

# RESONANCE EVALUATION FOR $^{233}\text{U}$

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# Evolution of the $^{233}\text{U}$ Evaluation

- **R-Matrix evaluation done by Moore, Reich and Vogt below 12 eV;**
- **Evaluation extended up to 60 eV by Bergen and Silbert;**
- **Reynolds and Steiglitz used least squared fitting code MULTI;**
- **G. de Saussure converted the Reich-Moore parameters to Adler-Adler parameters (ENDF/B-V and ENDF/B-VI);**
- **Derrien performed SAMMY Reich-Moore evaluation up to 150 eV (JENDL);**

# $^{233}\text{U}$ Resolved Resonance Evaluation

## Features:

- Five transmission, seven fission cross section and one capture cross section data measurements were used in the evaluation.
- Evaluation performed up 600 eV with 769 resonances with 738 in the energy range analyzed and 31 external resonances.
- SAMMY: Reich-Moore formalism was used.
- **Evaluation combined differential and integral data**

## Selected Differential Measurements

Author	Energy Region Analyzed (eV)	Features
Moore et al., 1960	0.020 – 15.0	Transmission, TOF 15.7 m
Pattenden and Harvey, 1963	0.080 – 15.0	Transmission, TOF 45 m
Weston et al., 1968	1.0 – 600.0	Simultaneous Capture and Fission, TOF 25.6 m
Weston et al., 1968	0.020 – 1.0	Simultaneous Capture and Fission, TOF 25.6 m
Blons, 1973	4.0 – 600.0	Fission, TOF 50.1 m
Deruyter and Wagemans, 1974	0.020 – 15.0	Fission, TOF 8.1 m
Harvey et al., 1979	0.020 – 1.2	Transmission, TOF 17.9 m
Wagemans et al., 1988	0.002 – 1.0	Fission, TOF 8.1 m
Guber et al., 1998	0.5 – 700	Fission, TOF 80 m Temperature (two sets)
Guber et al., 1998	1.0 – 700.0	Transmission, TOF 80 m, Temperature 11 K (two sets)

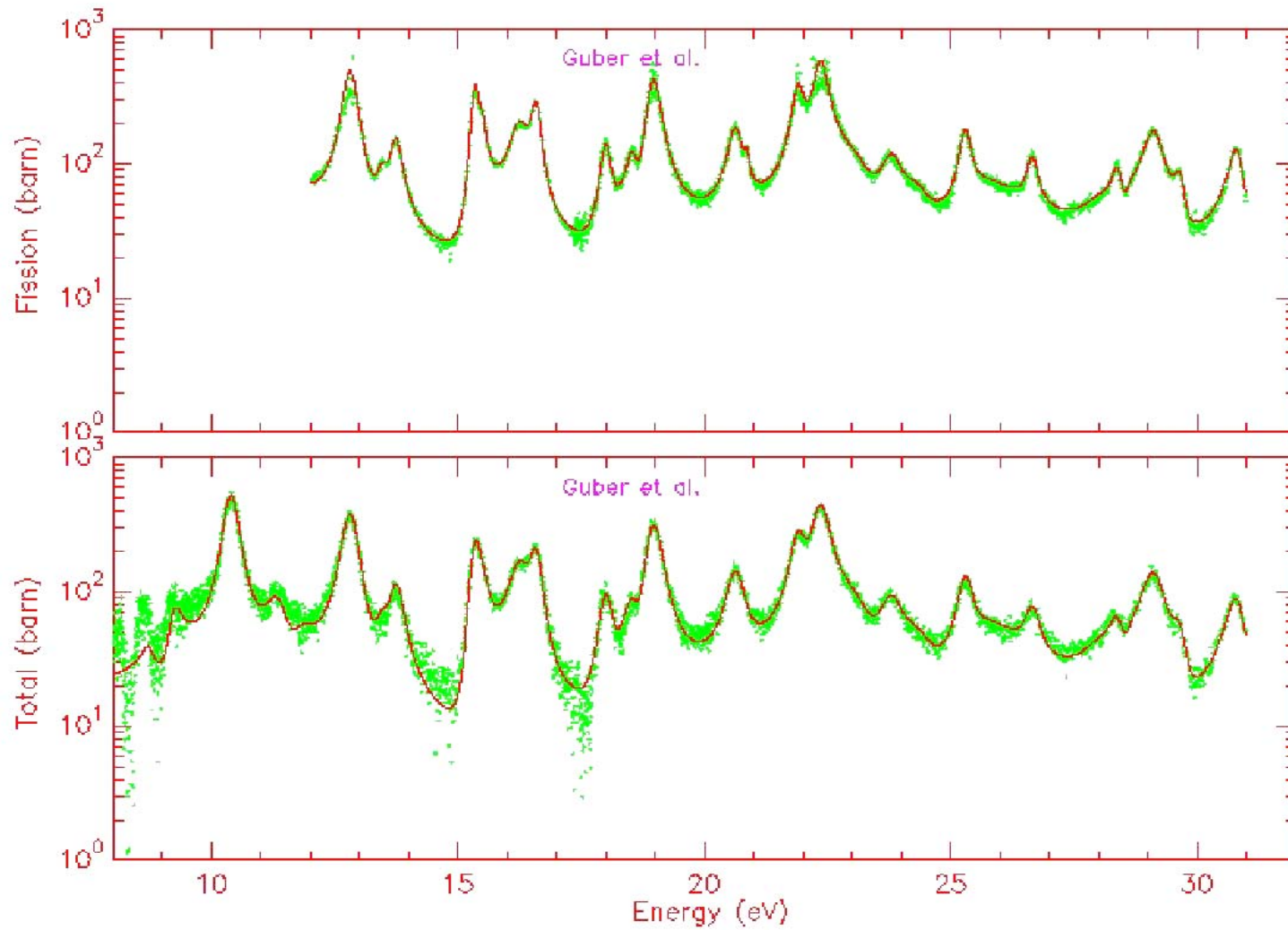
# Evaluated Integral Quantities

Quantity	ENDF/B-VI	Axton Standard	BNL
$g_a$	$0.9996 \pm 0.0011$	$0.9995 \pm 0.0011$	$0.9995 \pm 0.0011$
$g_f$	$0.9955 \pm 0.0014$	$0.9955 \pm 0.0011$	$0.99996 \pm 0.0011$
$I_a$			$897 \pm 20$
$I_f$			$760 \pm 17$
$K_1$	$742.60 \pm 2.40$	$742.25 \pm 2.37$	738

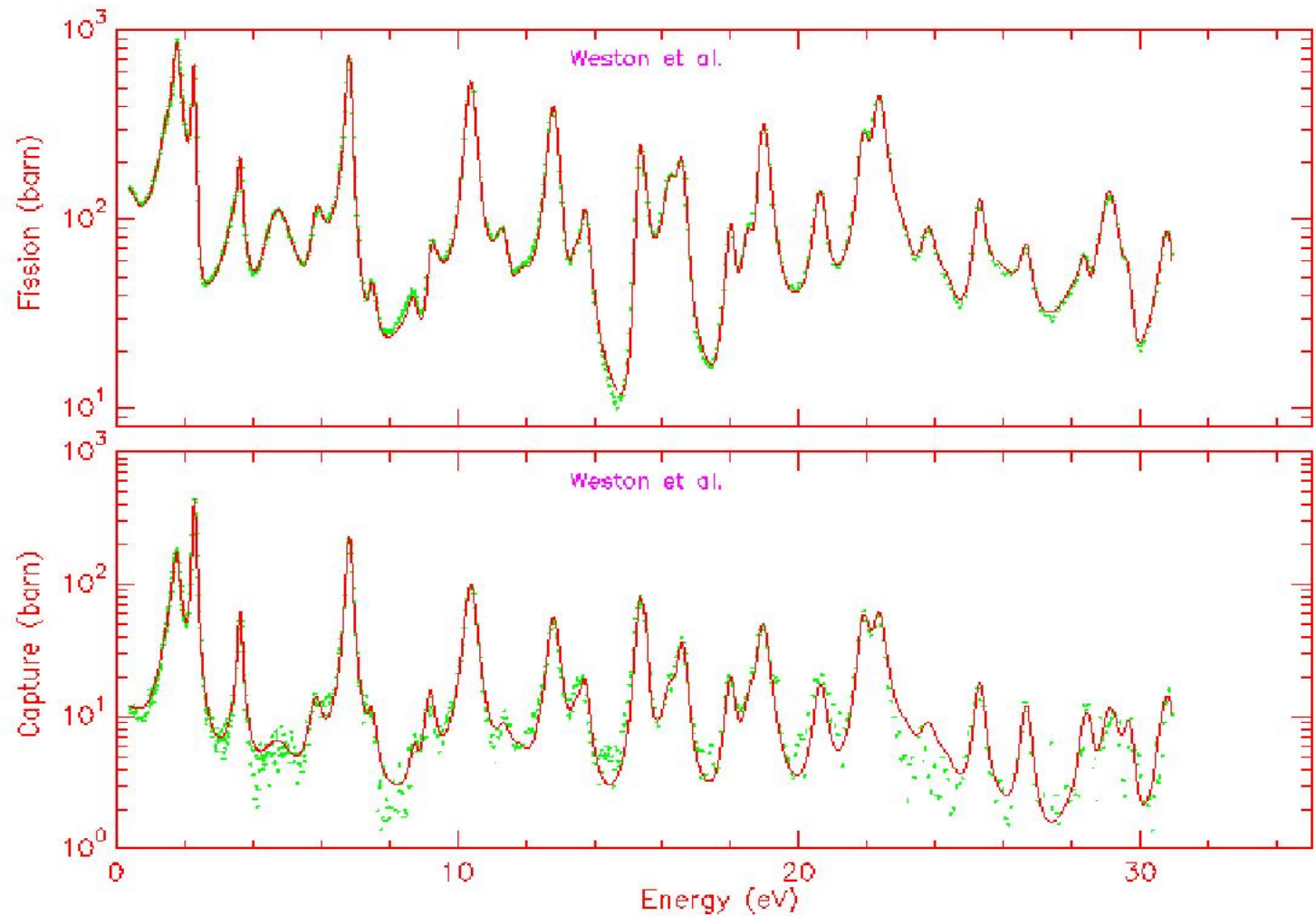
# Results of the SAMMY Analysis

- Experimental data are in green
- SAMMY fit: Solid line in red

# Total and Fission Cross Sections of Guber et al.

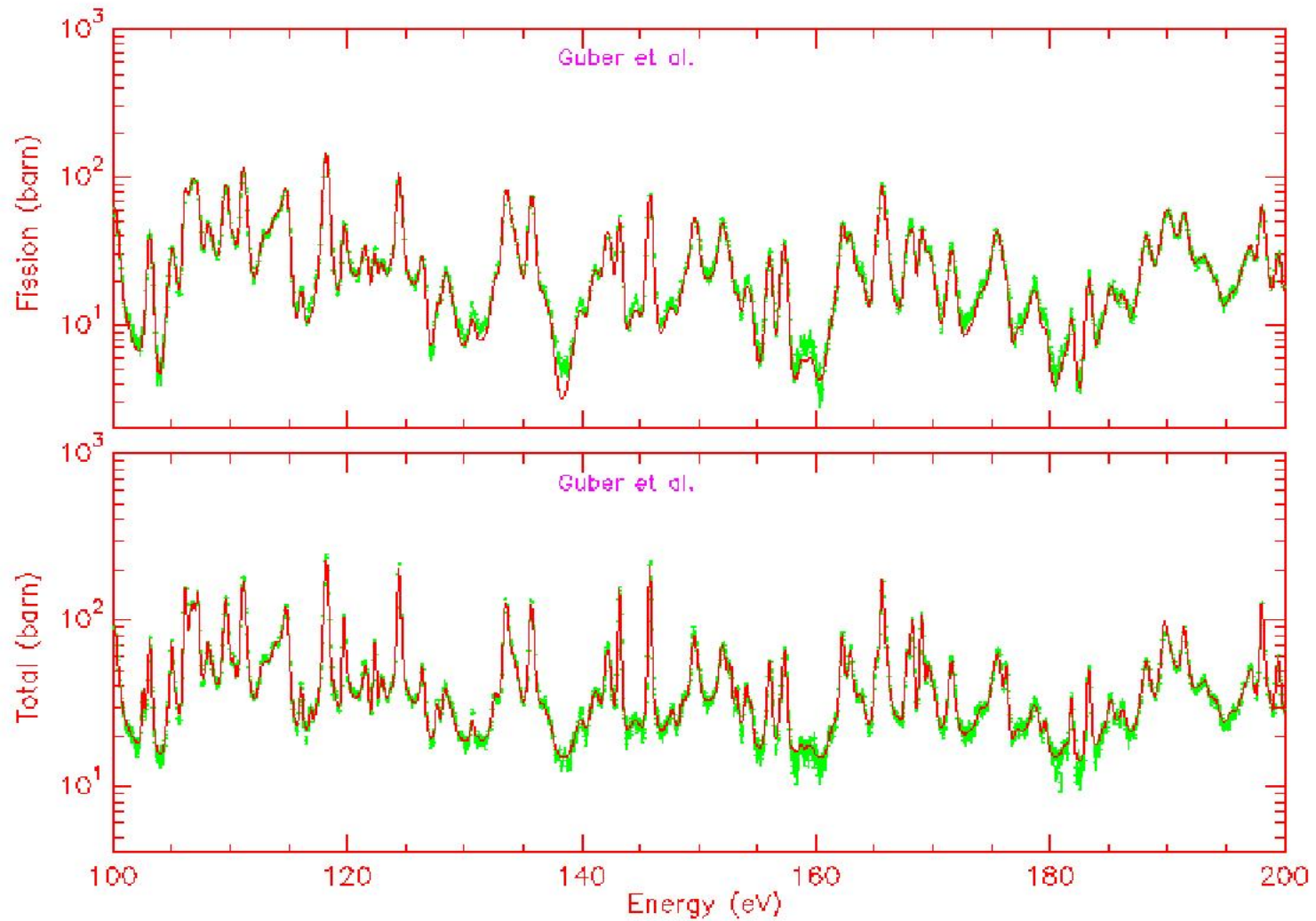


# Capture and Fission Cross Sections of Weston et al.

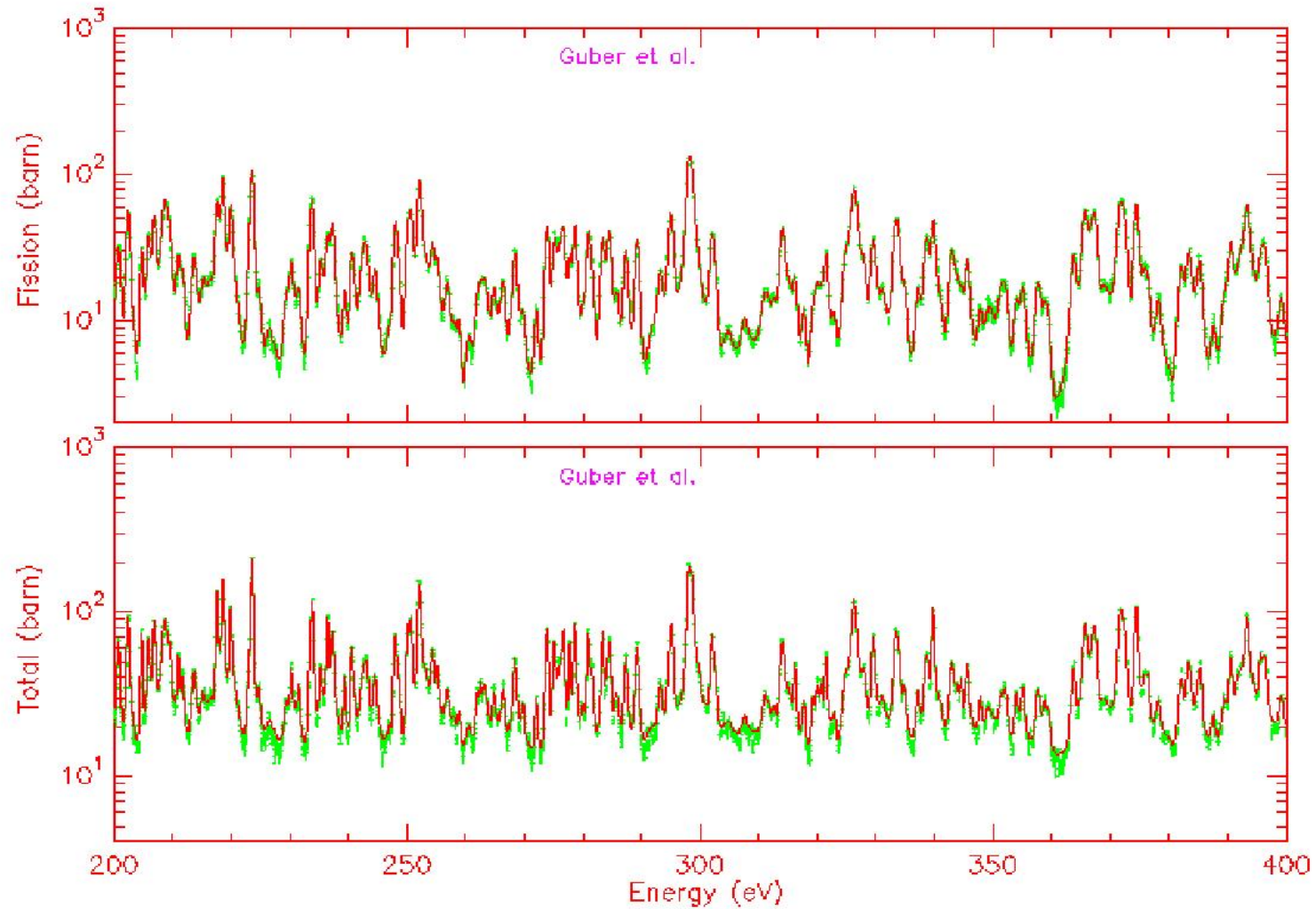




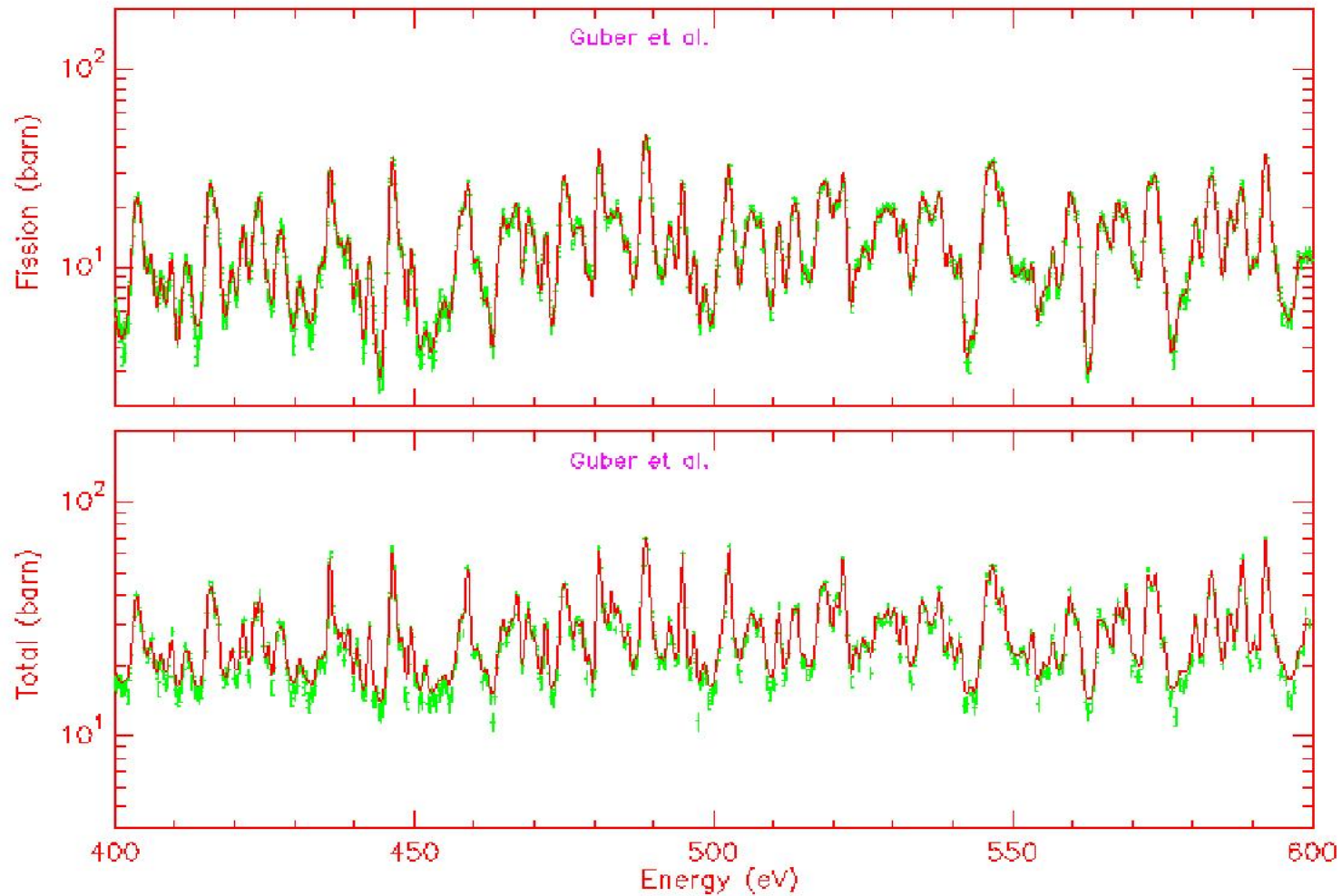
# Total and Fission Cross Sections of Guber et al.



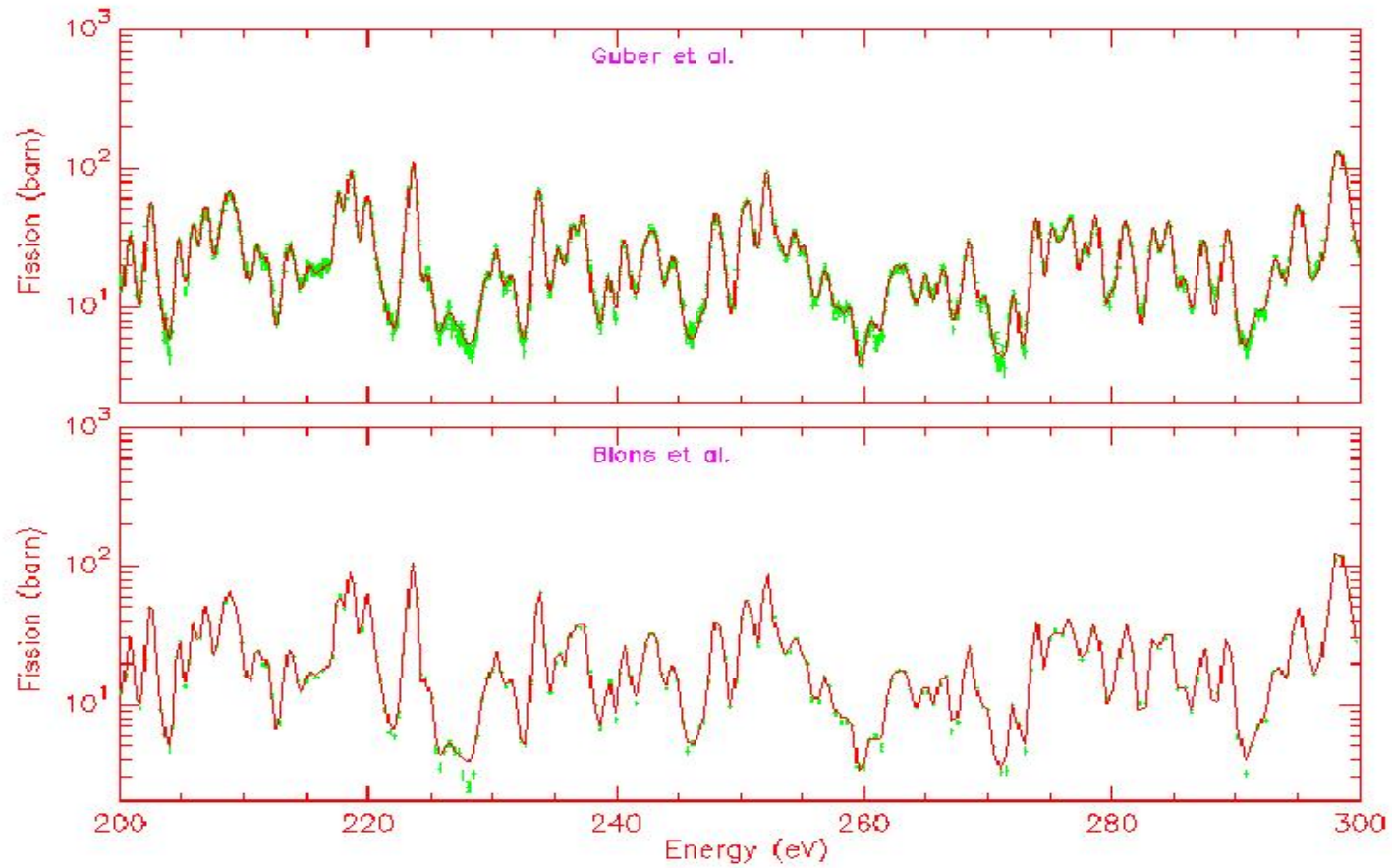
# Total and Fission Cross Sections of Guber et al.



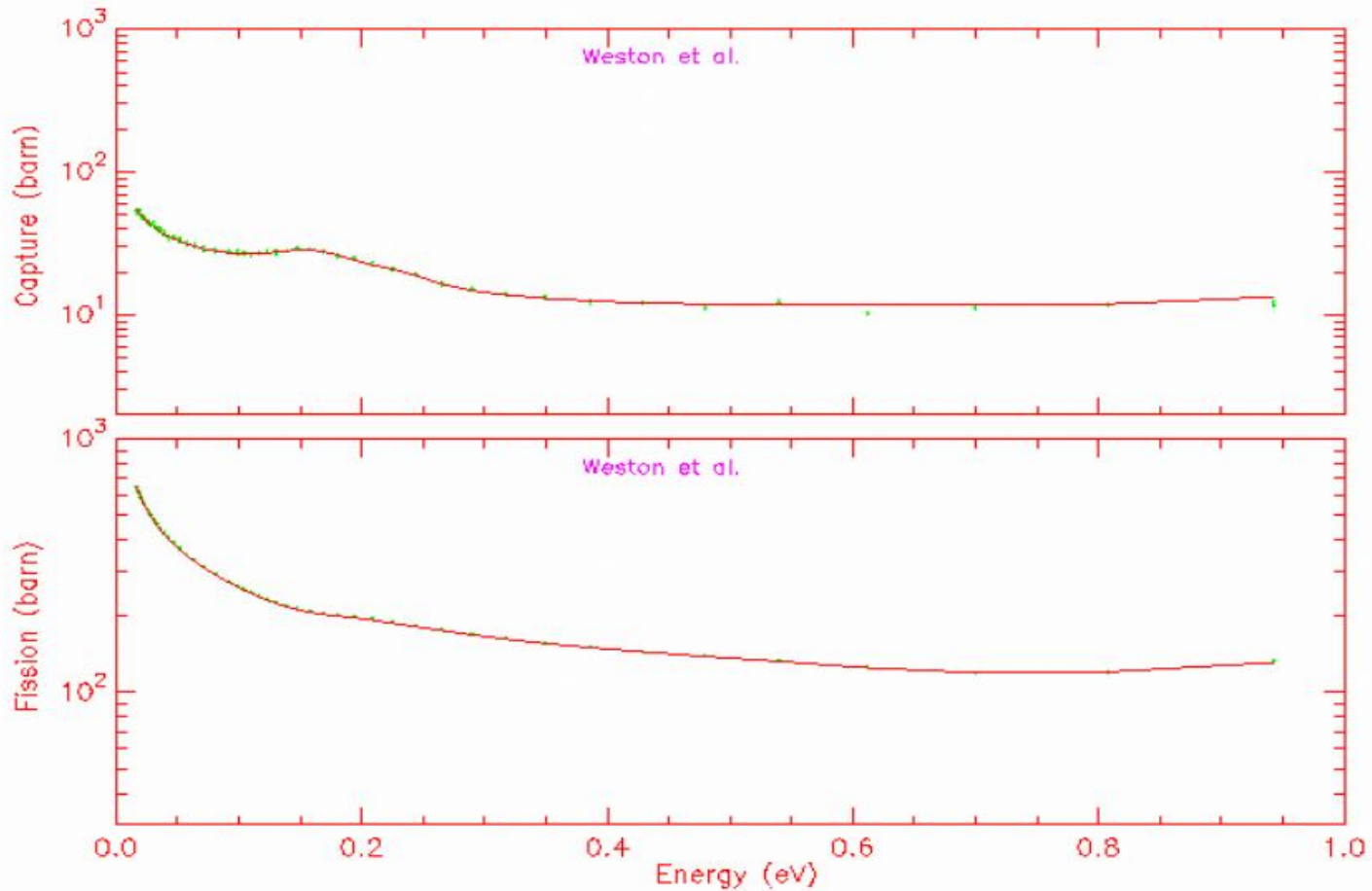
# Total and Fission Cross Sections of Guber et al.



# Fission Cross Sections of Guber et al. and Blons et al.



# Thermal Fission and Capture Cross Sections of Weston et al.



## Thermal Cross Sections (0.0253 eV)

<b>Data</b>	<b>ENDF/B-VI Standard</b>	<b>Axton Standard</b>	<b>ORNL Evaluation</b>
<b>Fission</b>	<b><math>531.14 \pm 1.33</math></b>	<b><math>530.70 \pm 1.34</math></b>	<b>530.70</b>
<b>Capture</b>	<b><math>45.51 \pm 0.68</math></b>	<b><math>45.52 \pm 0.70</math></b>	<b>45.52</b>
<b>Scattering</b>	<b><math>12.13 \pm 0.66</math></b>	<b><math>12.19 \pm 0.67</math></b>	<b>12.18</b>

# Integral Quantities

- **Westcott Factor** 
$$g_x = \frac{2}{\pi} \frac{\sigma_x}{\sigma_{0x}}$$
- **K<sub>1</sub> Factor** 
$$k_1 = \nu \sigma_{0f} g_f - \sigma_{0a} g_a$$
- **Resonance Integral** 
$$I_x = \int_{0.5 \text{ eV}}^{20 \text{ MeV}} \frac{\sigma_x}{E} dE$$
- **$\alpha$  Ratio** 
$$\alpha = \frac{I_c}{I_f}$$

# Evaluated Integral Quantities

Quantity	ENDF/B-VI	Axton Standard	BNL	ORNL
$g_a$	$0.9996 \pm 0.0011$	$0.9995 \pm 0.0011$	$0.9995 \pm 0.0011$	1.00325
$g_f$	$0.9955 \pm 0.0014$	$0.9955 \pm 0.0011$	$0.9996 \pm 0.0011$	1.00045
$I_a$			$897 \pm 20$	917.45
$I_f$			$760 \pm 17$	777.82
$K_1$	$742.60 \pm 2.40$	$742.25 \pm 2.37$	738	746.77



# Concluding Remarks

- Resonance Evaluation of  $^{233}\text{U}$  cross sections up to 600 eV has been completed;
- Evaluation performed with the Reich-Moore formalism of the code SAMMY;
- Evaluation included high resolution experimental data;

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