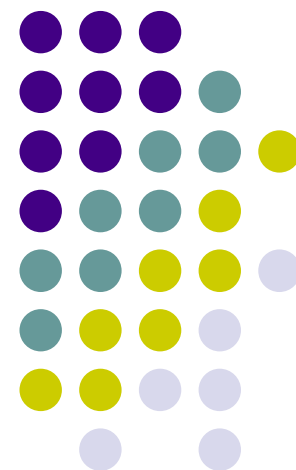


Nuclear Data Evaluation for Actinoid Nuclides

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Japan Atomic Energy Agency





Nuclear Data Evaluation

- **For JENDL Actinoid File (JENDL/AC)**

- **Nuclides**

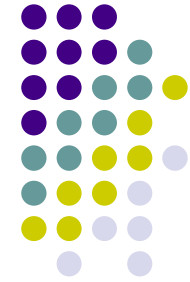
79 nuclides: Ac-225 to Fm-255

- 62 nuclides: JENDL-3.3 data were revised.
- 17 nuclides: additional nuclides for JENDL/AC.
Their half-lives are longer than 1 day.

- **Neutron energy range**

1.0e-5 eV to 20 MeV

Resolved Resonance Parameters



- **SAMMY analyses**

- Th-232, U-233, U-238, Pu-241: ENDF/B-VII.0 was adopted.
- U-235: JENDL-3.3 was adopted up to 500 eV
- Pu-239: JENDL-3.3. New analysis has been done by Derrien.
- Pu-240: JENDL-3.3 was slightly modified.
- Np-236: New evaluation was done by Furutaka (JAEA).

- **Other nuclides**

Parameters of Multi-Level Breit-Wigner formula were modified to reproduce experimental data.

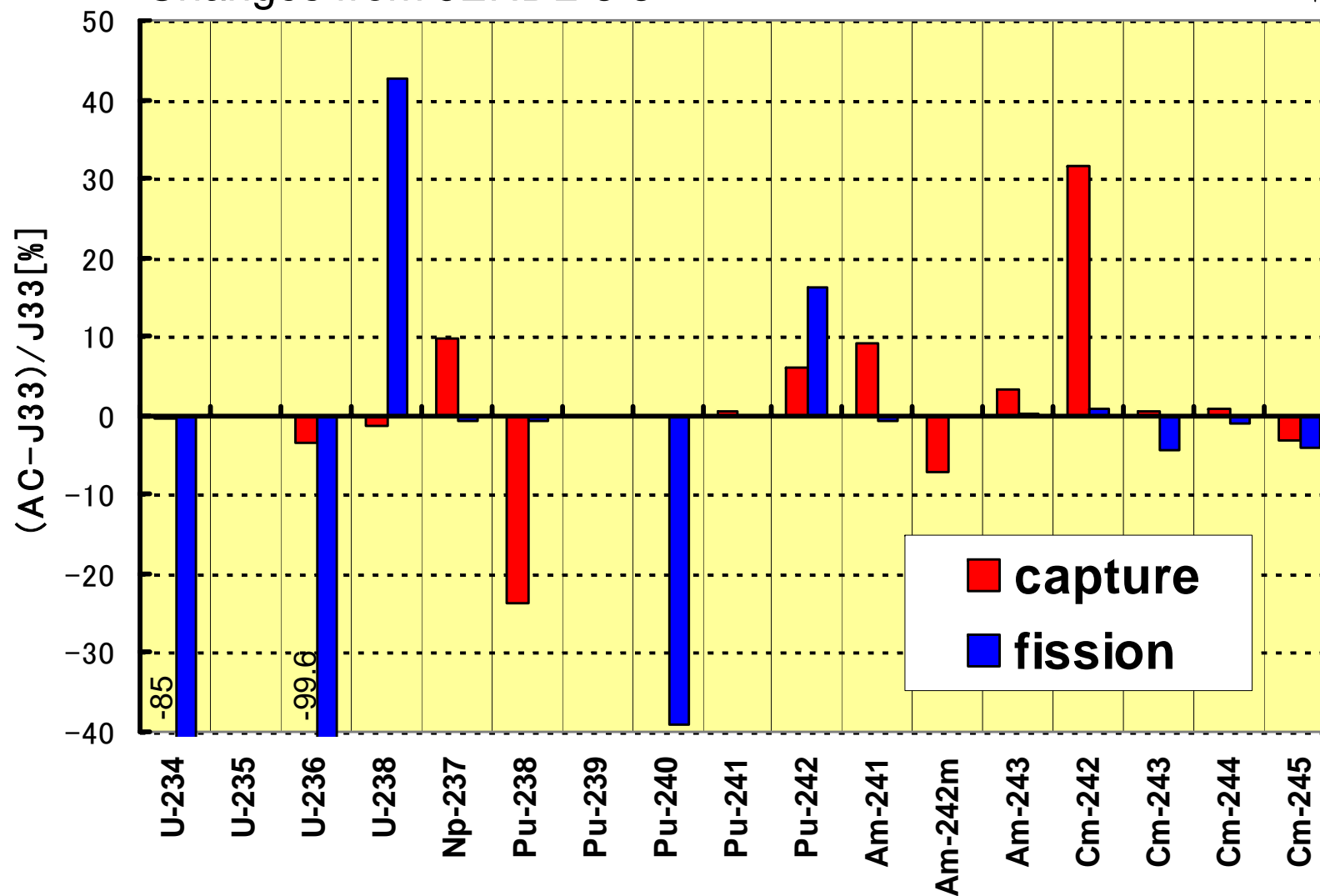
- **Thermal fission and capture cross sections**

Evaluated from experimental data if available.

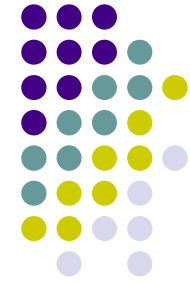


Thermal Cross Sections

Changes from JENDL-3.3.



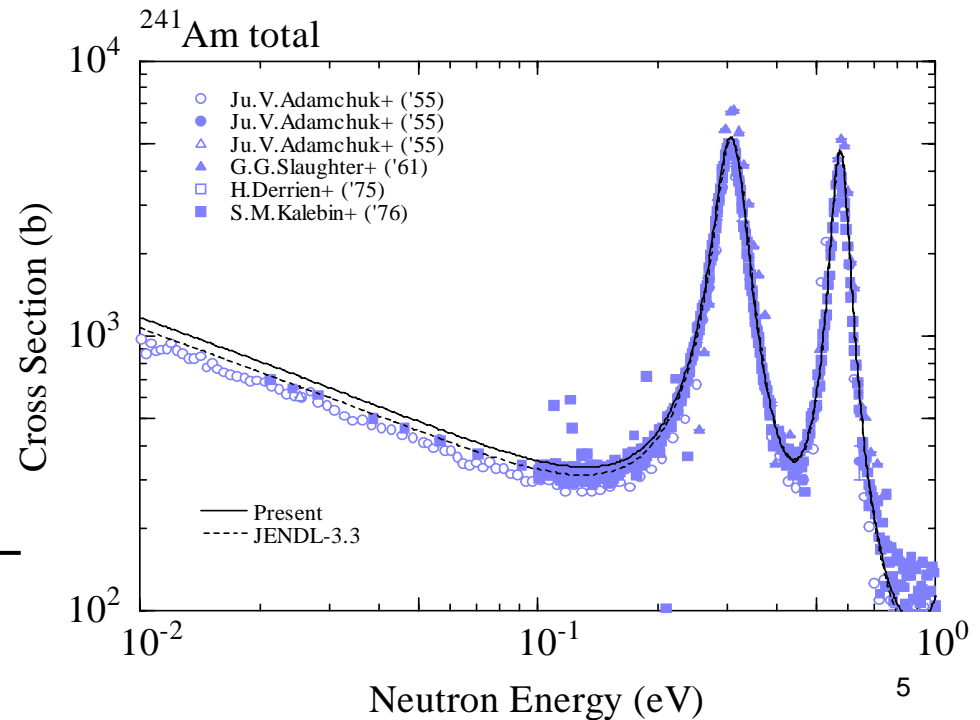
^{241}Am Capture Cross Section



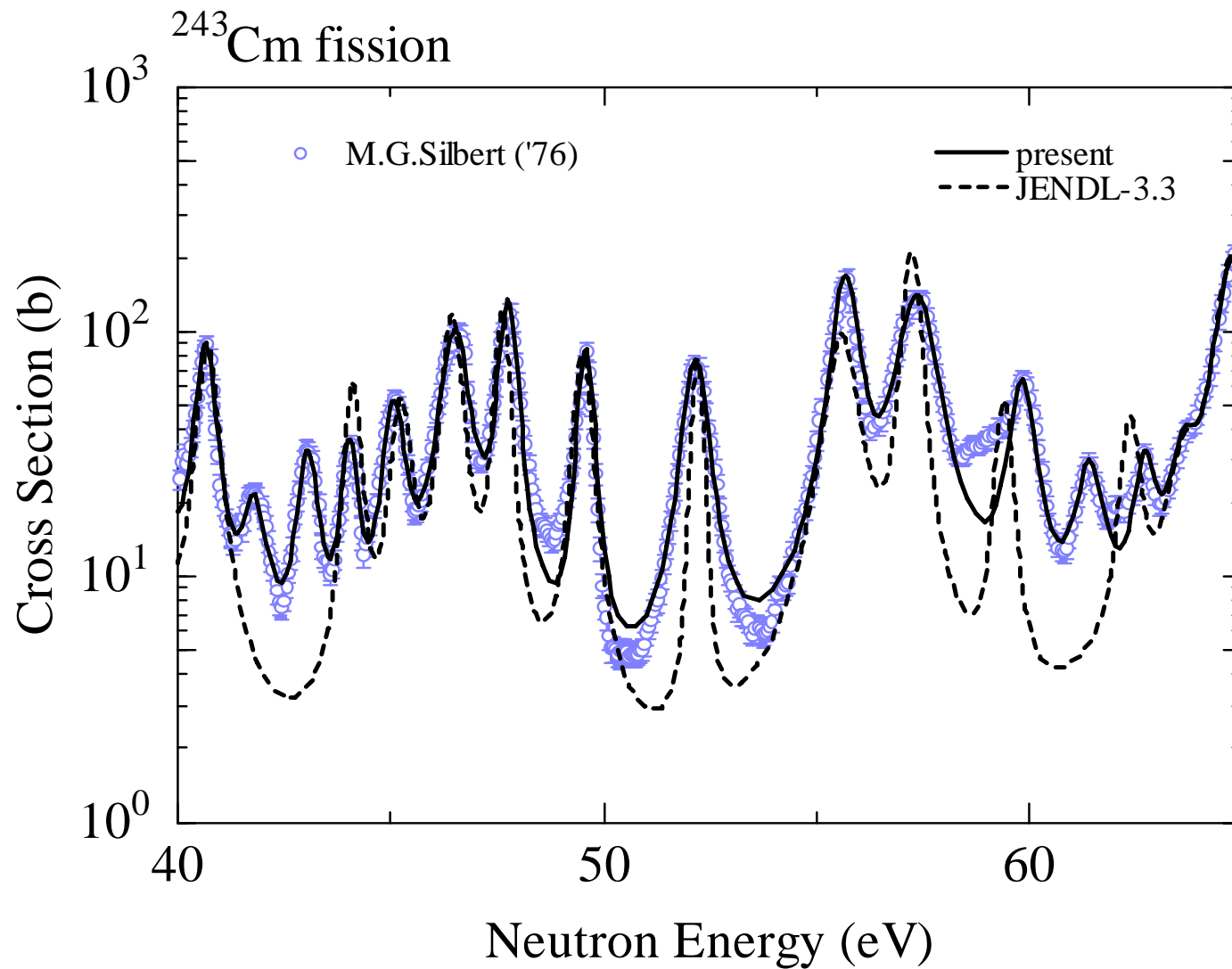
Thermal cross section (b)

| | |
|-------------------|--------------|
| JENDL-3.3 | 639.5 |
| Kalebin (1976) | 624 ± 20 |
| Shinohara+ (1997) | 854 ± 58 |
| Fioni+ (2001) | 696 ± 48 |
| Bringer+ (2006) | 714 ± 23 |
| Present | 697.1 |
| LANL (2007) about | 660 ± 25 |

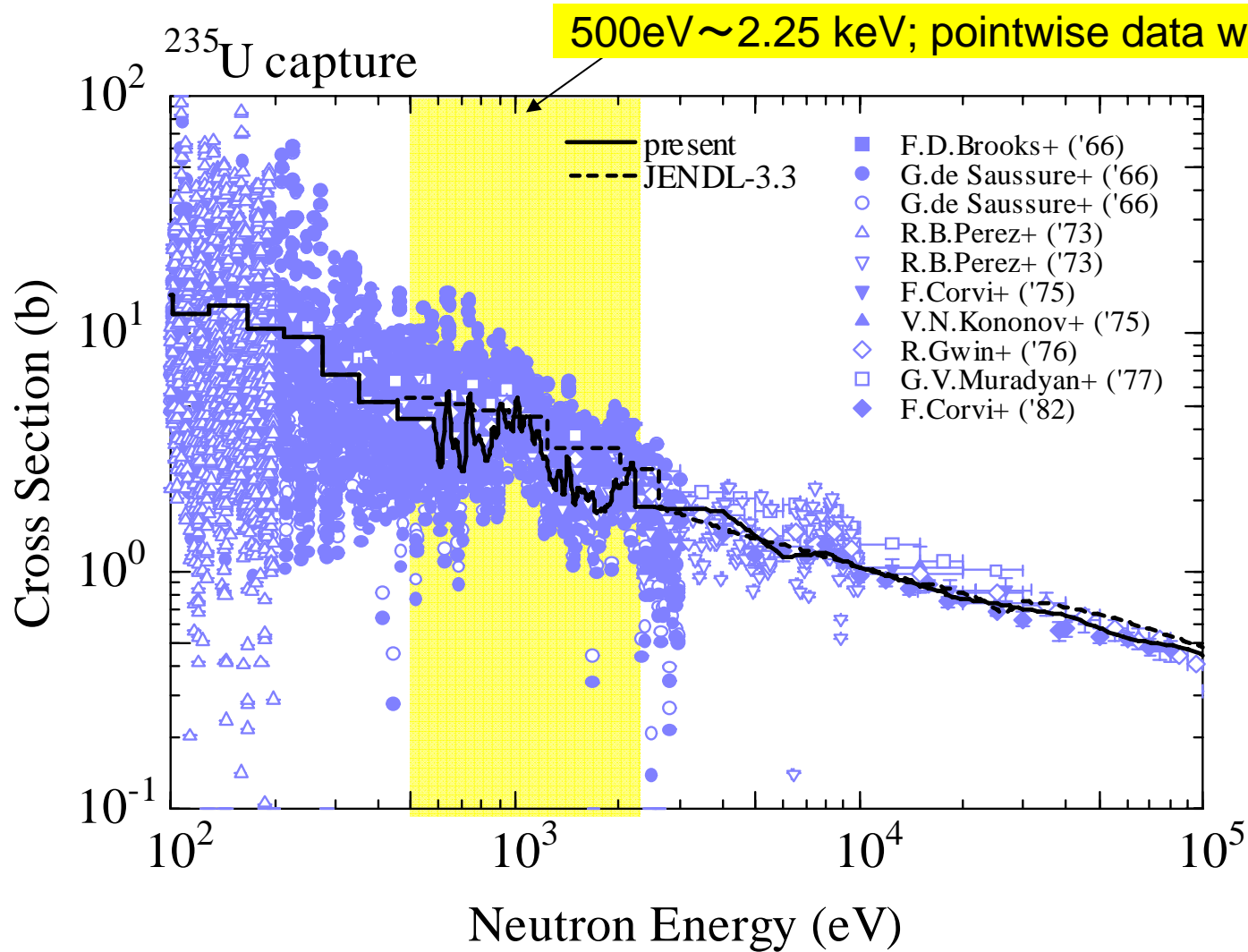
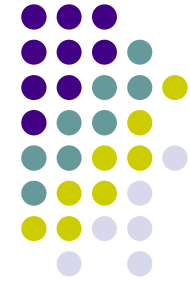
Large thermal capture cross section is inconsistent with measured total cross sections.



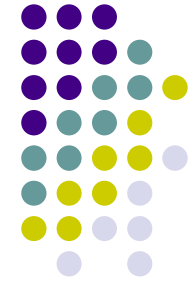
Modification of Resonance Parameters



^{235}U Capture Cross Section



Unresolved Resonance Parameters



- **Option LSSF=1**

Unresolved resonance parameters are used only for self-shielding calculations.

Cross sections are given in MF=3.

- **Upper boundary energies**

Selected to be high enough to avoid discontinuity of self-shielded cross sections.

- **Code for URP evaluation**

ASREP code



Theoretical Calculation

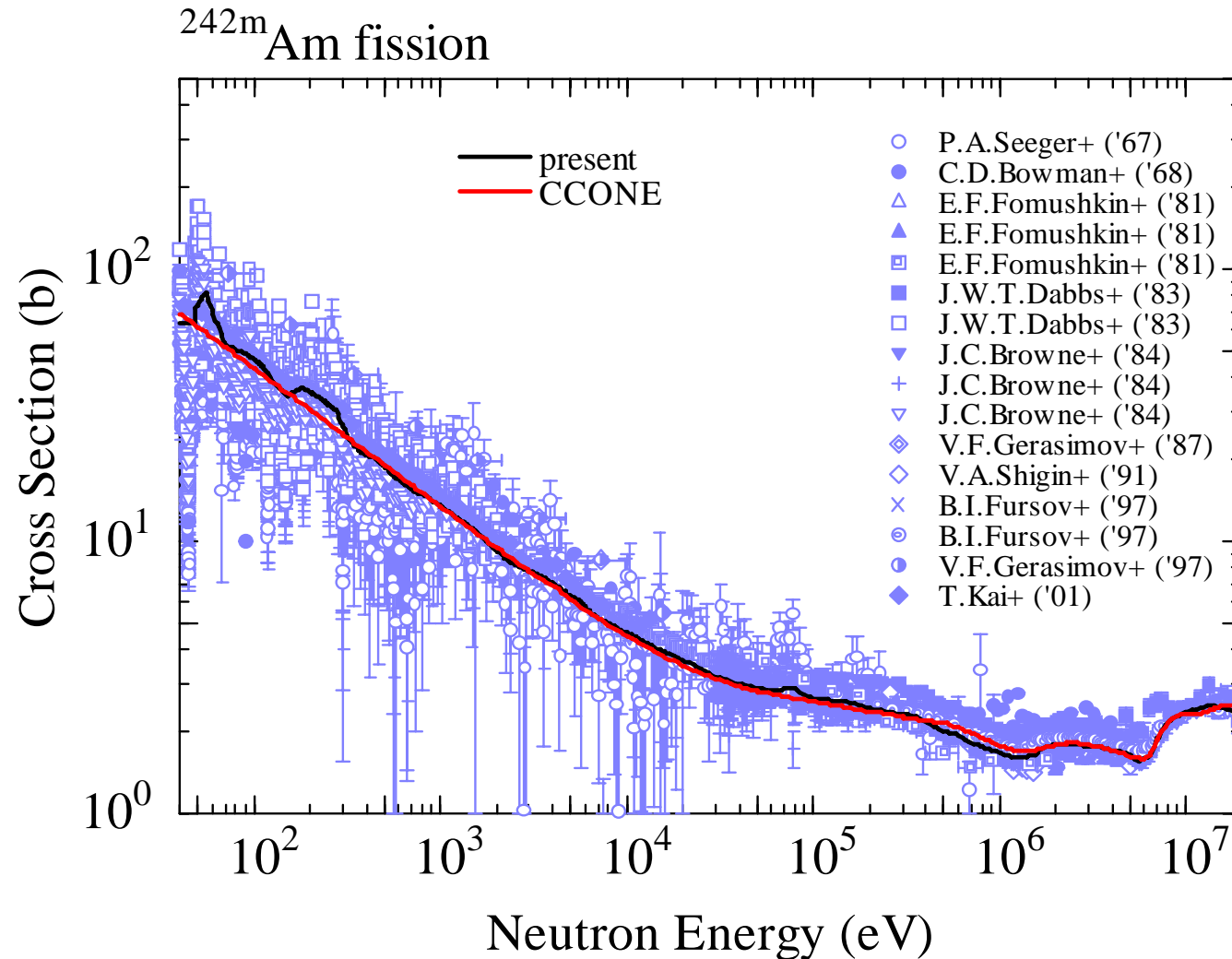
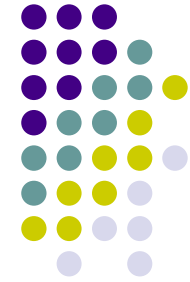
- **CCONE code**

Developed by O. Iwamoto (*Nuclear Data Center, JAEA*).

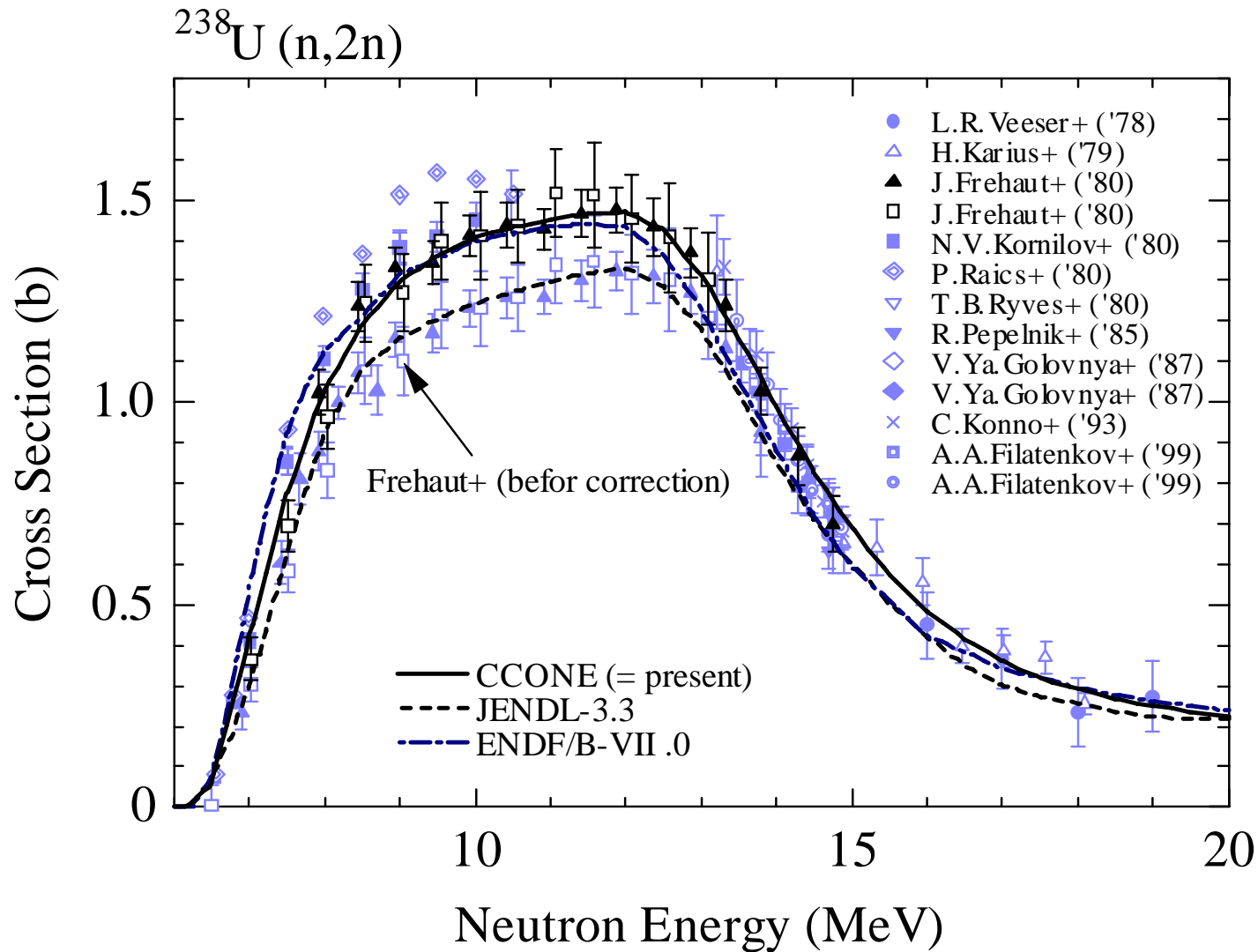
Based on coupled channel optical model, DWBA, pre-equilibrium exciton model, statistical model.

- ✓ Fission cross section can be calculated.
- ✓ Programming language: C++

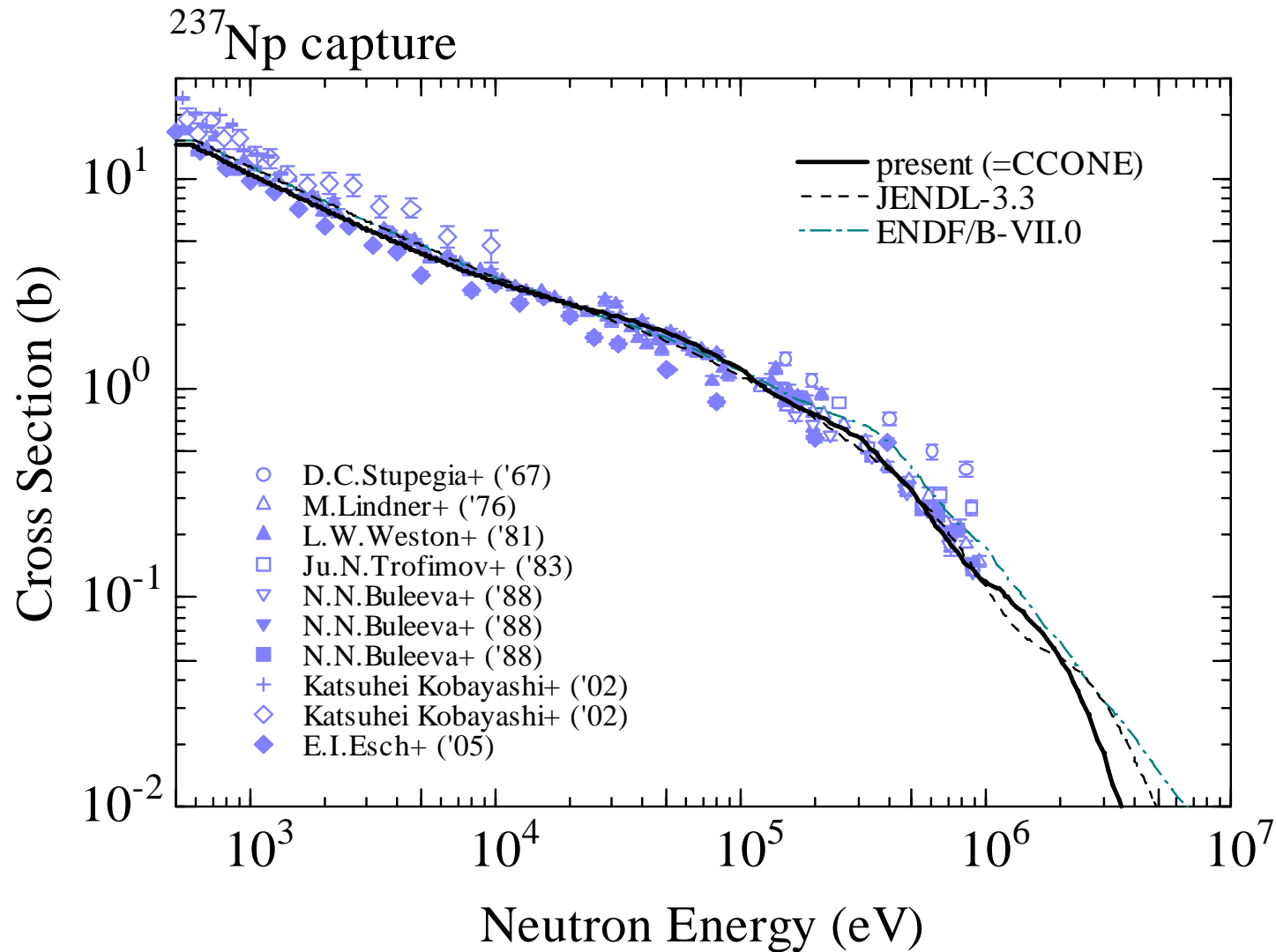
Fission Cross Sections calculated with CCONE Code



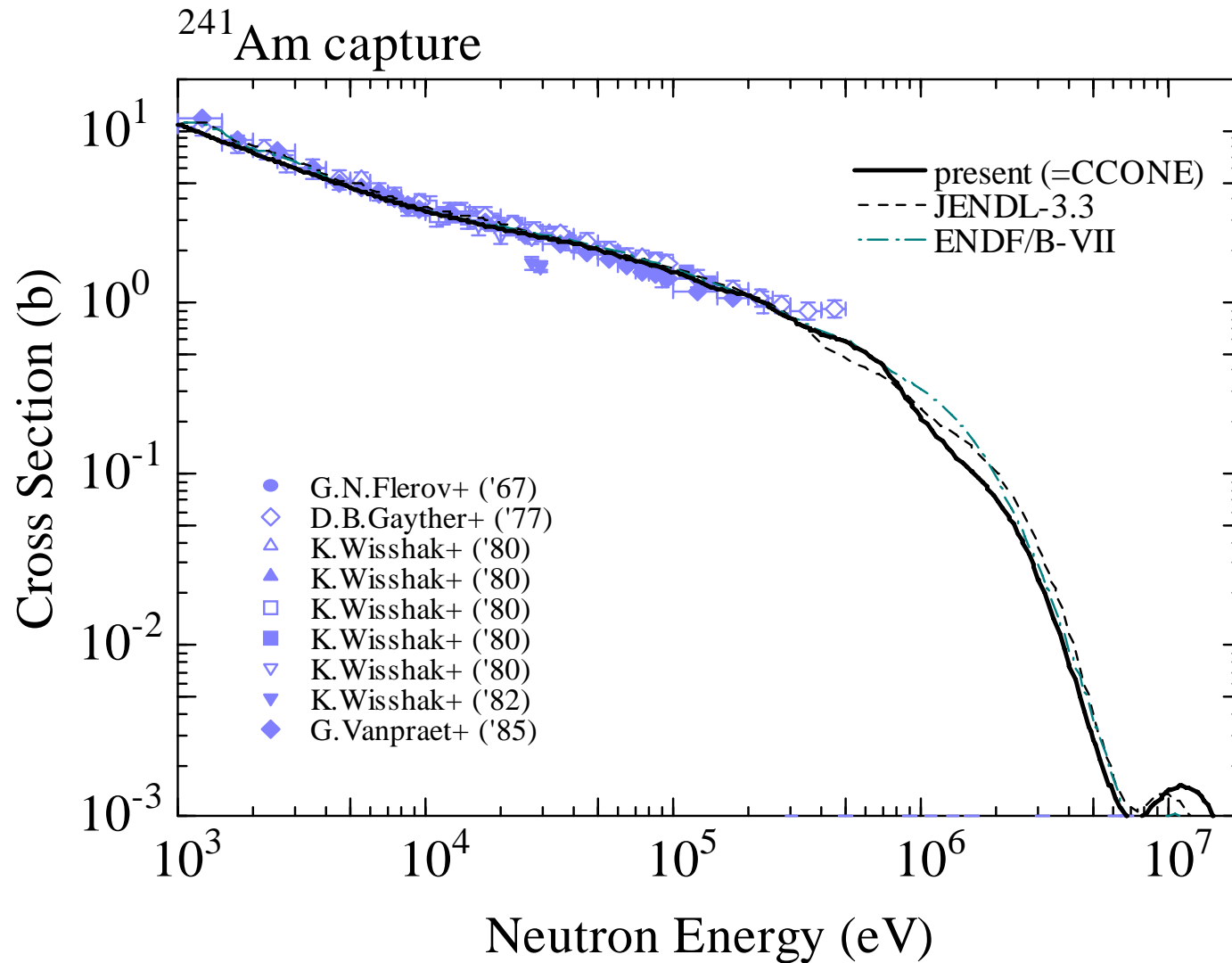
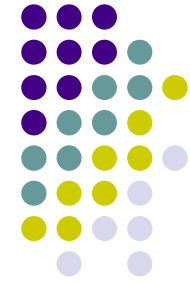
$^{238}\text{U}(n,2n)$ Cross Section



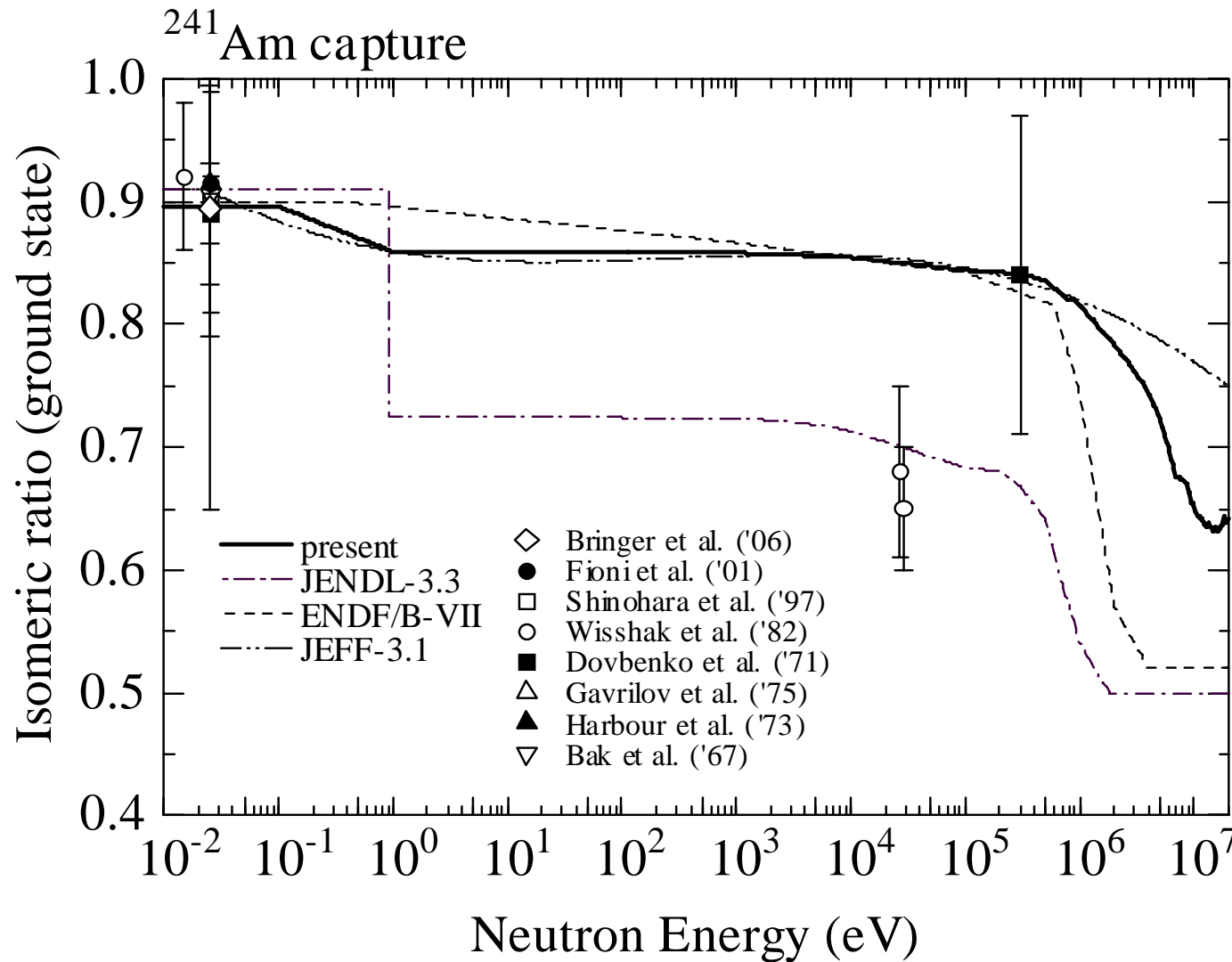
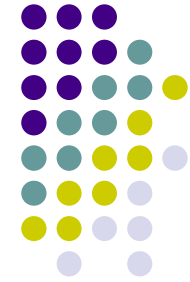
^{237}Np Capture Cross Section



^{241}Am Capture Cross Section



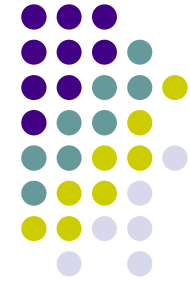
Isomeric Ratio of ^{241}Am Capture Cross Section



present IR

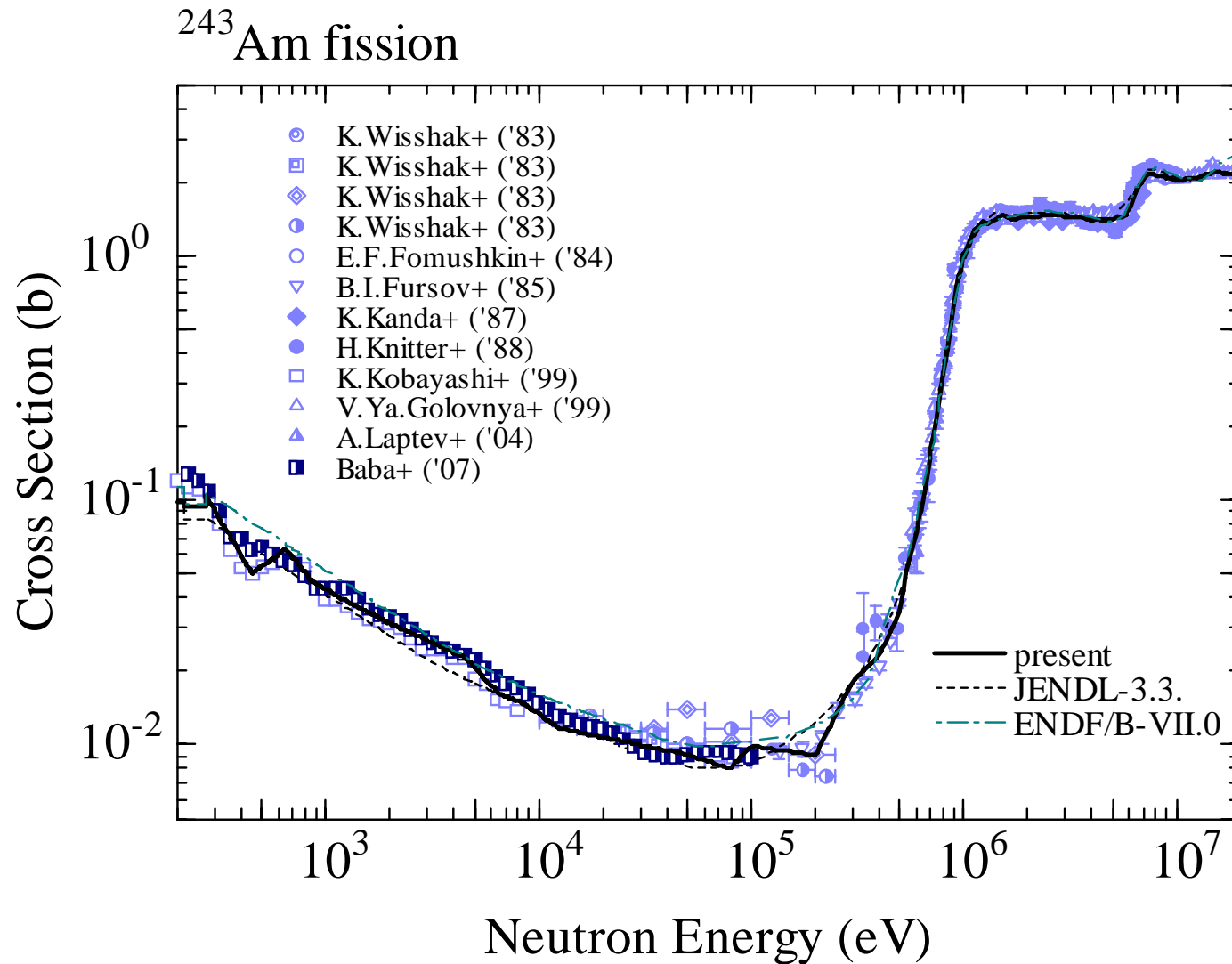
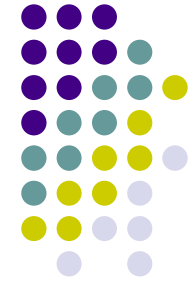
| | |
|-----|-------|
| FBR | 0.850 |
| PWR | 0.878 |
| BWR | 0.884 |

Fission Cross Sections

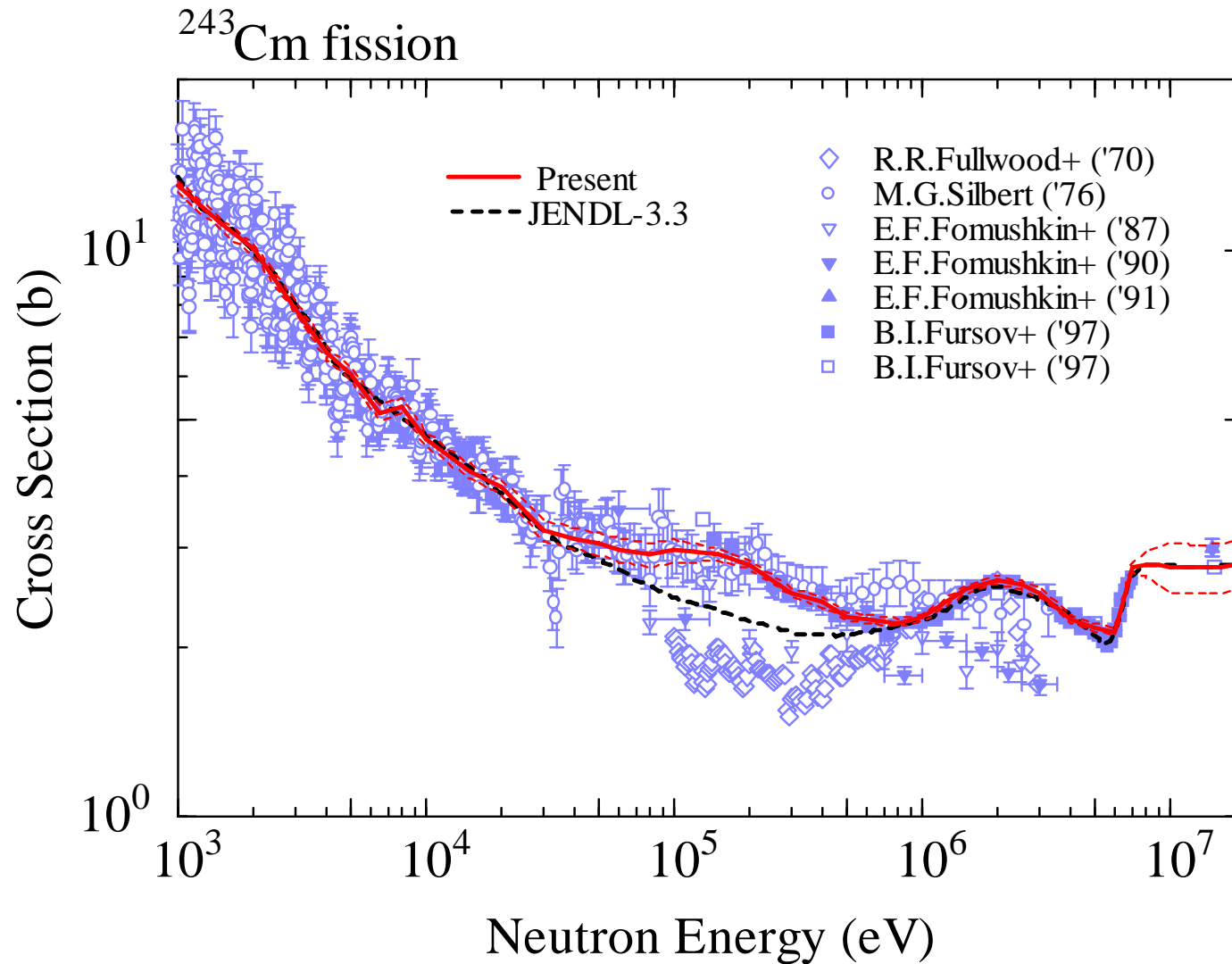


- **Evaluated with GMA code and experimental data**
GMA is a least-squares fitting code developed by Poenitz, and improved by S.Chiba et al.
- **Simultaneous Evaluation for important nuclides**

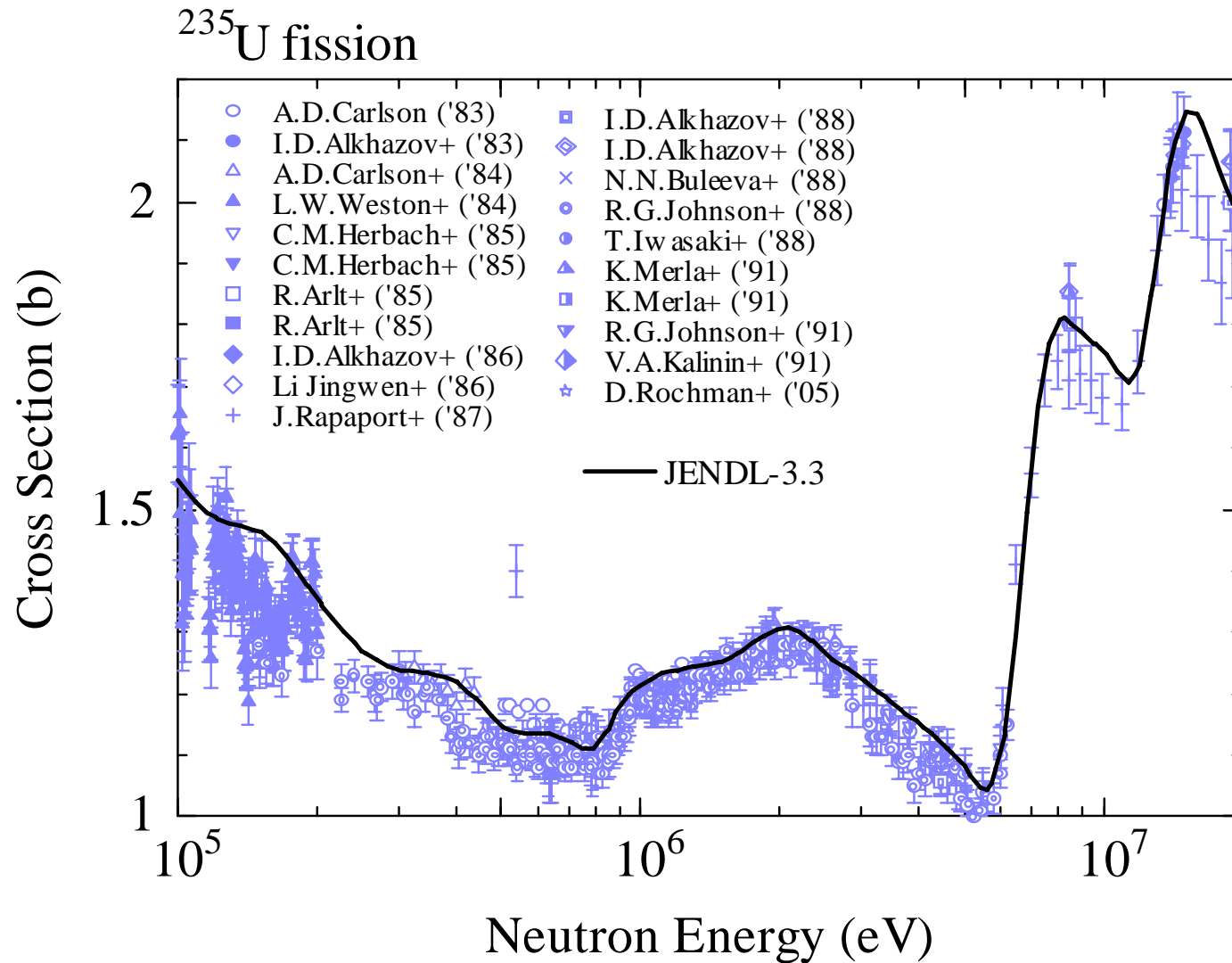
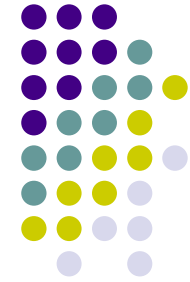
^{243}Am Fission Cross Section



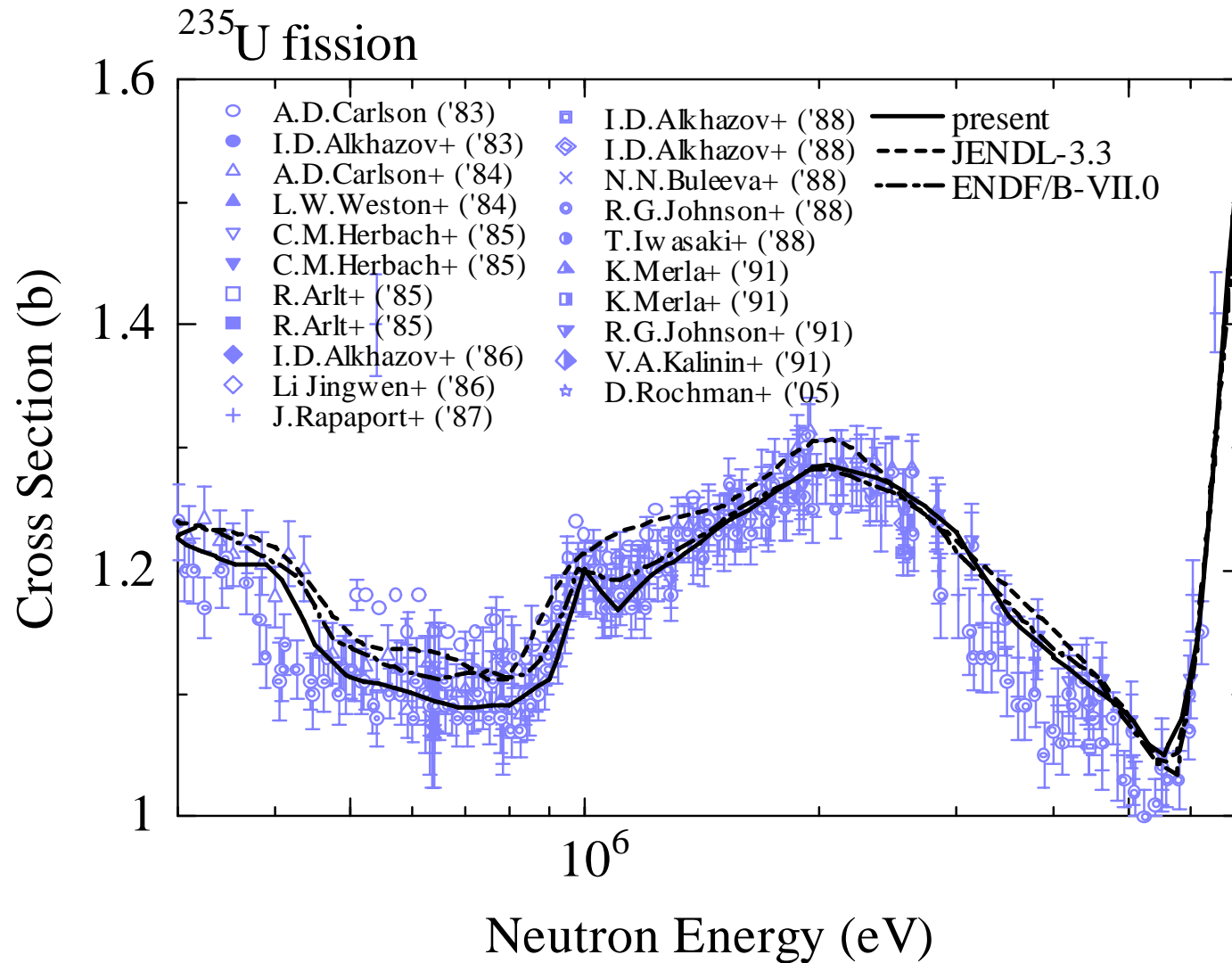
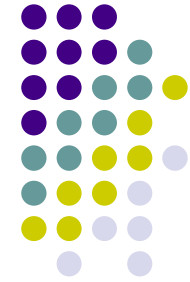
^{243}Cm Fission Cross Section



^{235}U Fission Cross Section



^{235}U Fission Cross Section

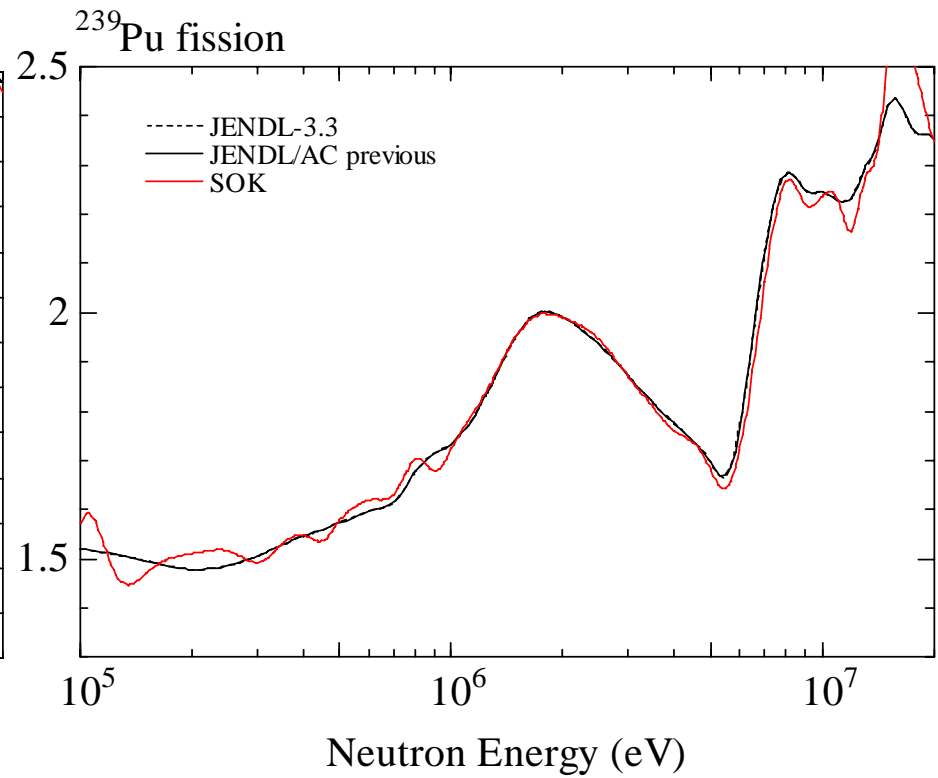
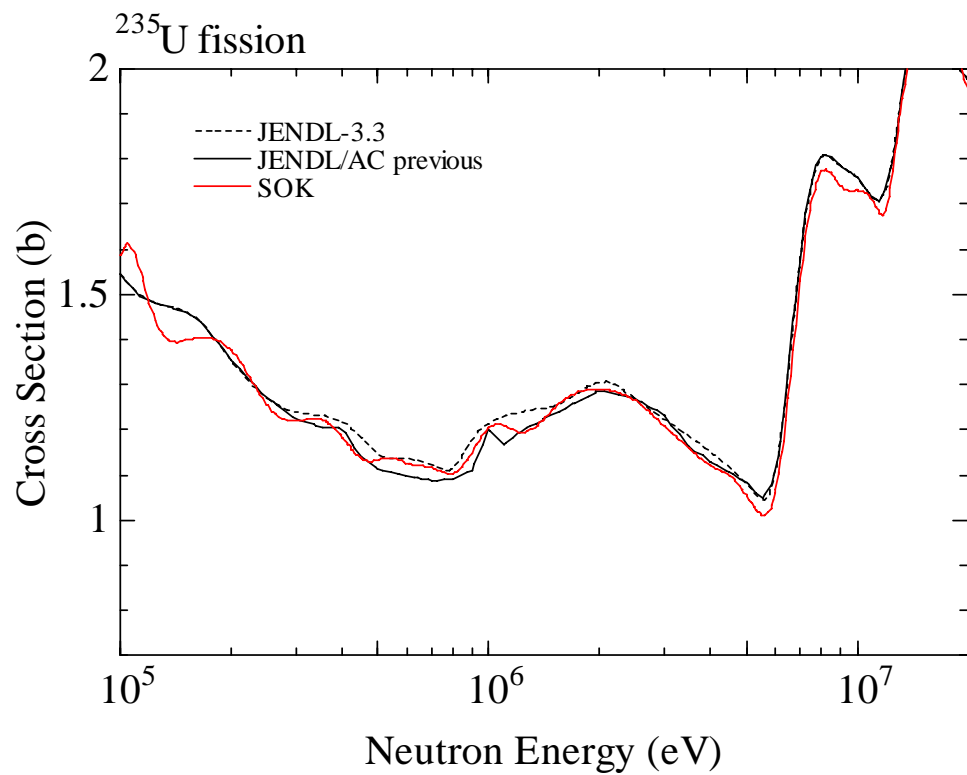


Simultaneous Evaluation of Fission Cross Sections



- **Nuclides**
U-233, U-235, U-238, Pu-239, Pu-240, Pu-241
- **Neutron energy range**
10 keV to 20 MeV
- **Code used for the evaluation**
SOK code developed by T. Kawano (LANL)

Simultaneous Evaluation of Fission Cross Sections

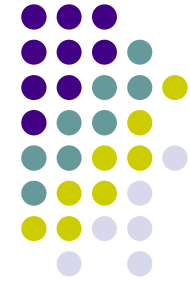


Adjustment of Model Parameters to Integral Data



- Integral data are also experimental data.
- Model parameters used in the CCONE calculation for important nuclides will be adjusted to integral data.
- Integral data: k-eff of FBR and small cores at LANL, etc.
- Preliminary adjustment was successfully done.
 - Cross-section changes were small and reasonable.
 - C/E values were considerably improved.

Summary



- JENDL/AC is under development.
- Evaluated data are given to 79 nuclides from Ac to Fm.
- Results of theoretical calculation with CCONE code are widely adopted.
- The present evaluation is based on experimental data as much as possible.
- Integral data are considered as experimental data, and model parameters of CCONE code will be adjusted to them.
- JENDL/AC will be released in FY2007.
- Covariance data will be provided for important nuclides in FY2008.