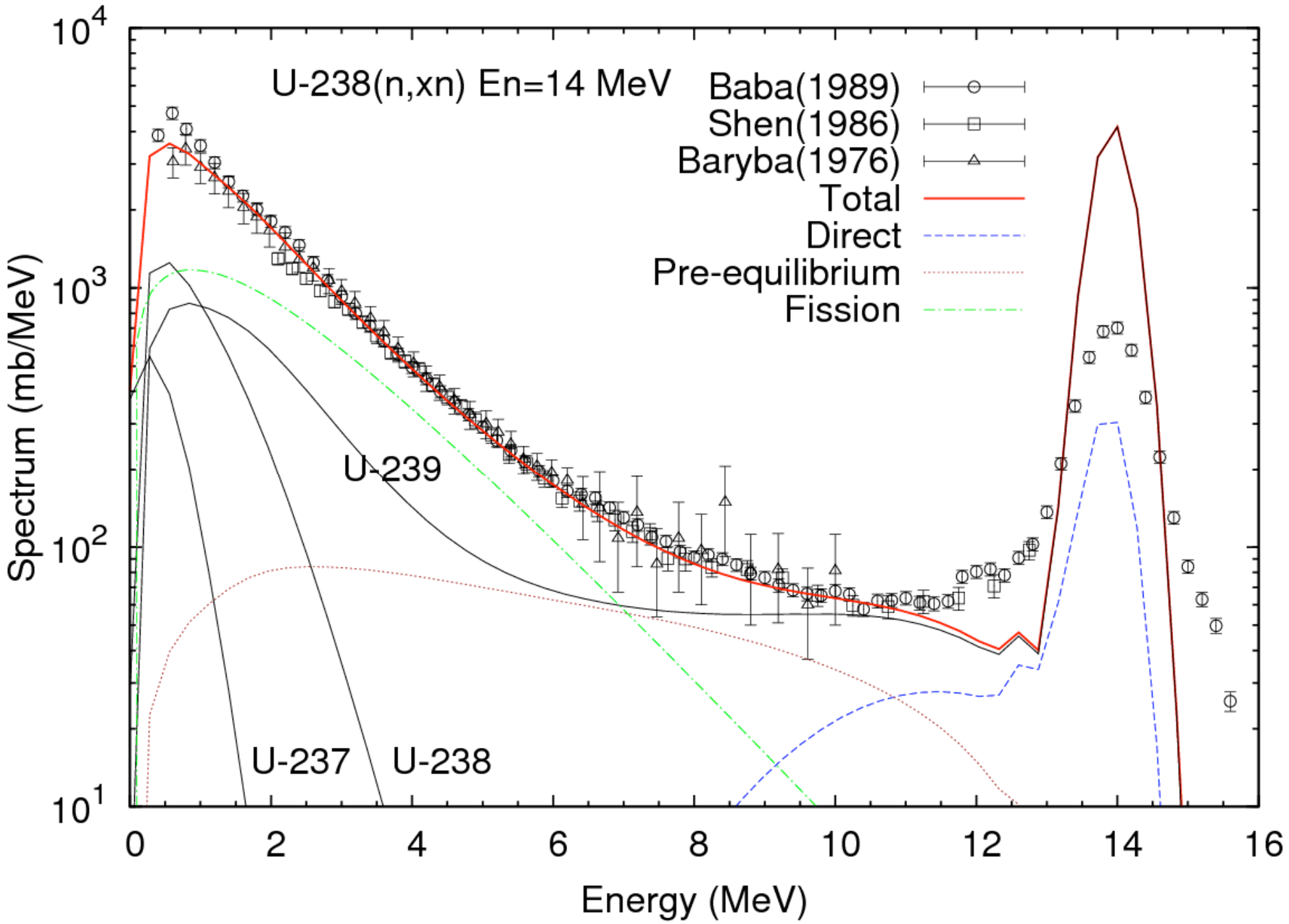
Example of CCONE Results



Evaluation of FP Data

- 213 nuclei to be evaluated　　JENDL-3.3: 185 nuclei
  - newly evaluated: 28 nuclei
  - $T_{1/2}$ ≥ 10 days, fission yield ≥ 0.1%
- Low energy region (E_n = 10^{-5} eV - 100 keV)
  - Resolved resonance parameters
- High energy region (E_n = 10 keV - 20 MeV)
  - Optical model, direct-reaction model, pre-equilibrium model, statistical model

Priorities for FP Evaluation

- Needs from LWR, FBR, ADS
- Availability of new differential measurements
- Comparison of JENDL-3.3 total and capture cross sections with experimental data
- Benchmark results of JENDL-3.3 on STEK experiments
- Results of data selection by WPEC SG21

Priority-A　63 nuclei

Resolved Resonance Parameters for FP Nuclei

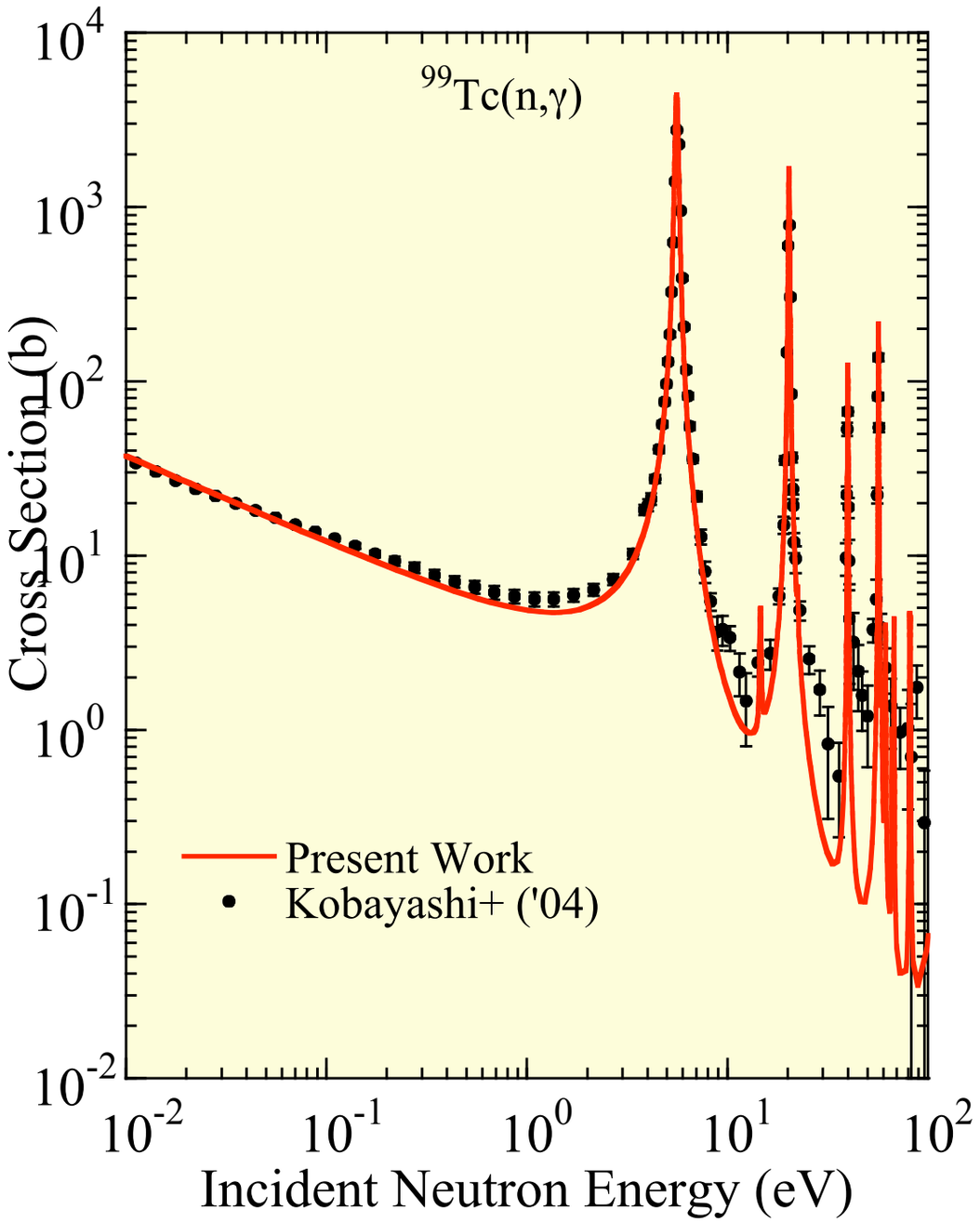
- Comparison of RRP obtained from exp.
- Determination of L and J
- Check on calculated thermal cross sections and resonance integrals with Mughabghab 06
- Comparison of energy-averaged cross sections
- 107 nuclei updated; 51 nuclei unchanged from JENDL-3.3; 13 new evaluation; 42 no RRP

n - ^{99}Tc

- Gunsing+ (’00)
  - Same as JENDL-3.3
- Thermal capture
  - Adjust negative res.
    - Harada+ (’95 revised)
    - Molnar+ (’02)
    - Furutaka+ (’04)

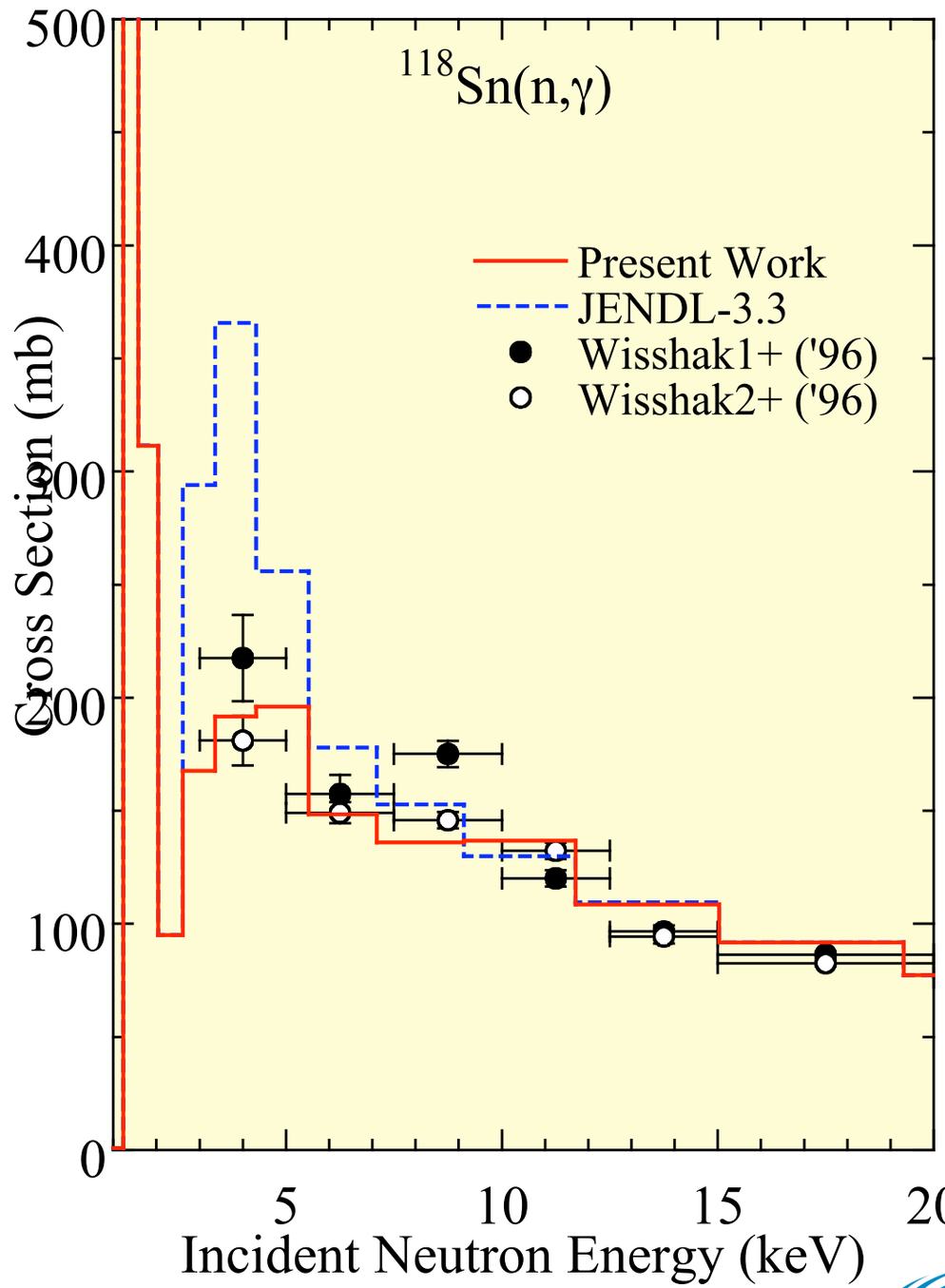
    Average 23.6±0.7 b

JENDL-3.3 22.76 b



n - ^{118}Sn

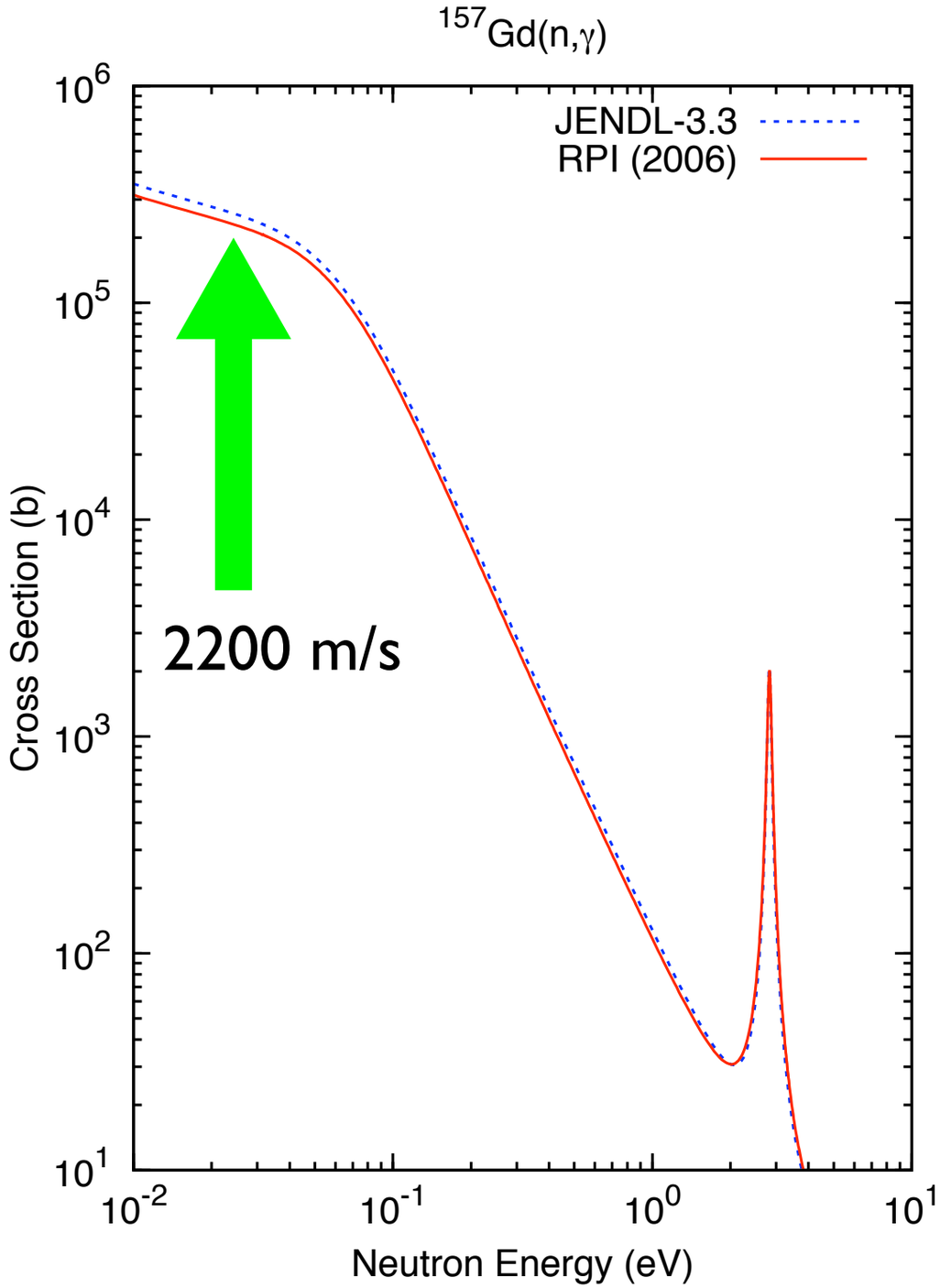
- Wisshak+ ('96)
  - E_r, L, $g\Gamma_n$, cap. area
  - cap. area $\longrightarrow \Gamma_\gamma$
  - Upper limit: 15 keV
- JENDL-3.3
  - Mughabghab 81
  - Upper limit: 4.8 keV
  - Unknown Γ_n
    - p-wave and reduced width of 250 meV assumed



n - ^{157}Gd

- Leinweber+ (2006)
  - Capture & trans.
  - Gd-152,154,155,156, 157,158,160
- Gd-157
  - 0.032-eV resonance
  - Thermal capture
    - 10% smaller than JENDL-3.3

PENDING !!



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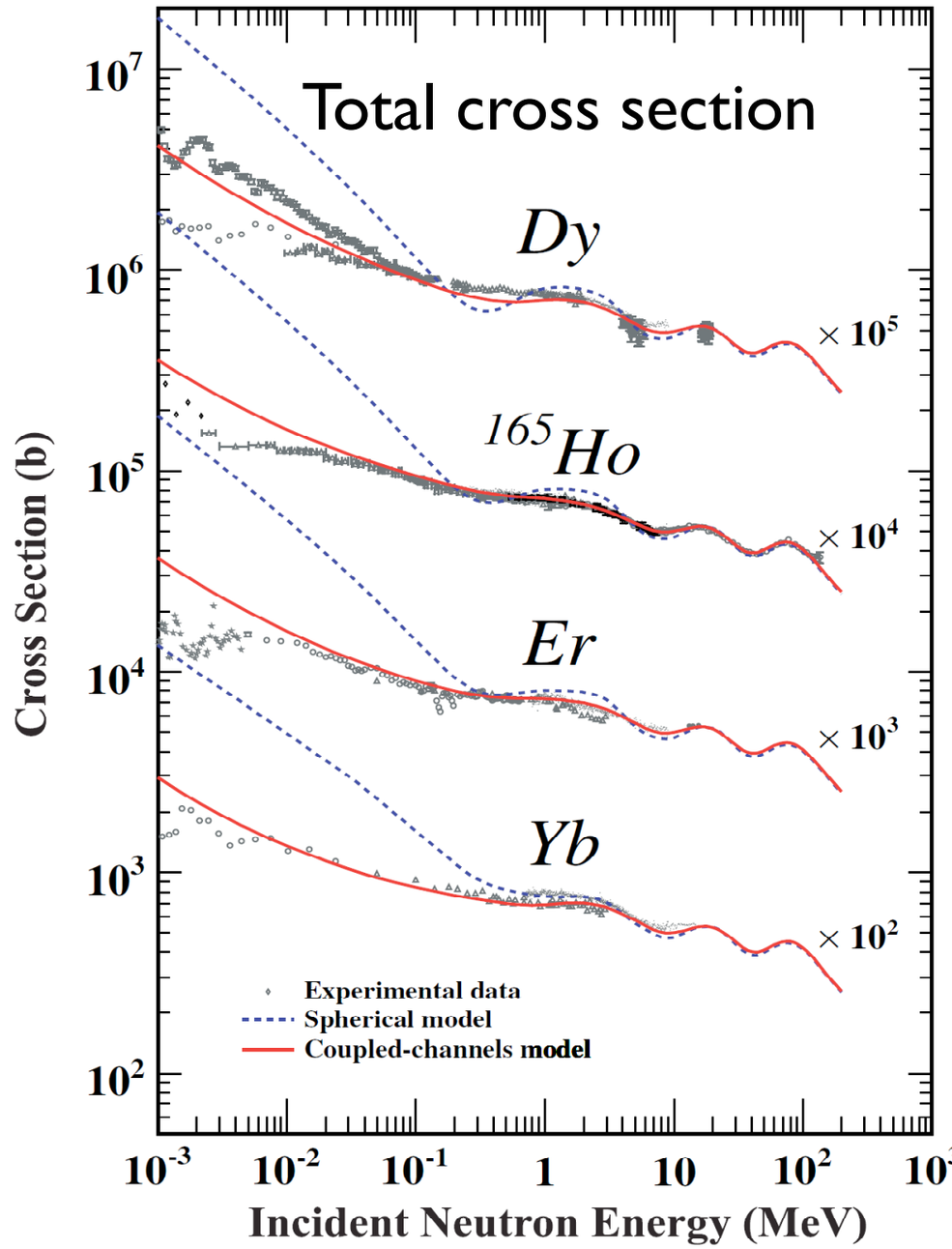
Optical Model Parameters for FP

- Global parameters needed
  - Koning-Delaroche (2003) spherical OMP → NOT applicable to deformed nuclei
- New global CC parameters applicable to a wide mass range up to 200 MeV
  - Can be used for deformed nuclei such as Sm



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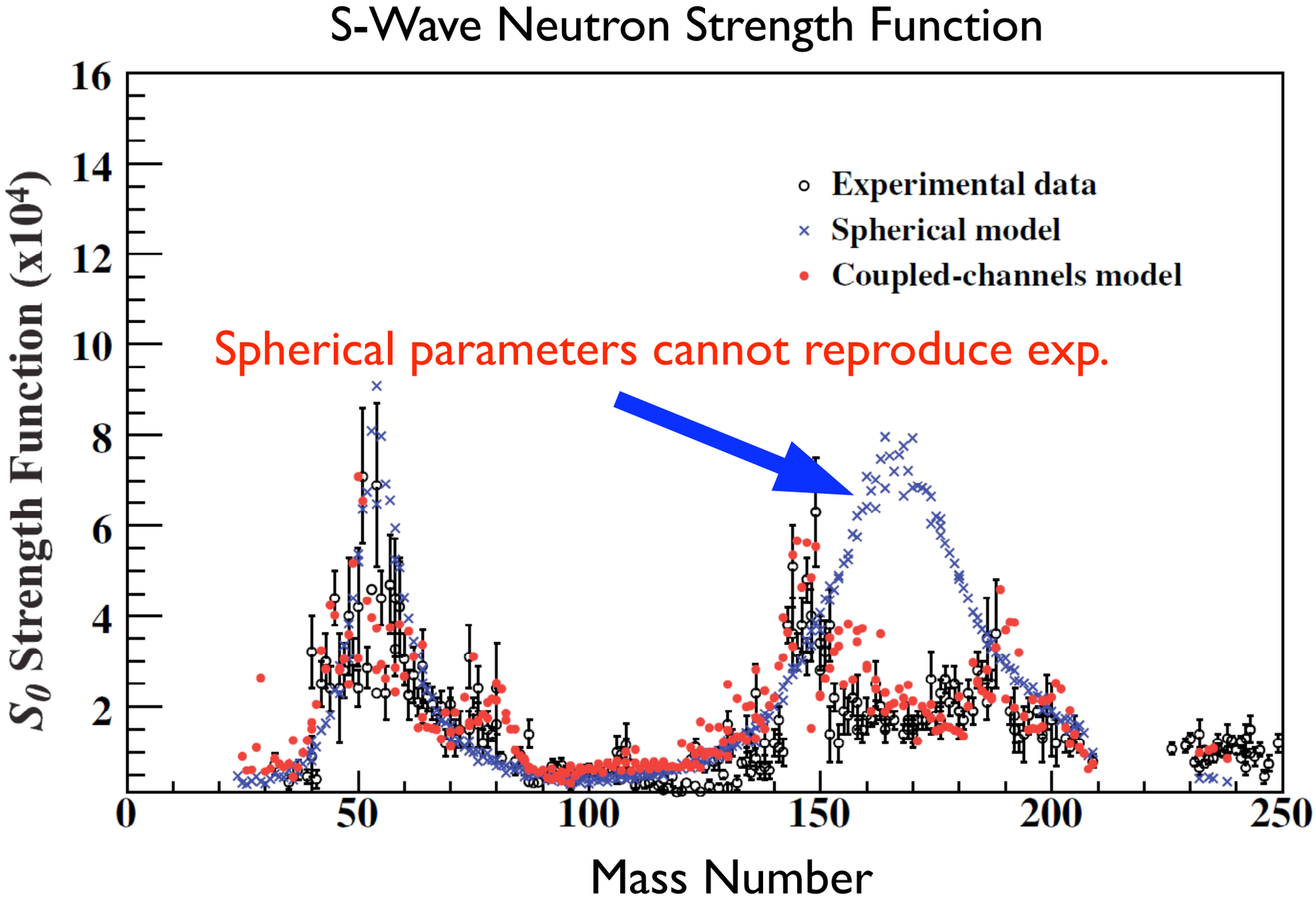
Low Energy Property of OMP Newly Obtained



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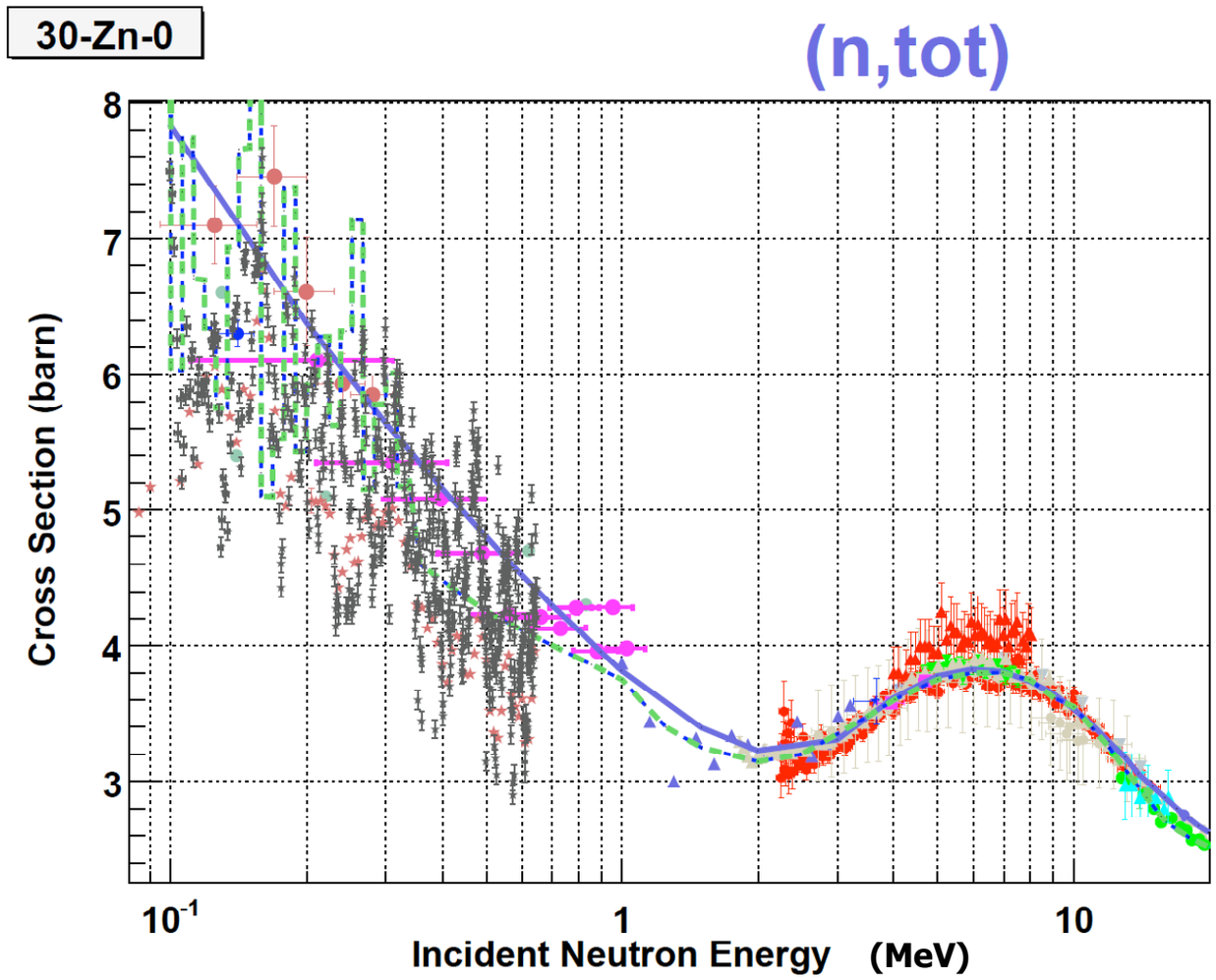
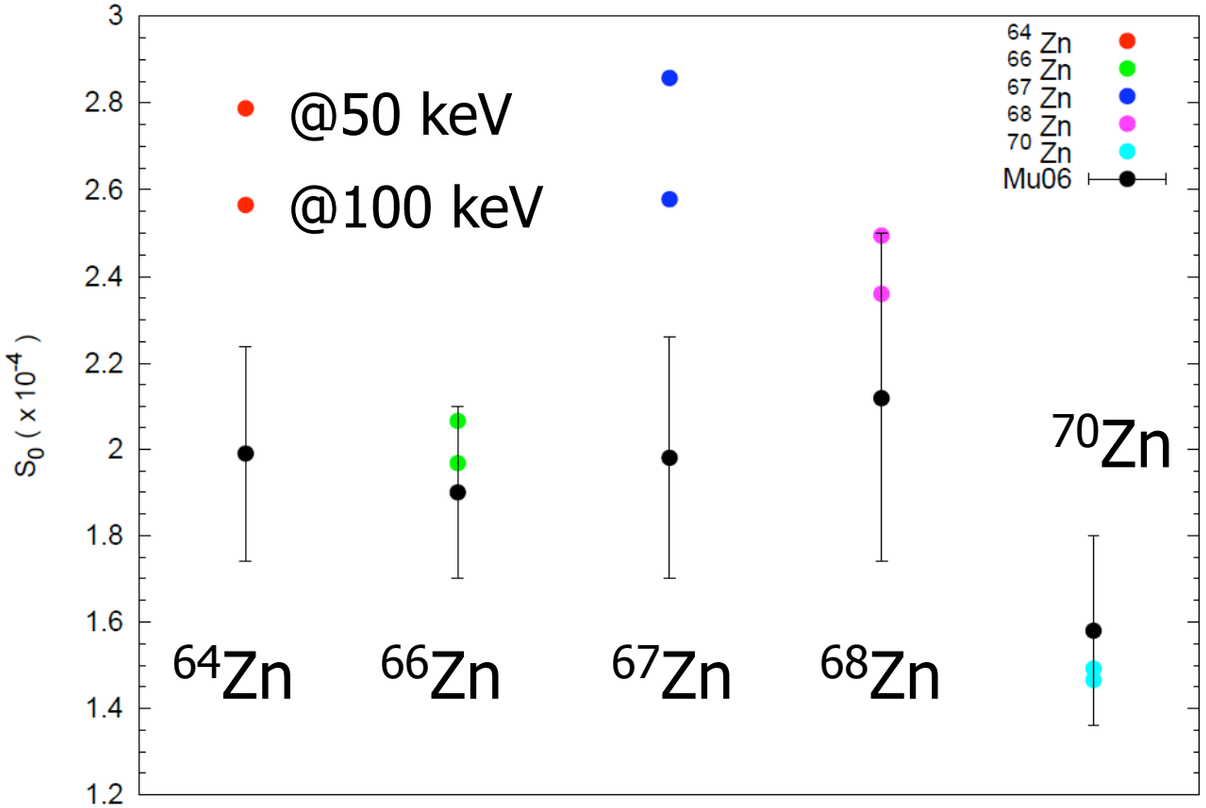
Evaluation of FP in the Non-Resonance Energy Region

- Finished
  - Zn, Ag, Sn, Nd, Pm, Tb, Dy
- In progress
  - Mo, Nb, Pd, Sm

Zn Cross Sections (1)



Comparison of calculated neutron strength functions with Mughabghab 2006



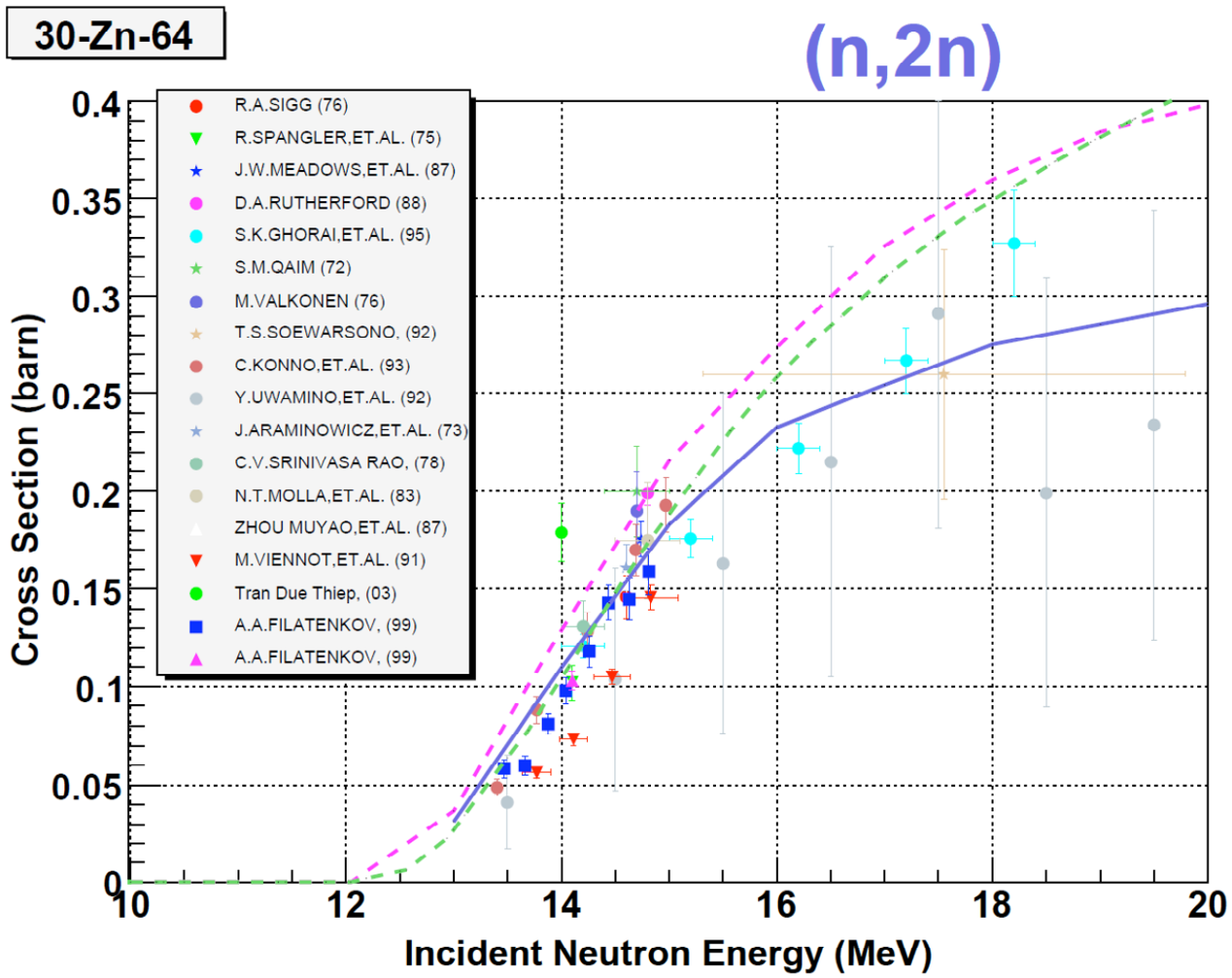
Coupled-channel optical model parameters for FP nuclei obtained by Kunieda et al. (2006)

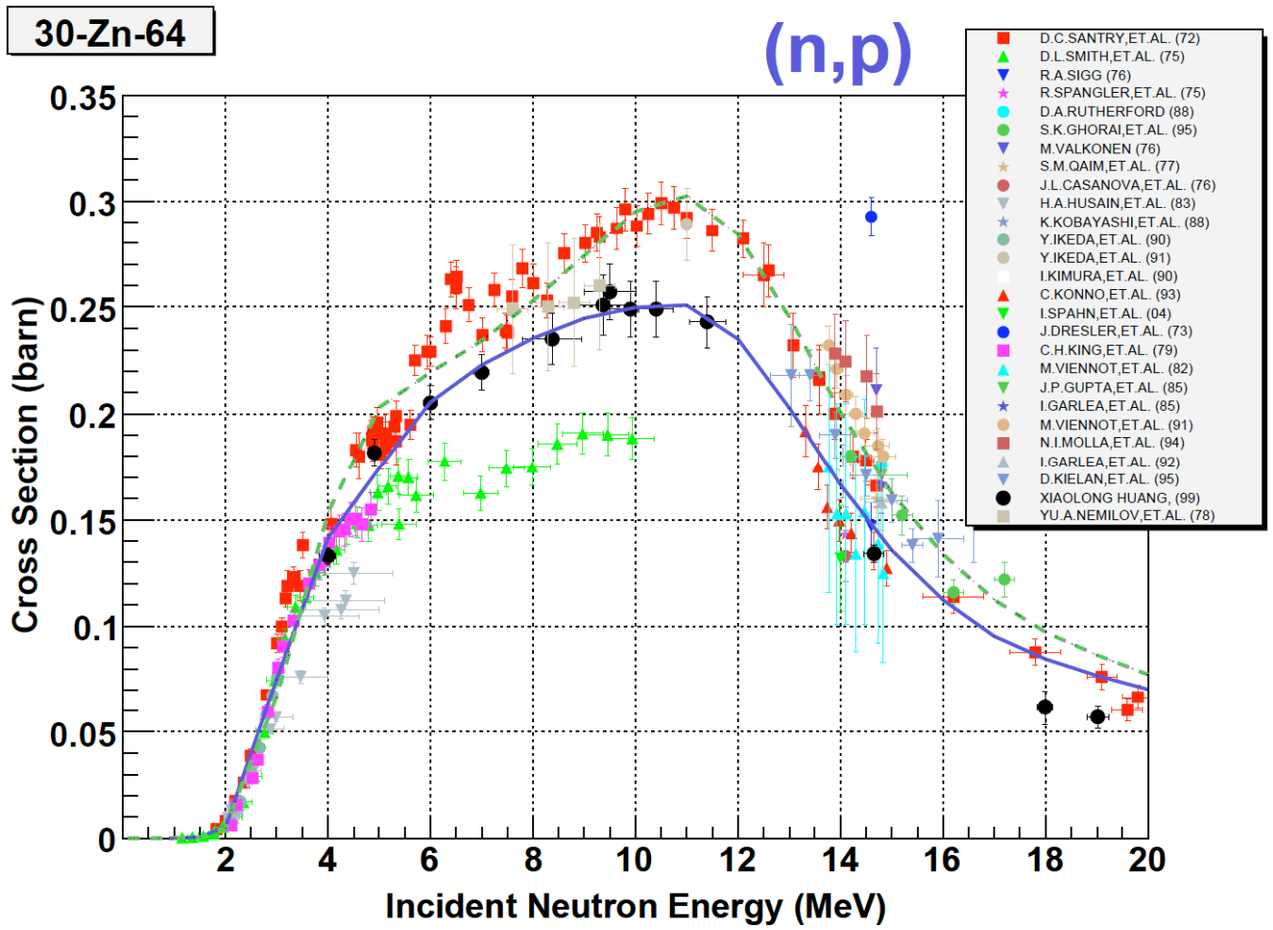
Zn Cross Sections (2)

Present

JENDL/A-96

JEFF-3.1/A





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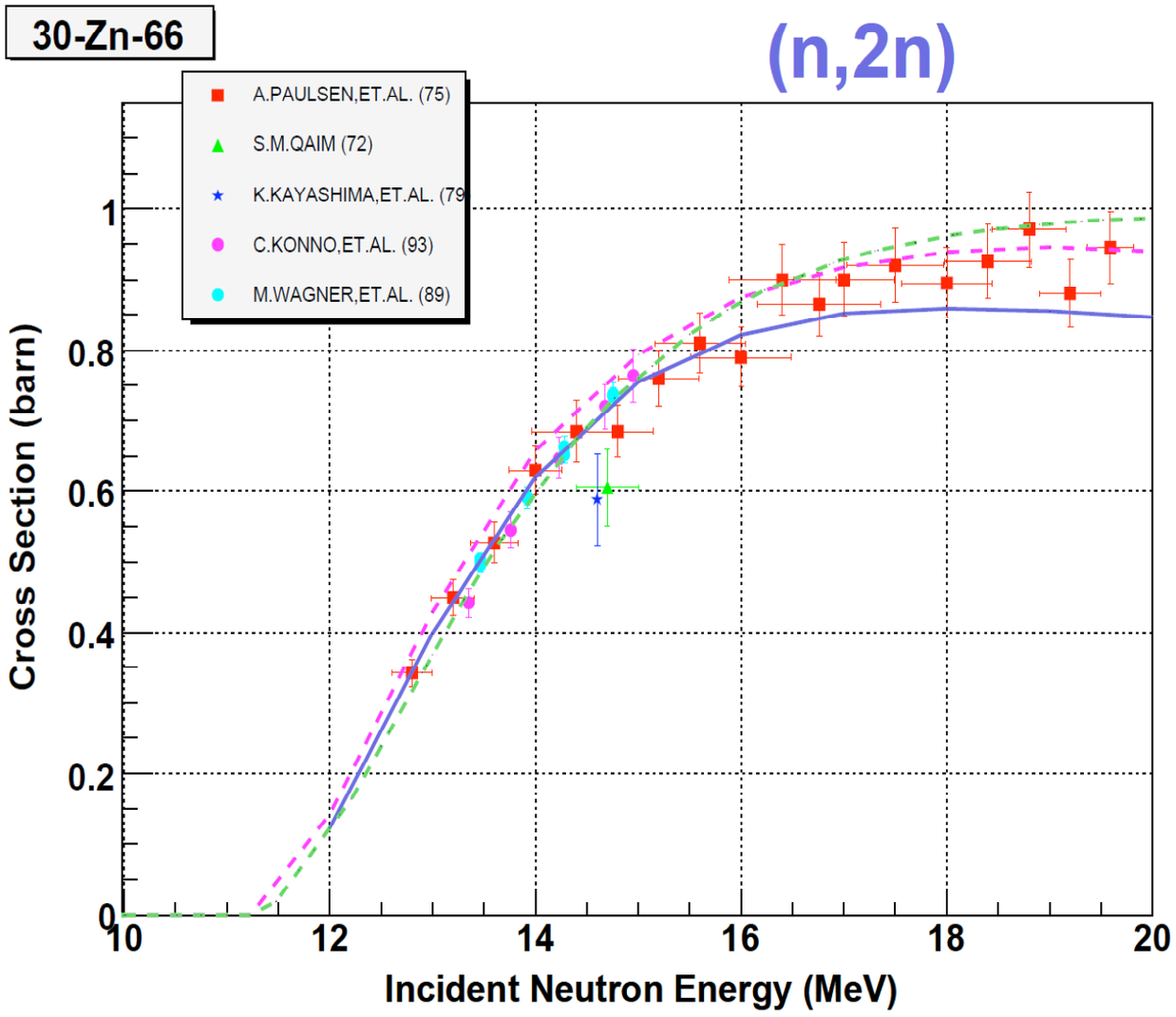
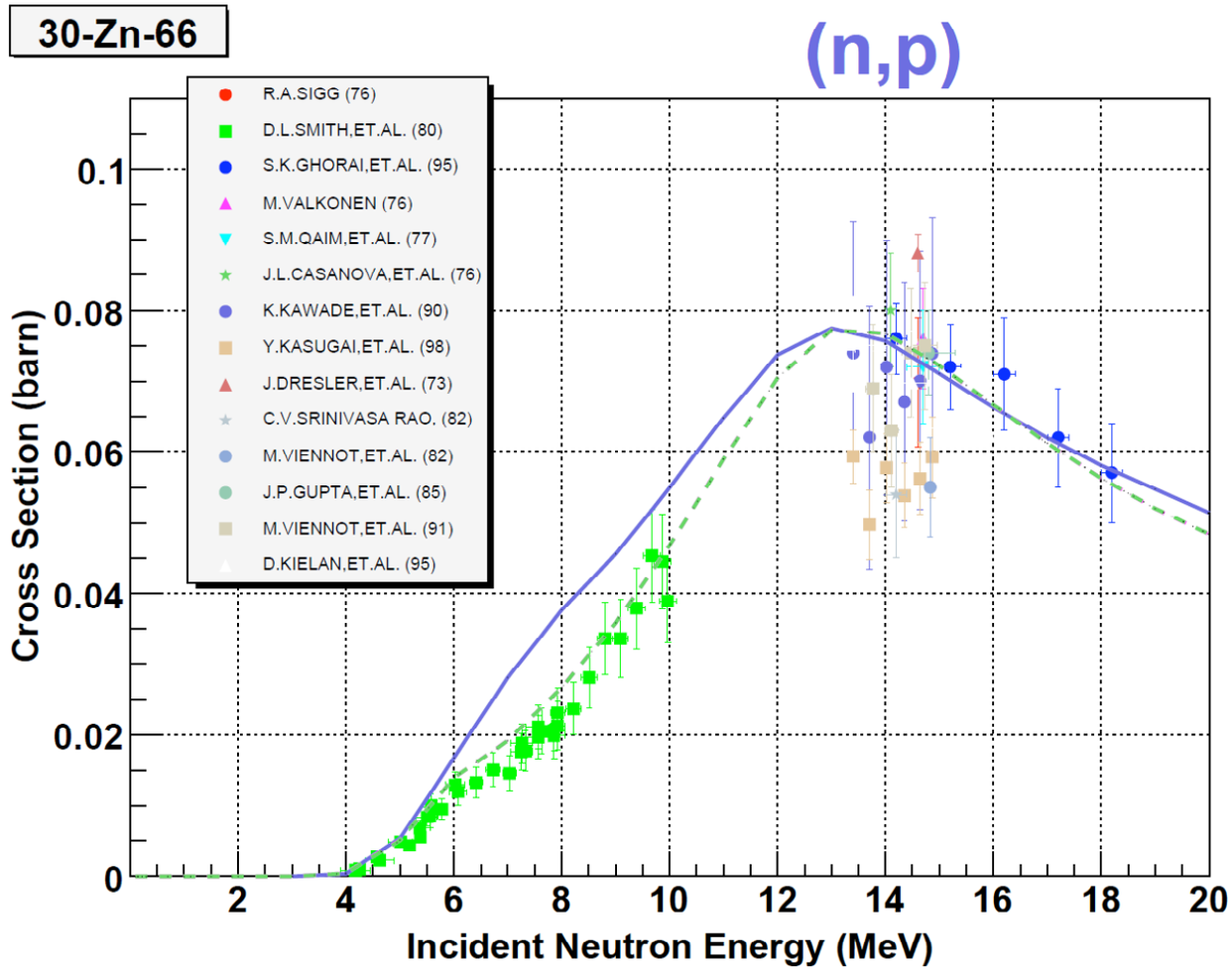
Zn Cross Sections (3)

Present

JENDL/A-96

JEFF-3.1/A





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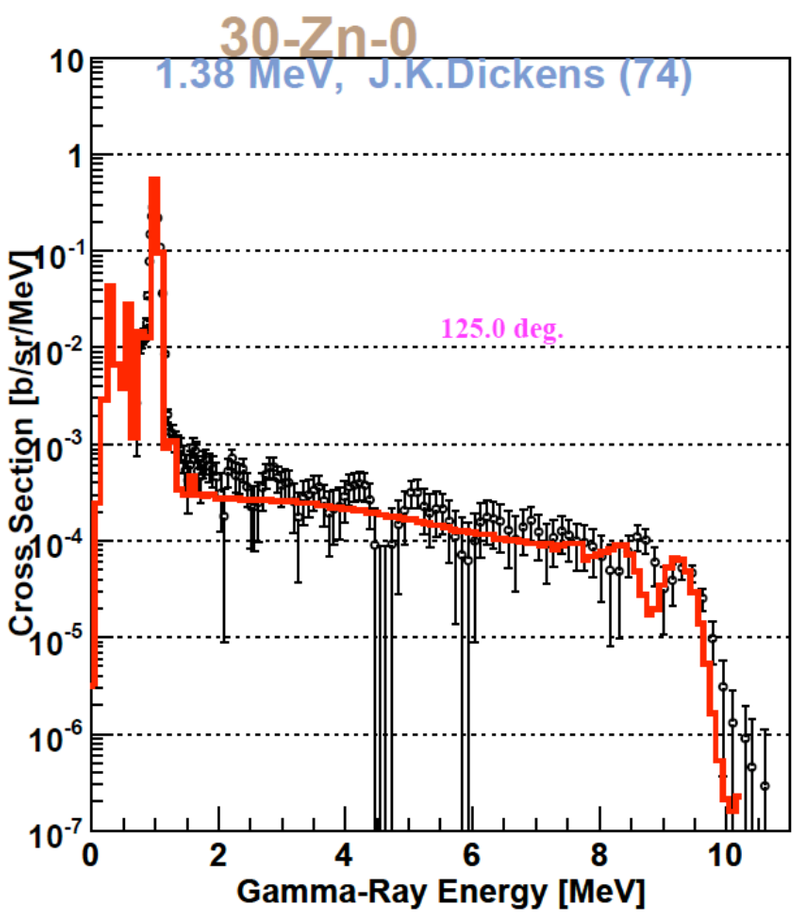
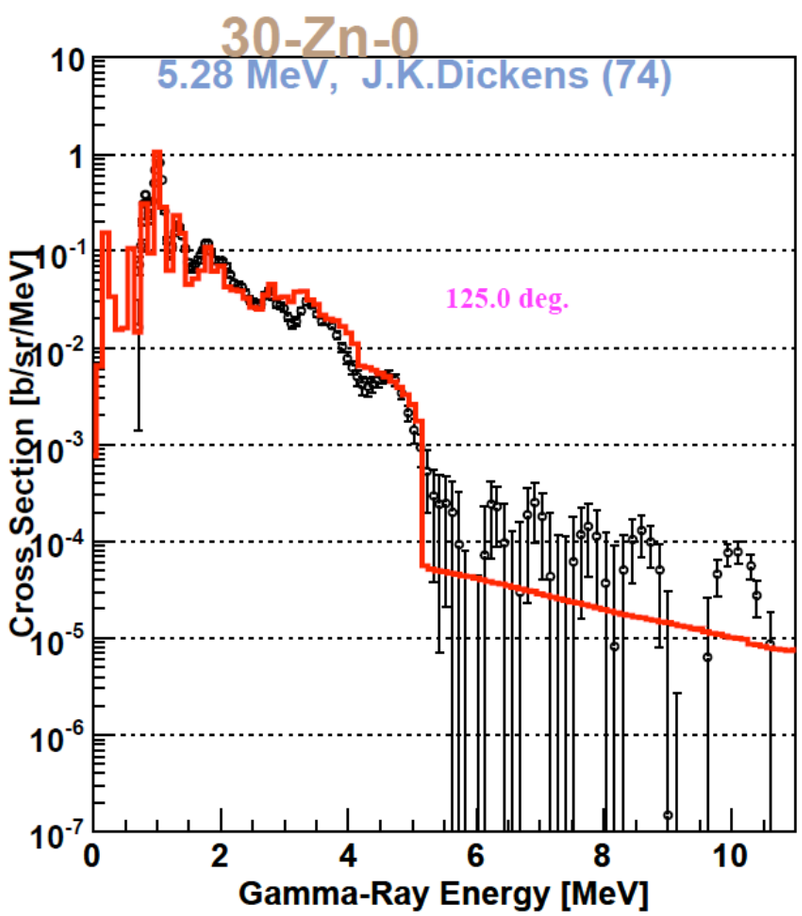
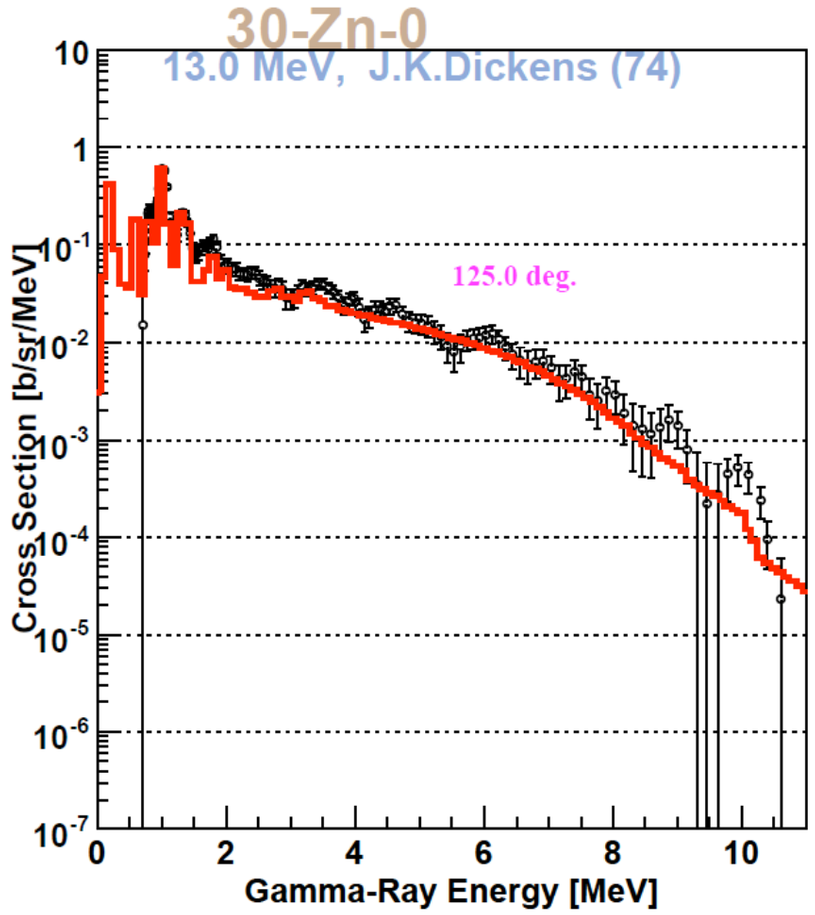
Zn Cross Sections (4)







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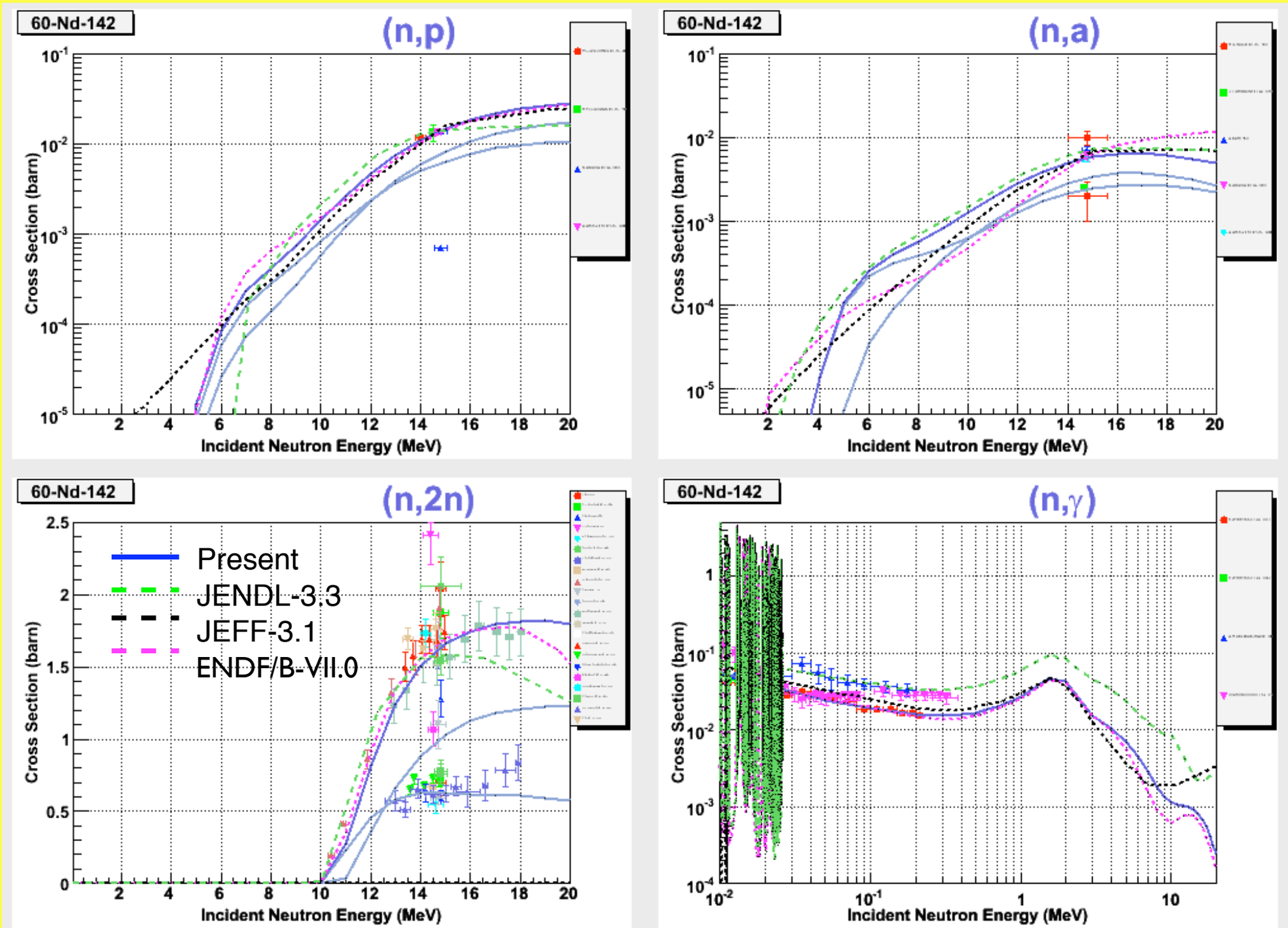
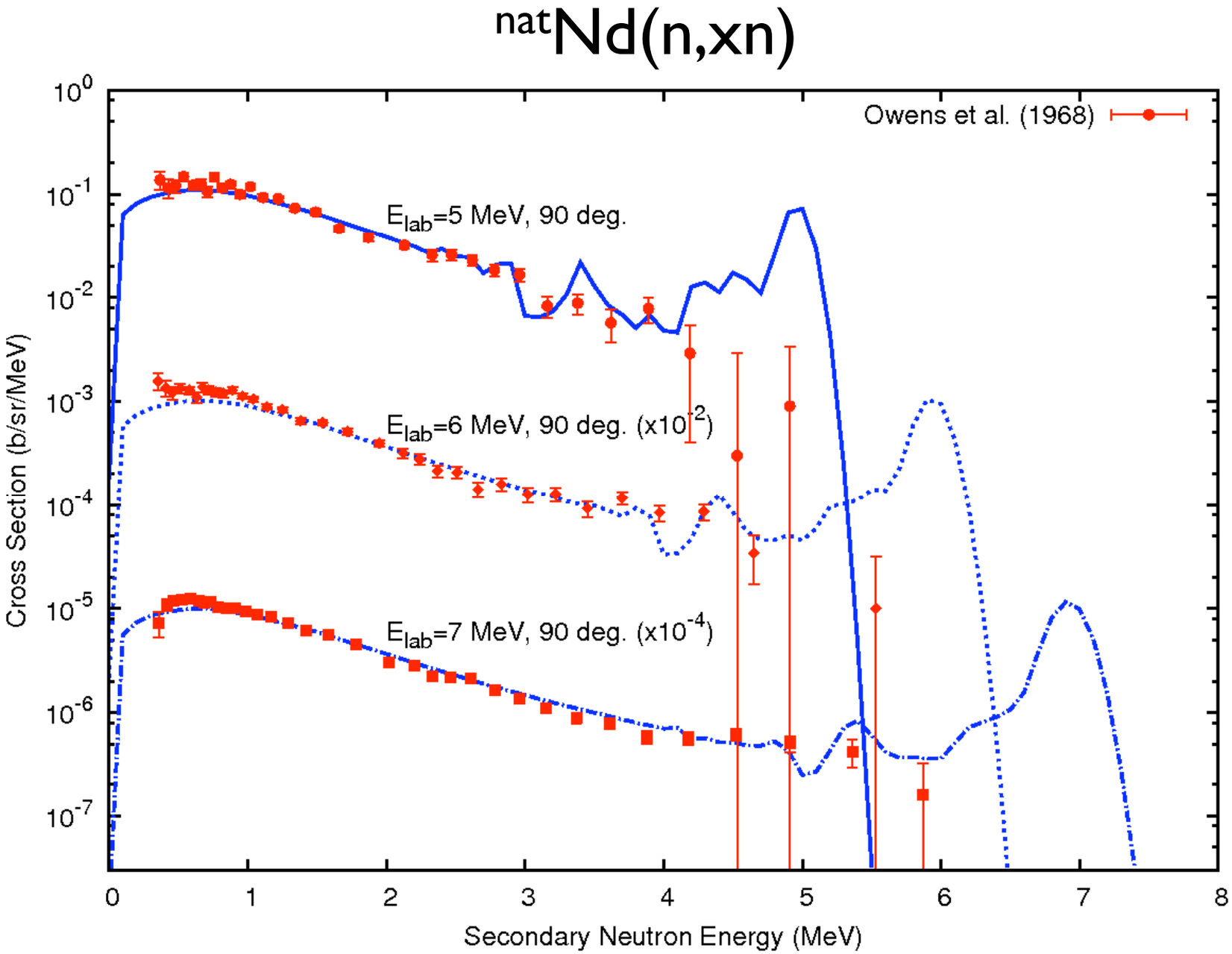
Nd Cross Sections (1)



Nd Cross Sections (2)



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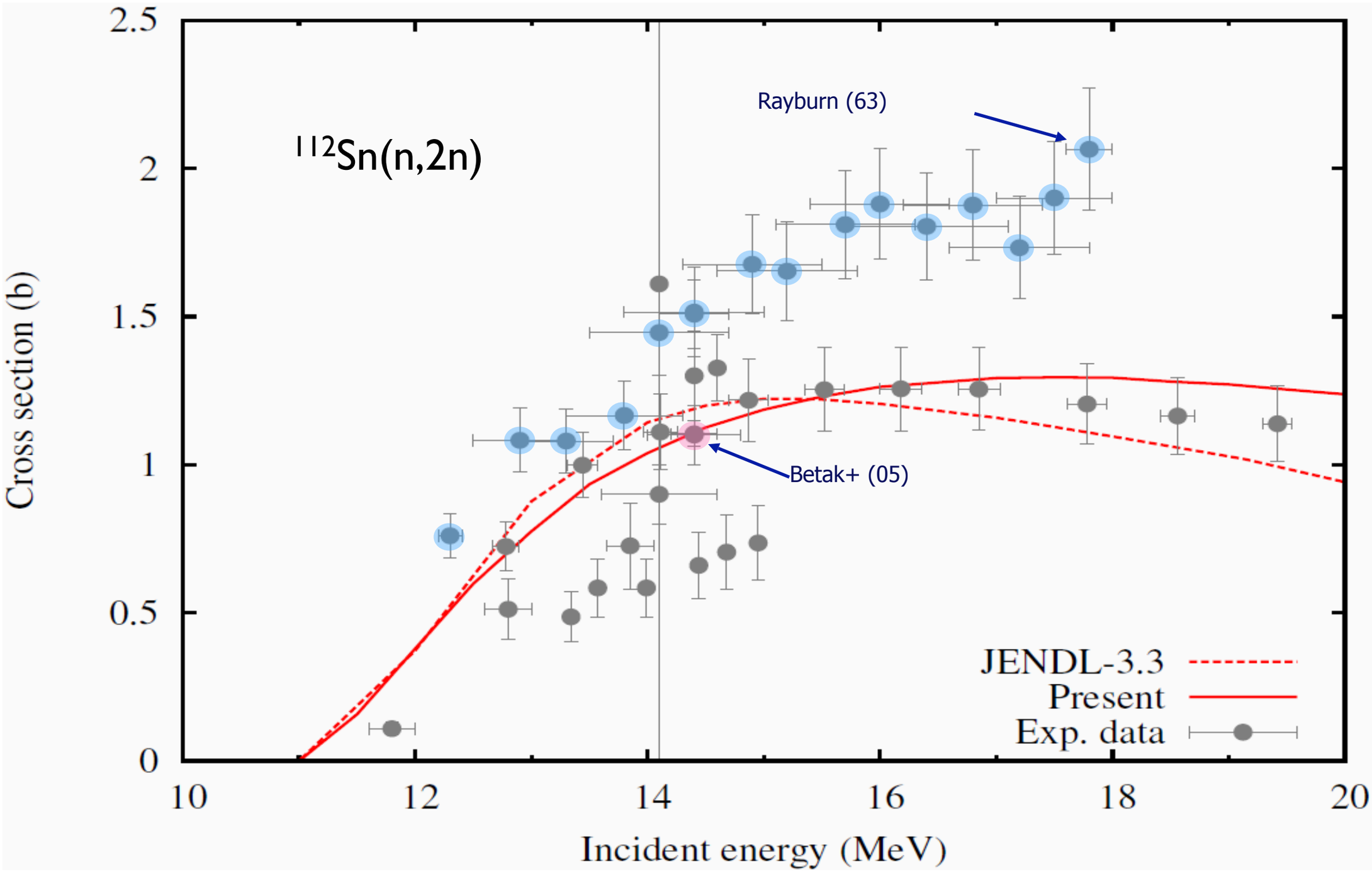
Sn Cross Sections (1)



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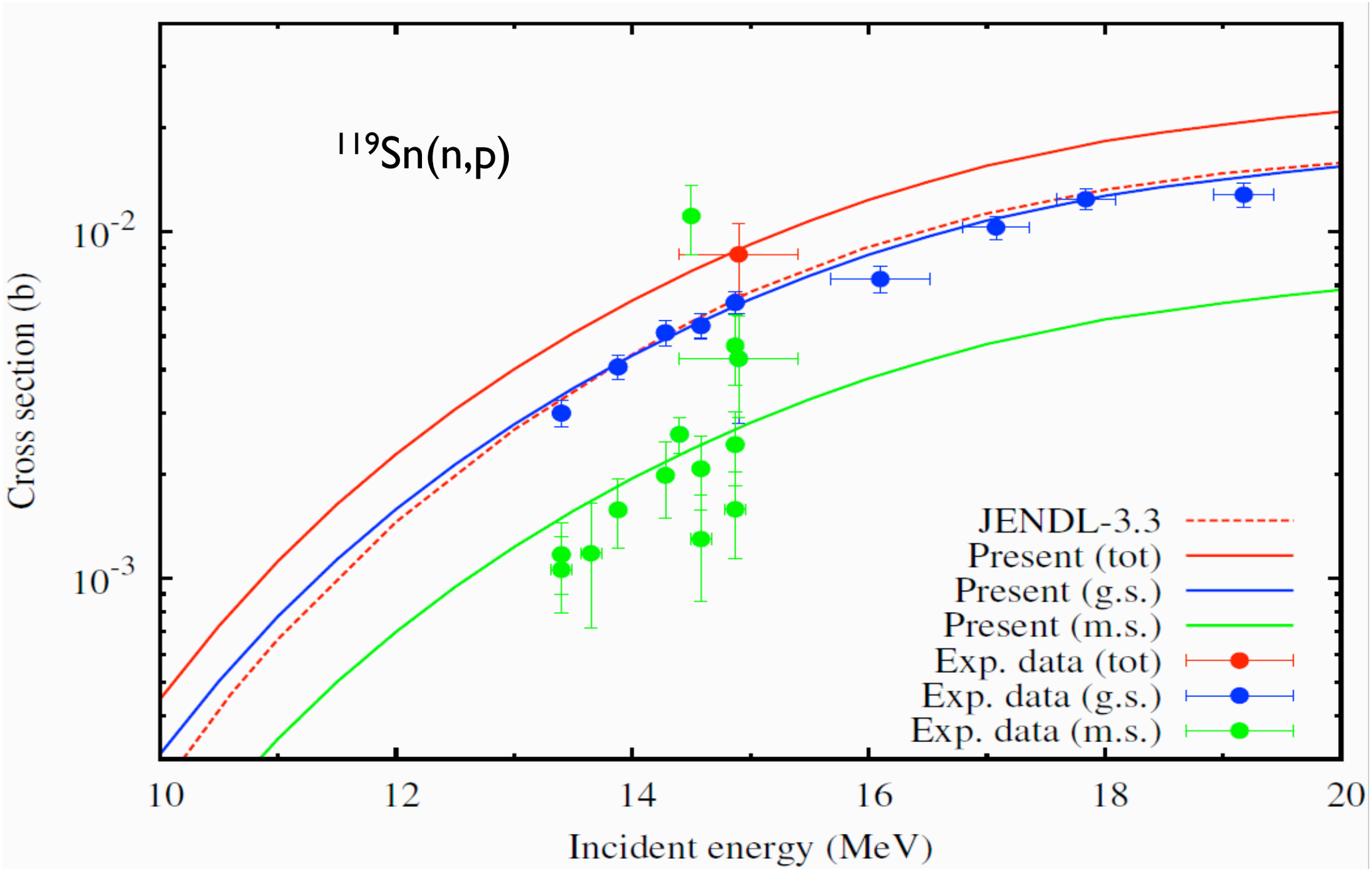
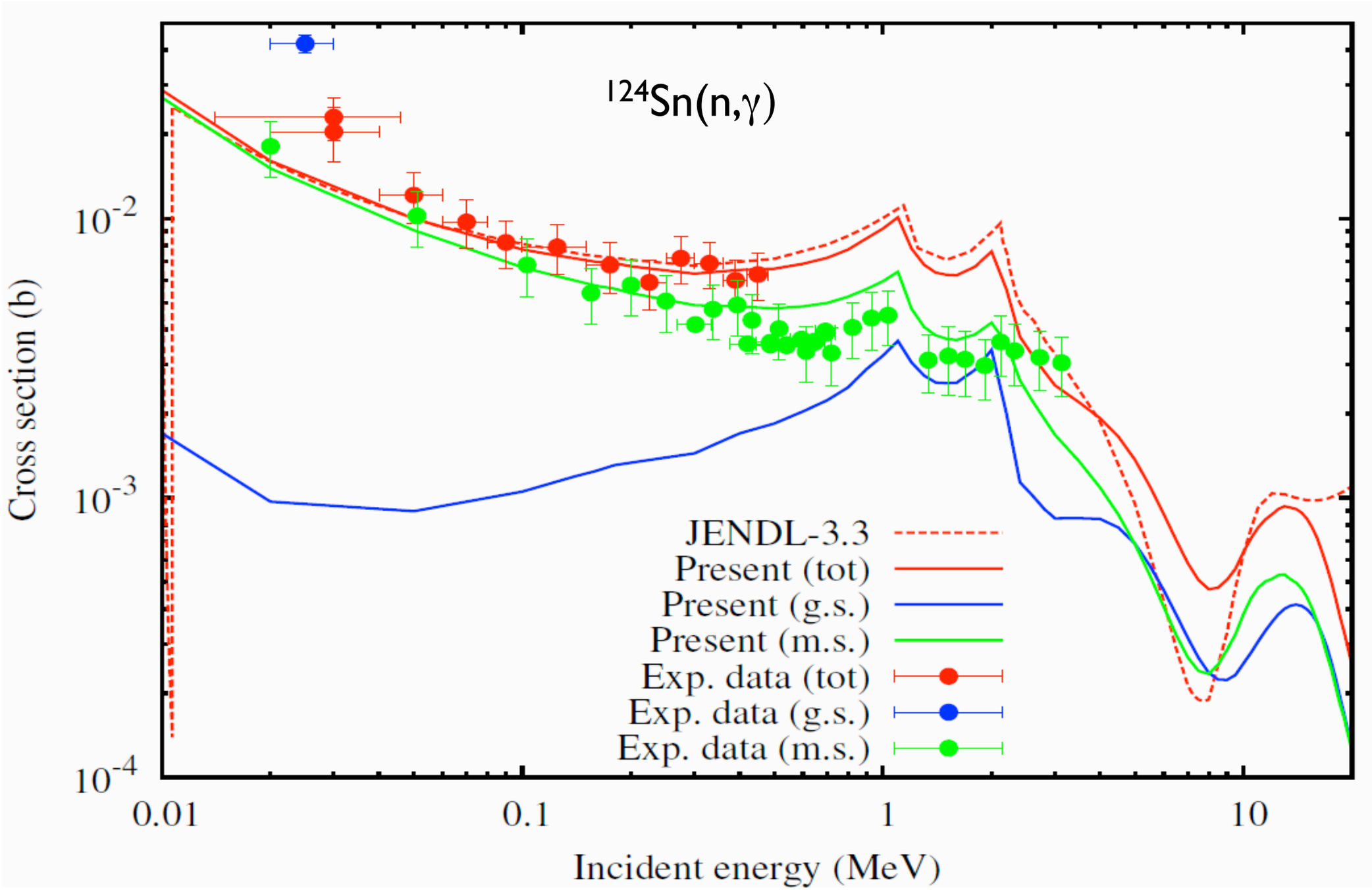
Sn Cross Sections (2)

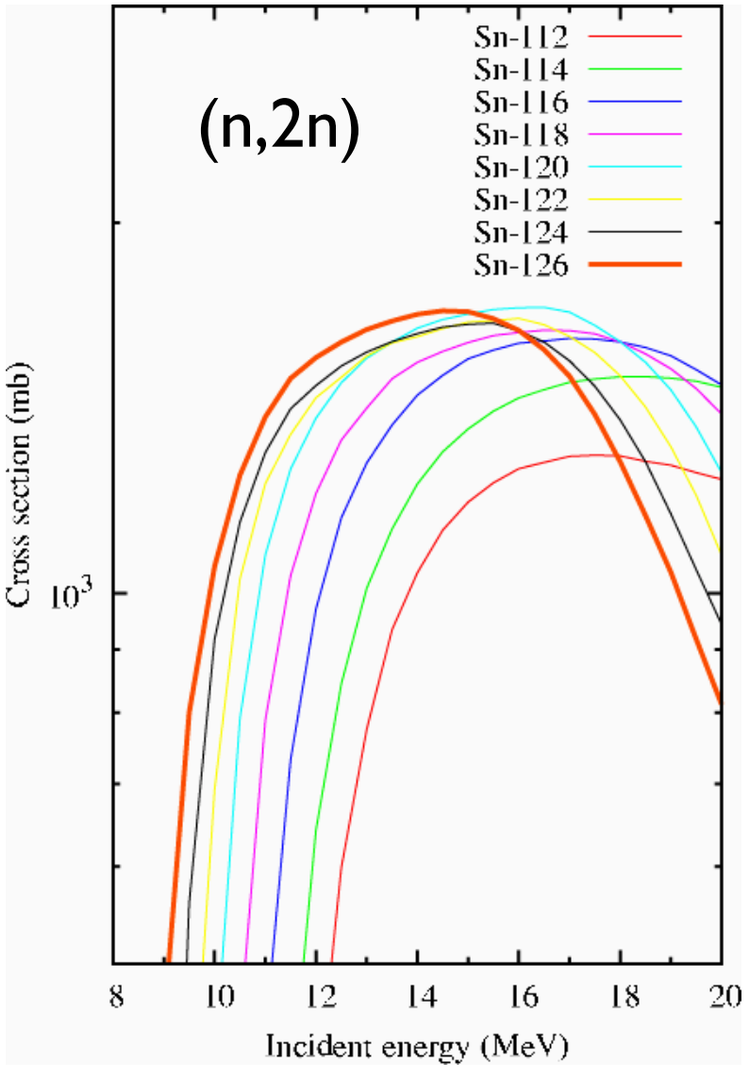


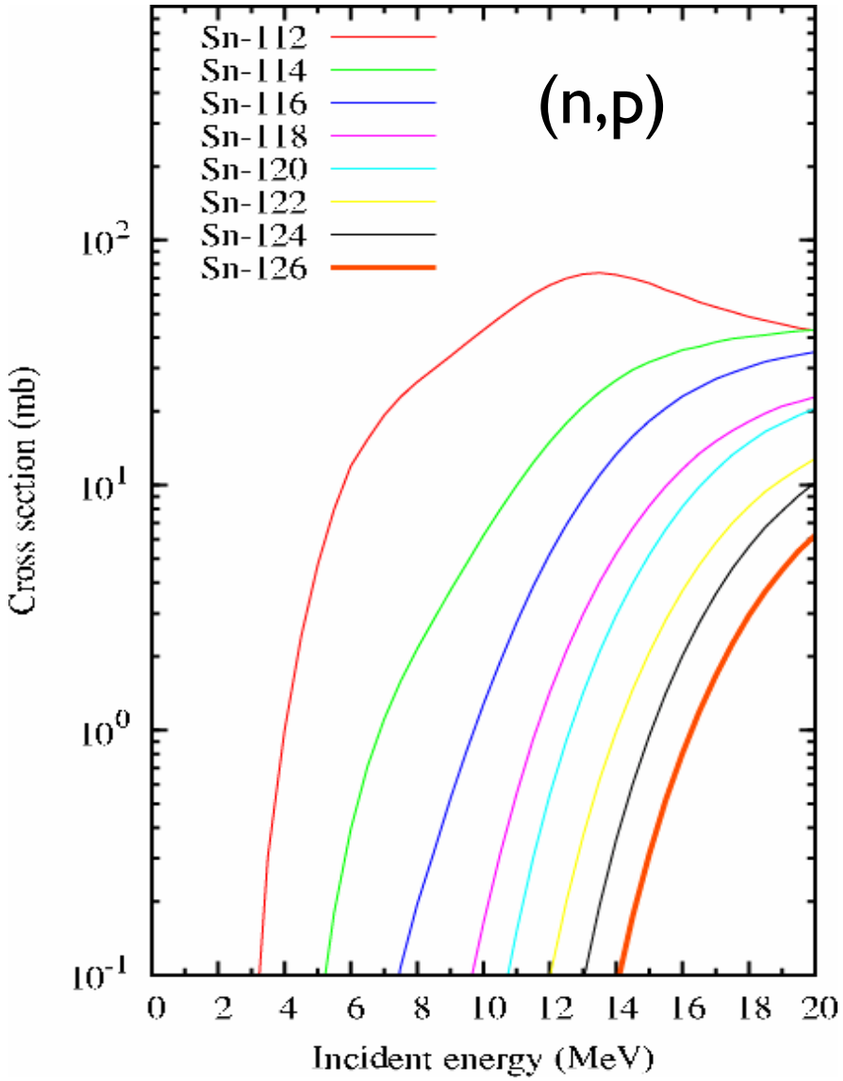
Sn Cross Sections (3)

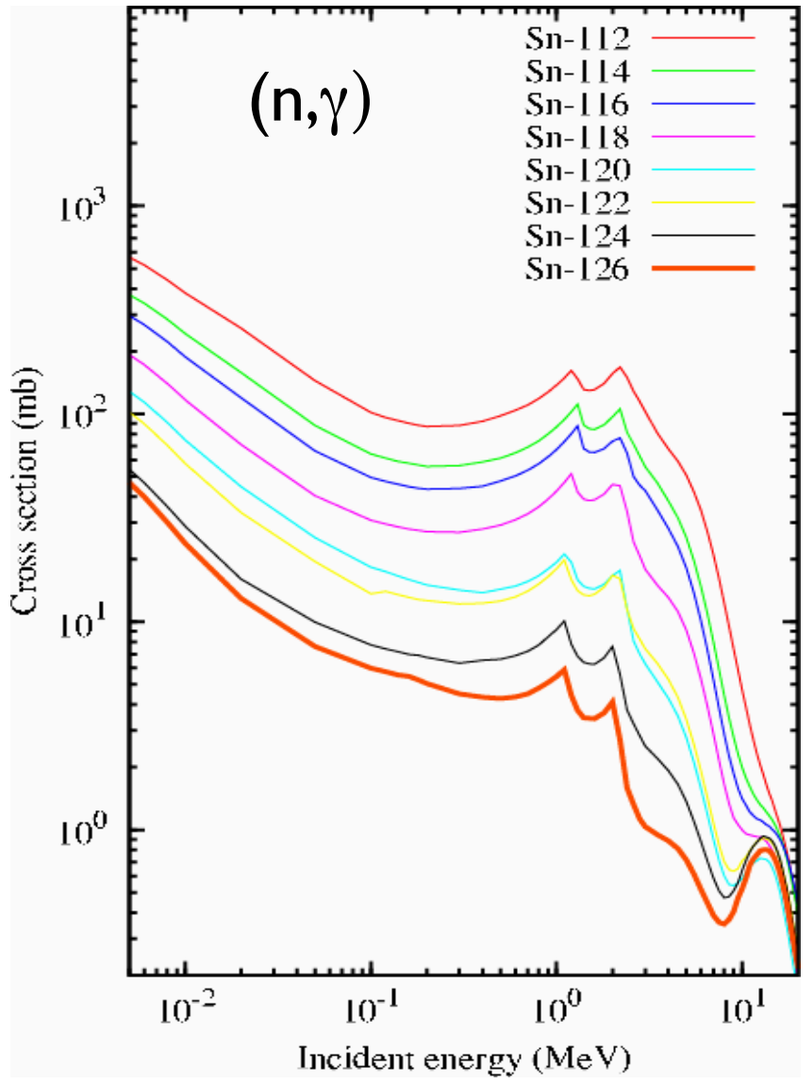


Sn Cross Sections (4)

Sn-126: LLFP $T_{1/2} = 2.3\times10^5$ year







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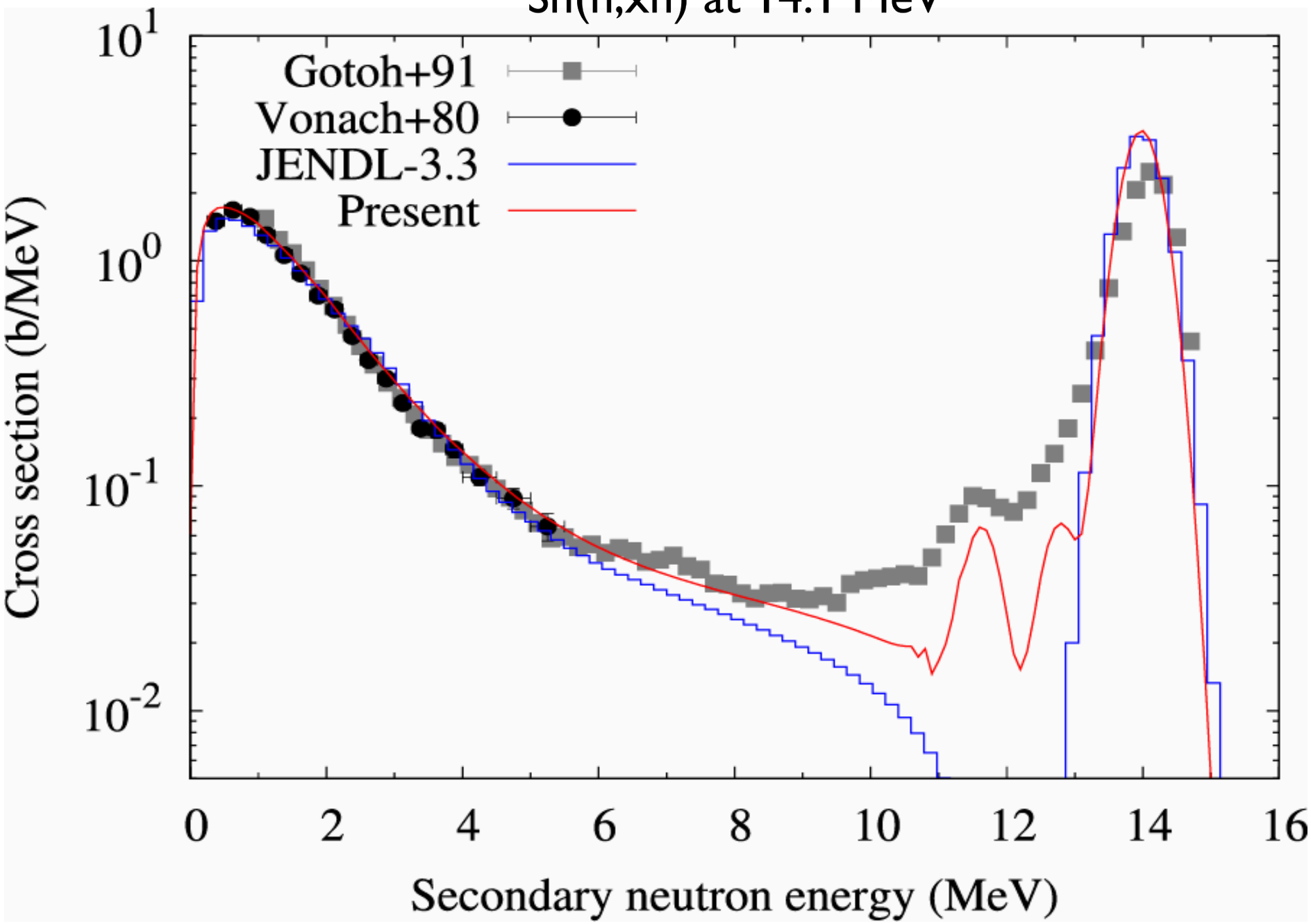
Sn Cross Sections (5)



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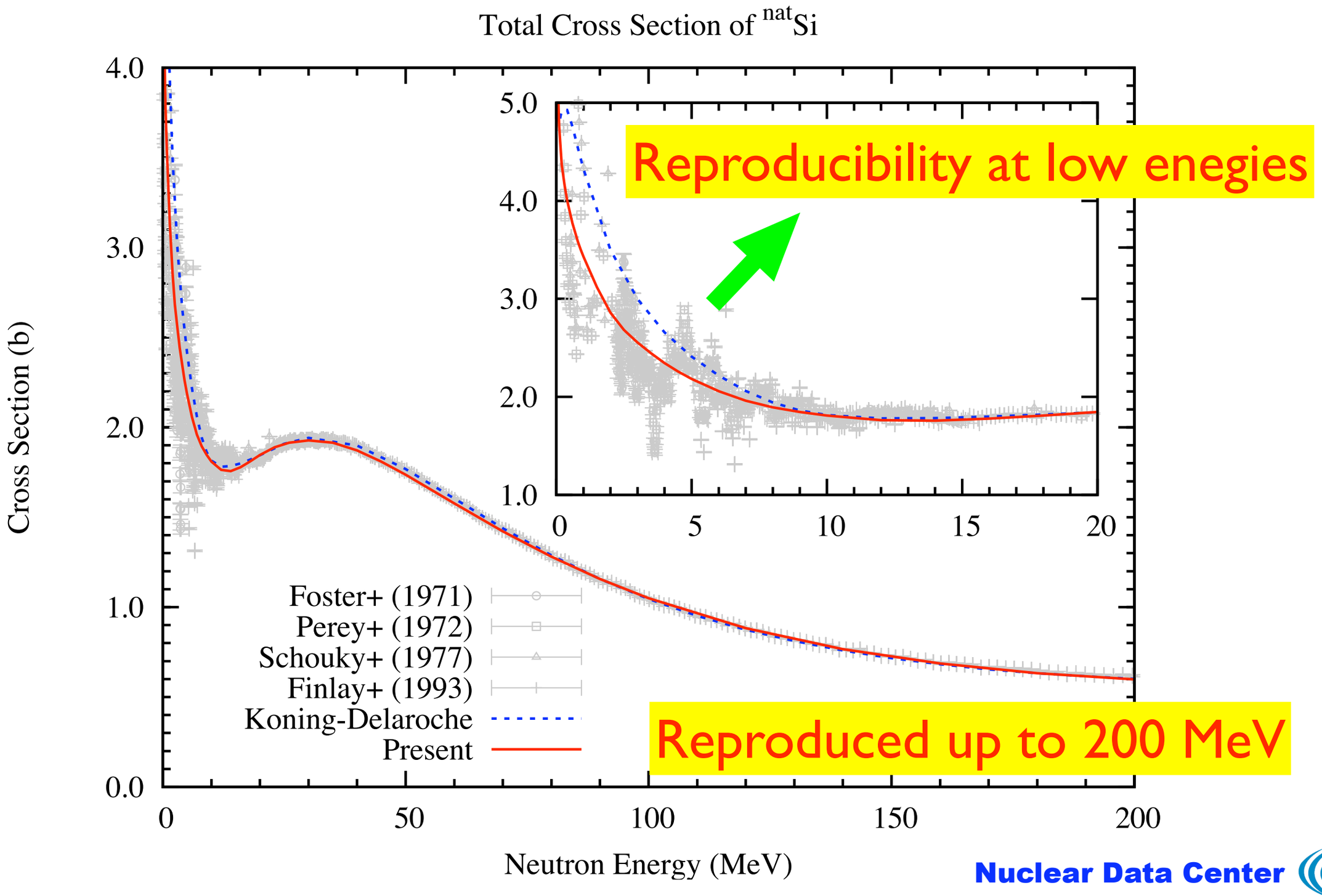
Evaluation of Light and Medium Nuclei

- Finished
  - Si-28, 29, 30
  - Ca-40, 42, 43, 44, 46, 48
- On-going
  - Au-197
- To be re-examined
  - H-1, O-16
  - Cr, Fe, Ni

Si Cross Sections (1)



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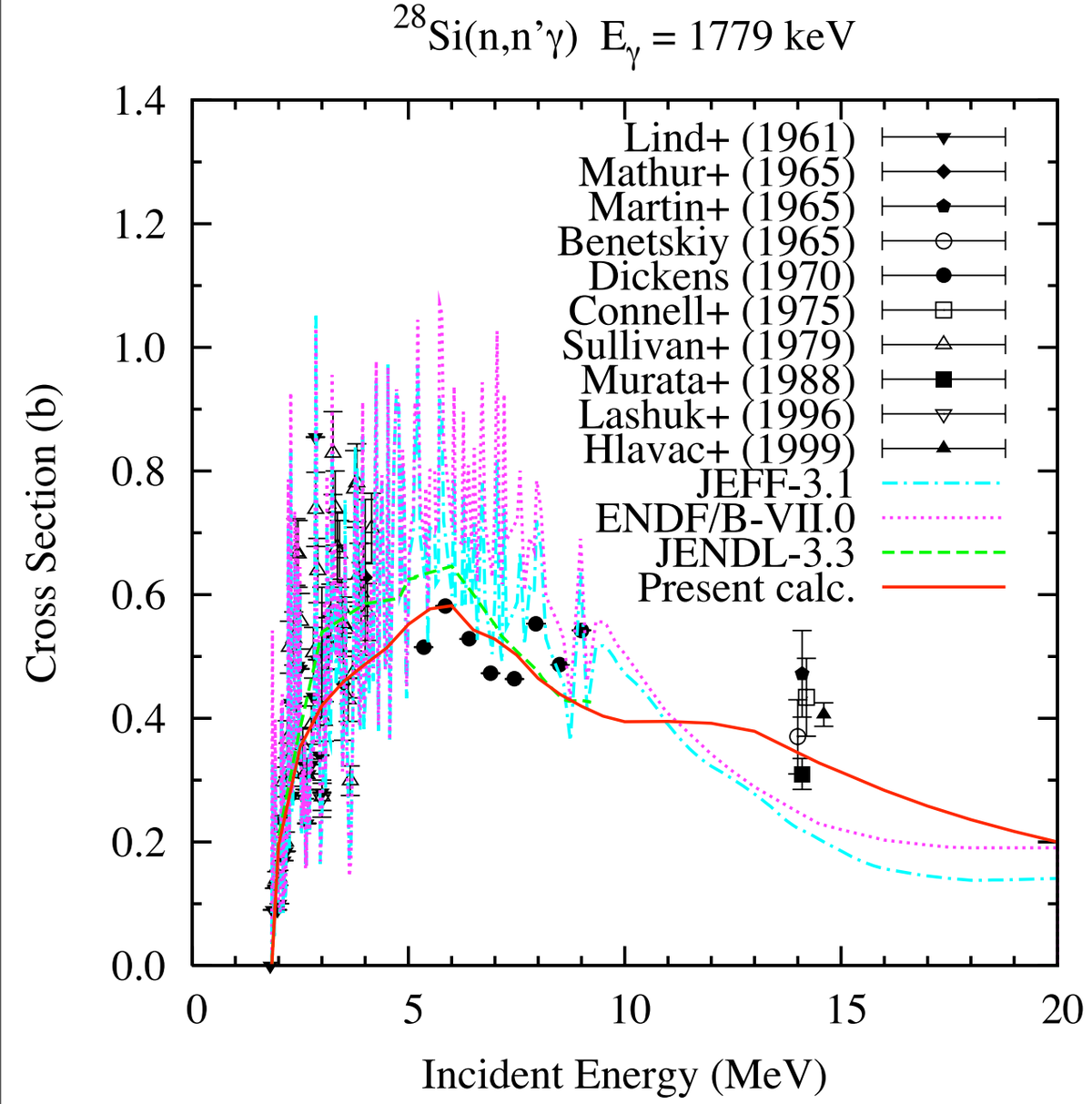
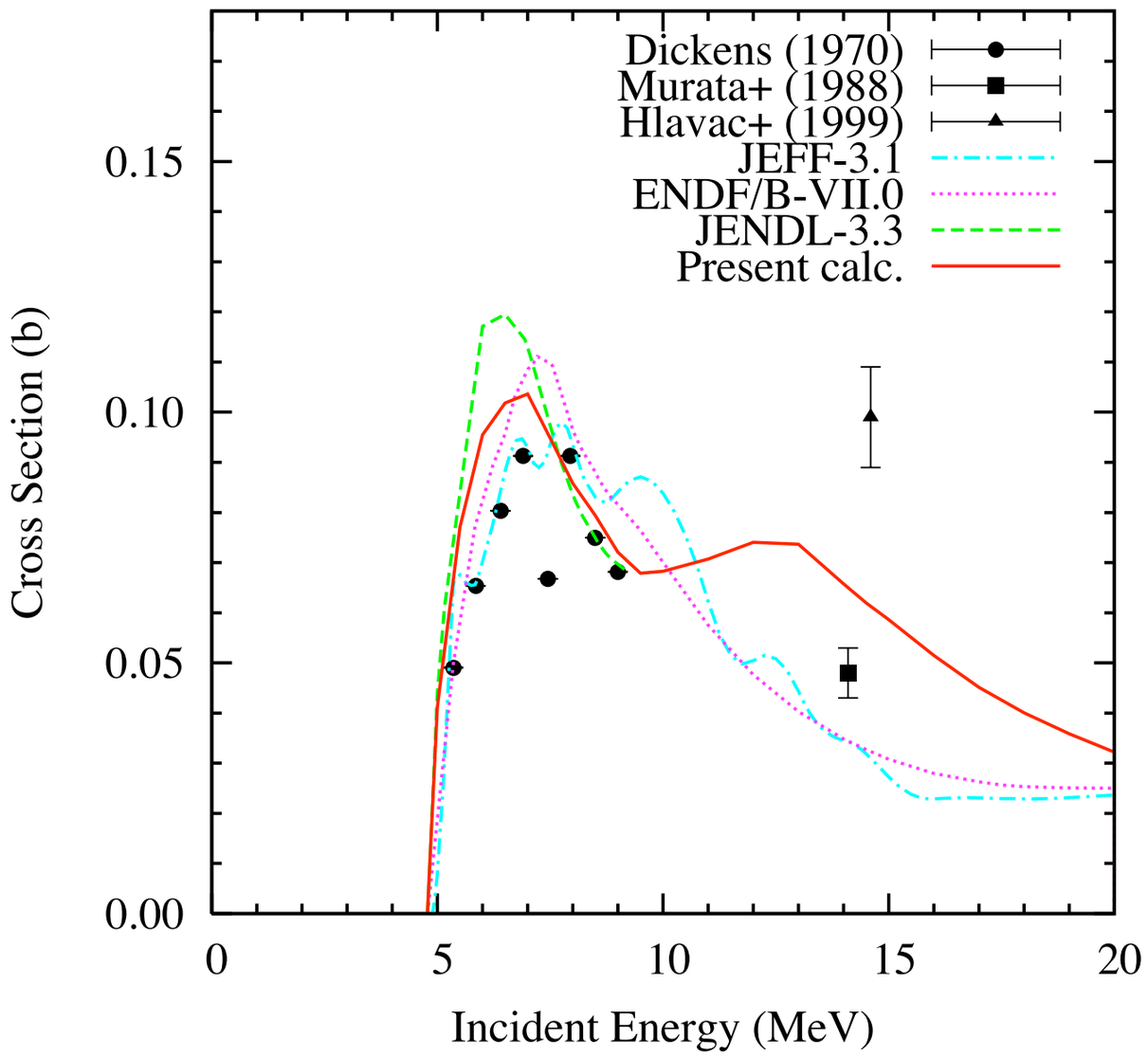
Si Cross Sections (2)

1st excited state→ground state



2nd excited state→1st excited state



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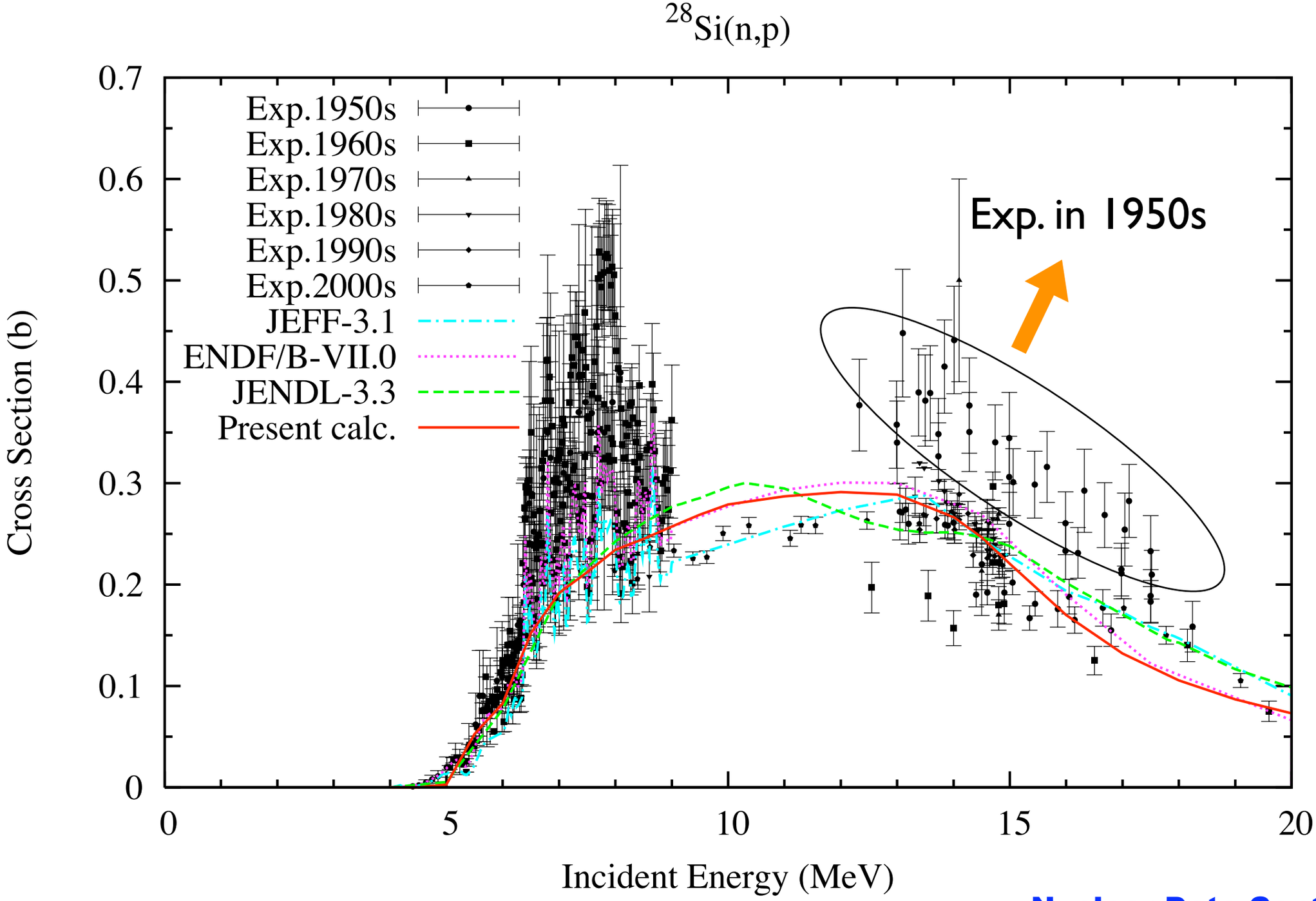
Si Cross Sections (3)



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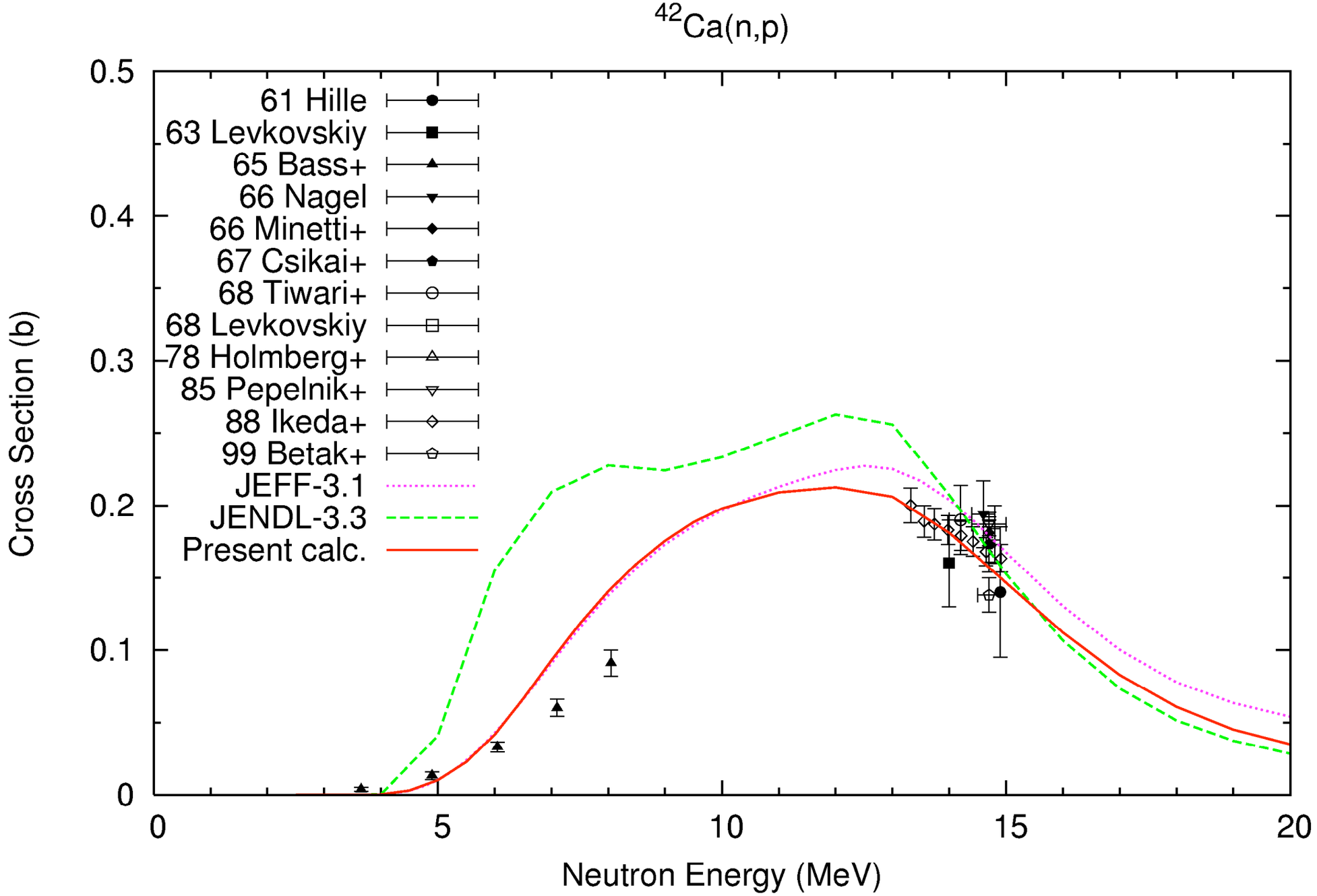
Ca Cross Sections (1)



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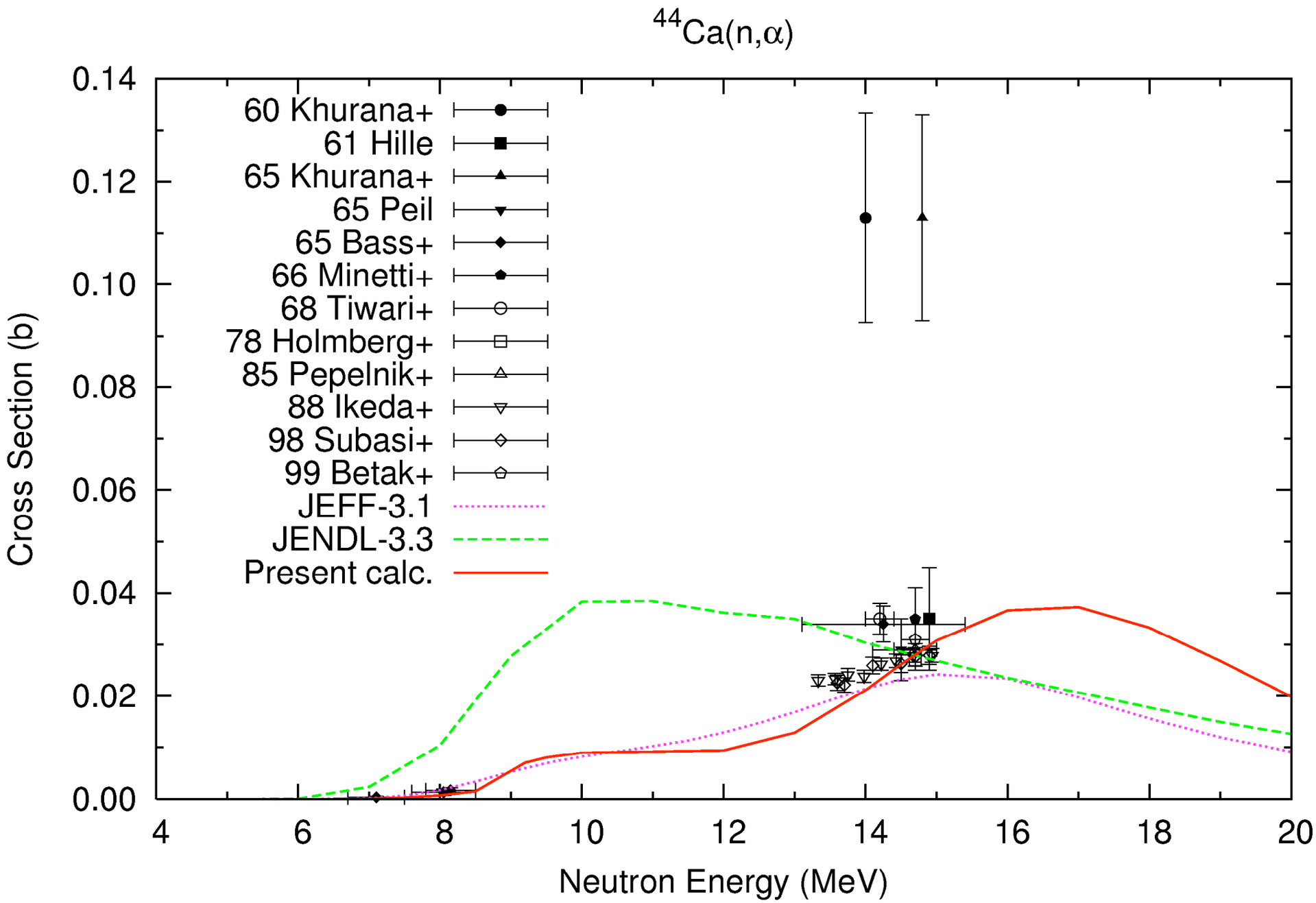
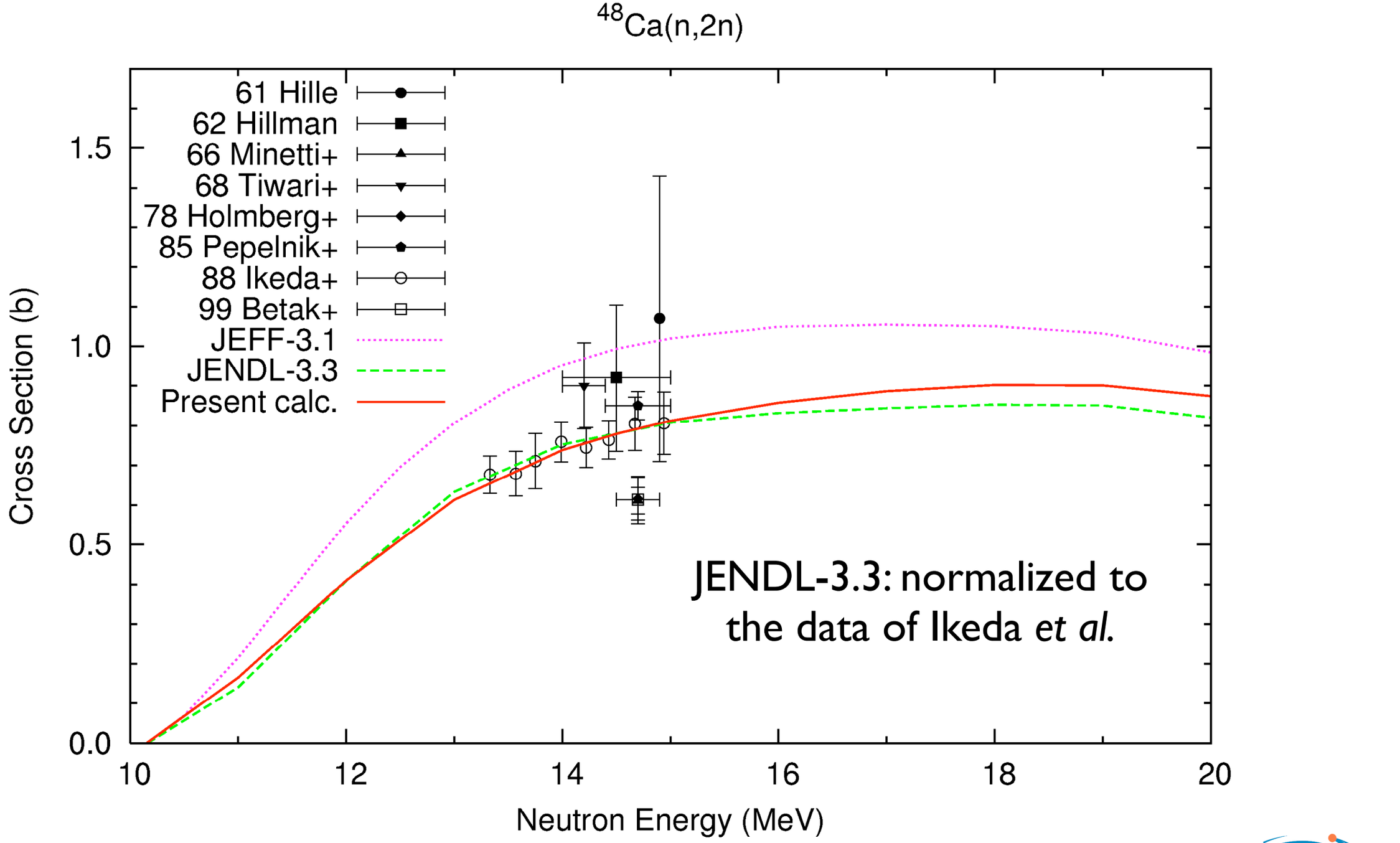
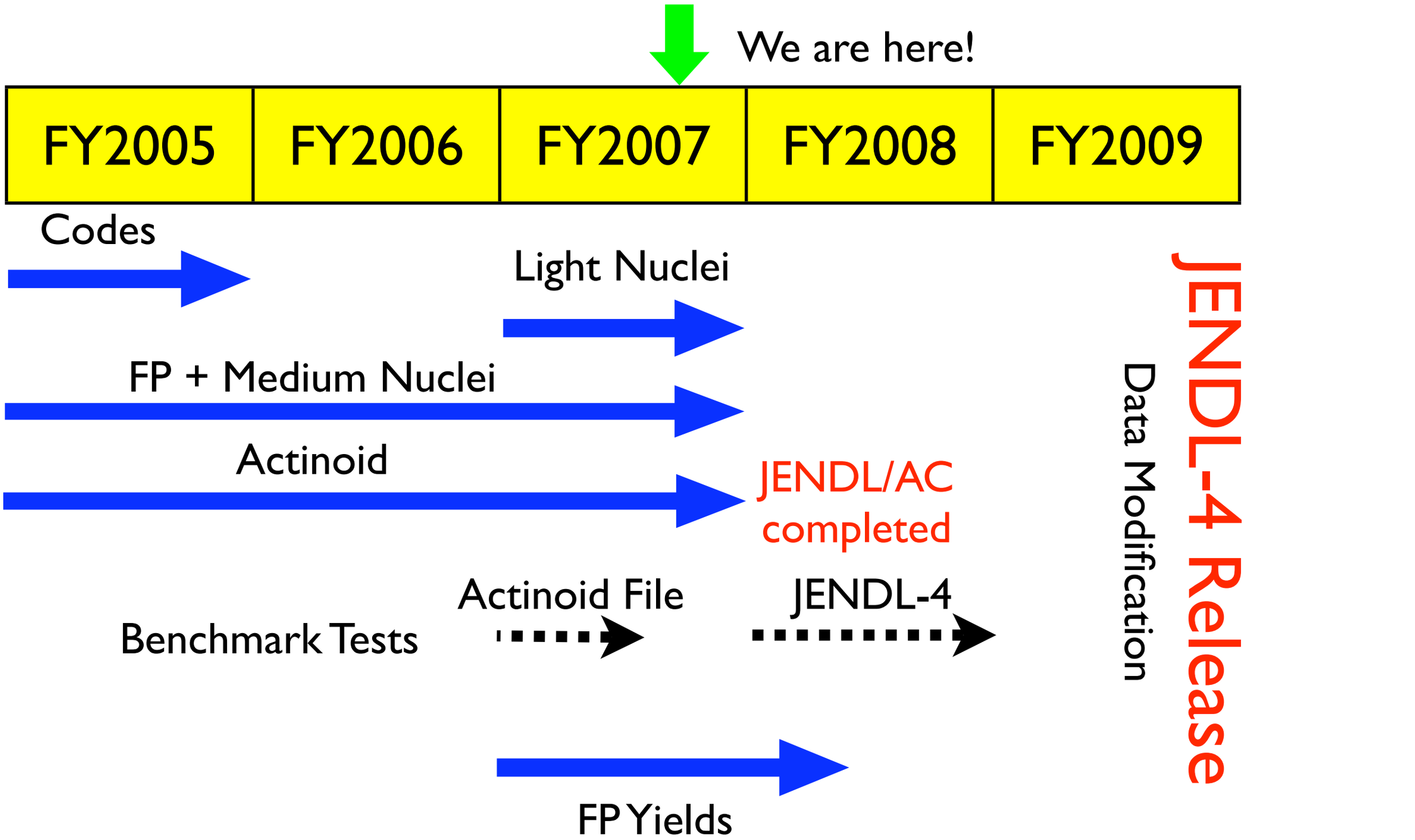
Ca Cross Sections (2)



Ca Cross Sections (3)



Time Schedule of JENDL-4



Time Schedule of JENDL-4

We are here!

FY2005	FY2006	FY2007	FY2008	FY2009

Codes → Light Nuclei

FP + Medium Nuclei

Actinoid

Benchmark Tests

Actinoid File

JENDL-4

FP Yields

Data Modification

JENDL-4 Release

Issues Probably Carried Over after JENDL-4

- Thermal Scattering Law Data
  - Difficult to find a specialist over the world
- Resonance Analysis
  - Important, but raw data and expertise needed!
- Processing Code (NJOY *etc*.)
  - Necessary to keep specialists
- (Nuclear Model Codes Made in Japan)
  - Resolved by JAEA activities