



Data evaluation activities at JAEA

T. Nakano
Japan Atomic Energy Agency

Personnel replacement



Representative of A&M activities at JAEA

- T. Shirai (~ 2002)
Expert of data compilation and evaluation
Passed away
- H. Kubo (~ 2006)
Promoted and transferred to Administration Department
No experience in data evaluation
- T. Nakano (2007 ~)
Experimentalist on nuclear fusion plasmas in JT-60U tokamak
No experience in data evaluation

[Review of data evaluation activities by Shirai based on his papers](#)

Japanese Evaluated A&M Data Library



JAEA Japan Atomic Energy Agency, Naka Fusion Institute
Fusion Plasma Research
Home Site Map Links
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JEAMDL

Y.Nakai, T.Shirai, T.Tabata, and R.Ito, *Cross Sections for Charge Transfer of Hydrgen Atoms and Ions Colliding with Gaseous Atoms and Molecules*, [Atomic Data and Nuclear Data Tables 37, 69 \(1987\)](#)

T.Tabata, R.Ito, Y.Nakai, T.Shirai, M.Satake, and T.Sugiura, *Analytic Cross Sections for Charge Transfer of Hydrgen Atoms and Ions Colliding with Metal Vapors*, [Nuclear Instruments and Methods in Physics Research B31, 375 \(1988\)](#)

R.K.Janev, R.A.Phanef, H.Tawara, and T.Shirai, *Recommended Cross Sections for State-Selective Electron Cappture in Collisions of C⁶⁺ and O⁸⁺ Ions with Atomic Hydrogen*, [Atomic Data and Nuclear Data Tables 55, 201 \(1993\)](#)

R.Ito, T.Tabata, T.Shirai, and R.A.Phanef, *Analytic Cross Sections for Collisions of H, H2, He and Li Atoms and Ions Colliding with Atoms and Molecules.I*, [JAERI-M 93-117 \(1993\)](#).

R.Ito, T.Tabata, T.Shirai, and R.A.Phanef, *Analytic Cross Sections for Collisions of H, H2, He and Li Atoms and Ions Colliding with Atoms and Molecules.II*, [JAERI-Data/Code 94-005 \(1994\)](#).

R.Ito, T.Tabata, T.Shirai, and R.A.Phanef, *Analytic Cross Sections for Collisions of H, H2, He and Li Atoms and Ions Colliding with Atoms and Molecules.III*, [JAERI-Data/Code 95-008 \(1995\)](#).

R.Ito, T.Tabata, T.Shirai, and R.A.Phanef, *Analytic Cross Sections for Collisions of H, H2, He and Li Atoms and Ions Colliding with Atoms and Molecules.IV*, [JAERI-Data/Code 96-024 \(1996\)](#).

T.Tabata and T.Shirai, *Analytic Cross Sections for Collisions of H⁺, H₂⁺, H₃⁺, H, H₂, and H⁻ with Hydrogen Molecules*, [Atomic Data and Nuclear Data Tables 76,1 \(2000\)](#).

T.Shirai, T.Tabata and H.Tawara, *Analytic Cross Sections for Electron Collisions with CO, CO₂, and H₂O Relevant to Edge Plasma Impurities*, [Atomic Data and Nuclear Data Tables 79, 143 \(2001\)](#). [Errata]

T.Shirai, T.Tabata, H.Tawara, Y.Itikawa, *Analytic Cross Sections for Electron Collisions with Hydrocarbons*, [Atomic Data and Nuclear Data Tables 80, 147 \(2002\)](#).

T.Tabata, T.Shirai, M.Sataka, H.Kubo, *Analytic Cross Sections for Electron Impact Collisions with Nitrogen Molecules*, [Atomic Data and Nuclear Data Tables 92, 375 \(2006\)](#). [Errata]

Evaluated

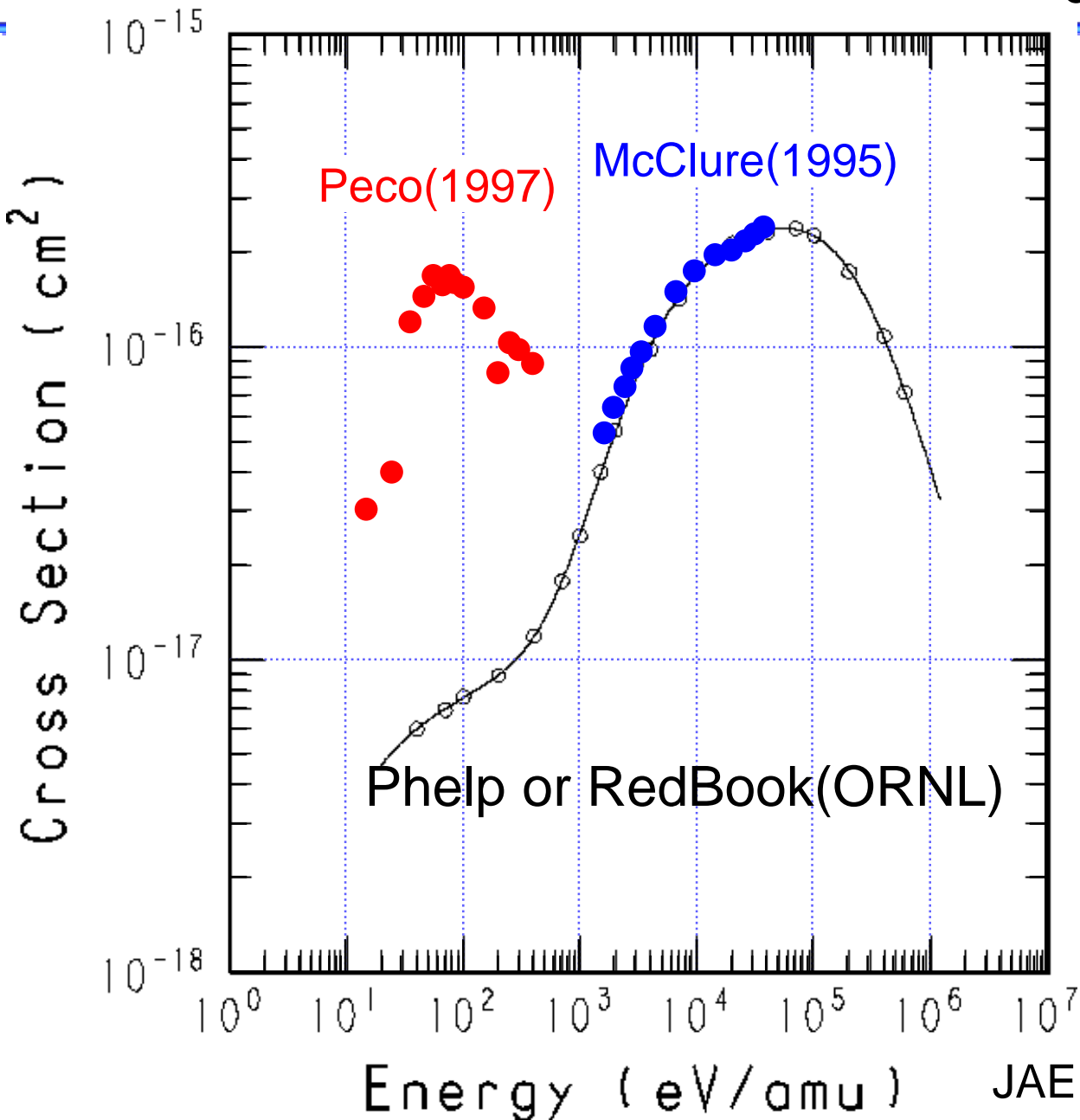
Preliminary data
Compilation
(internal report)

Evaluated

Evaluated

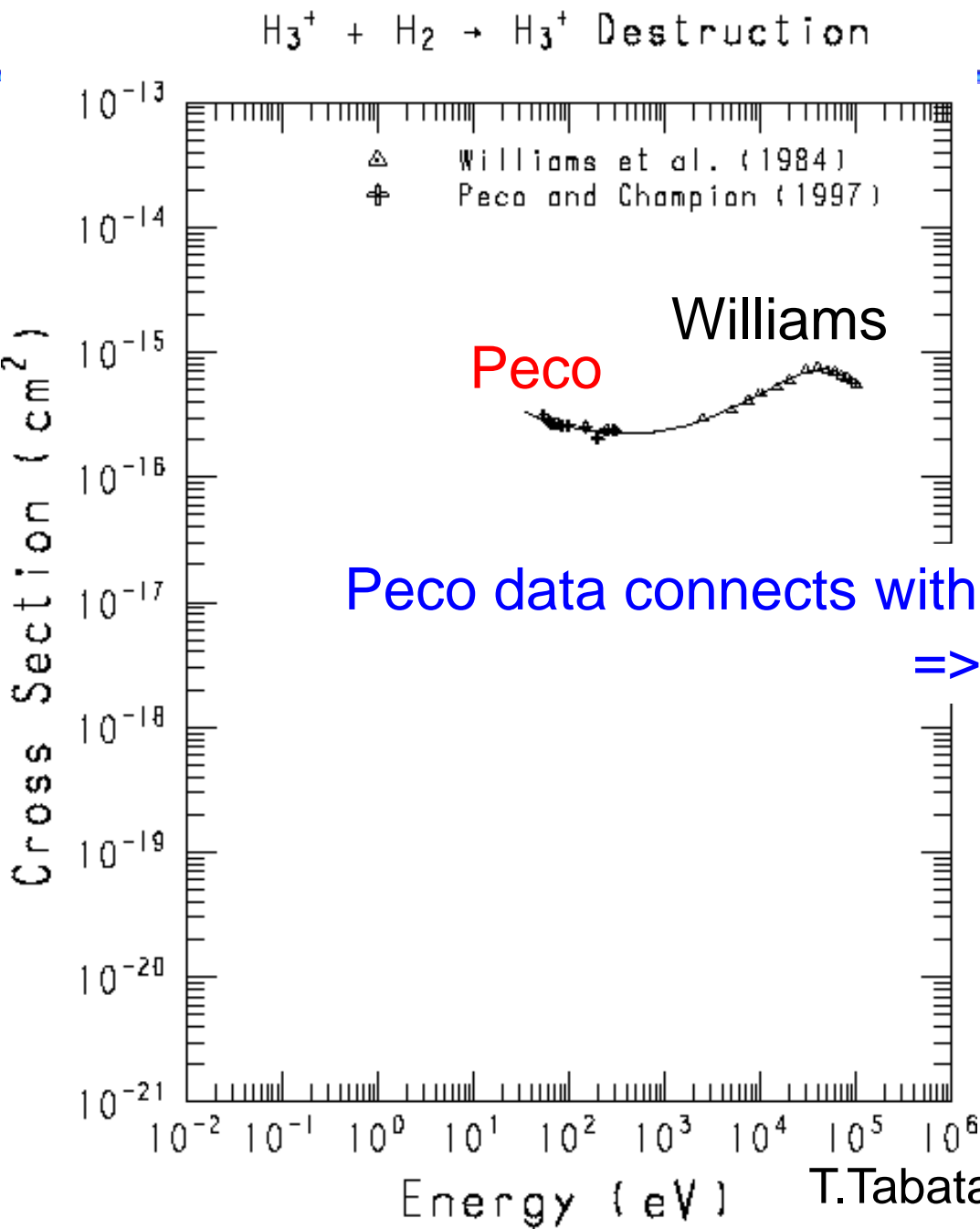


Evaluation of
experimental data



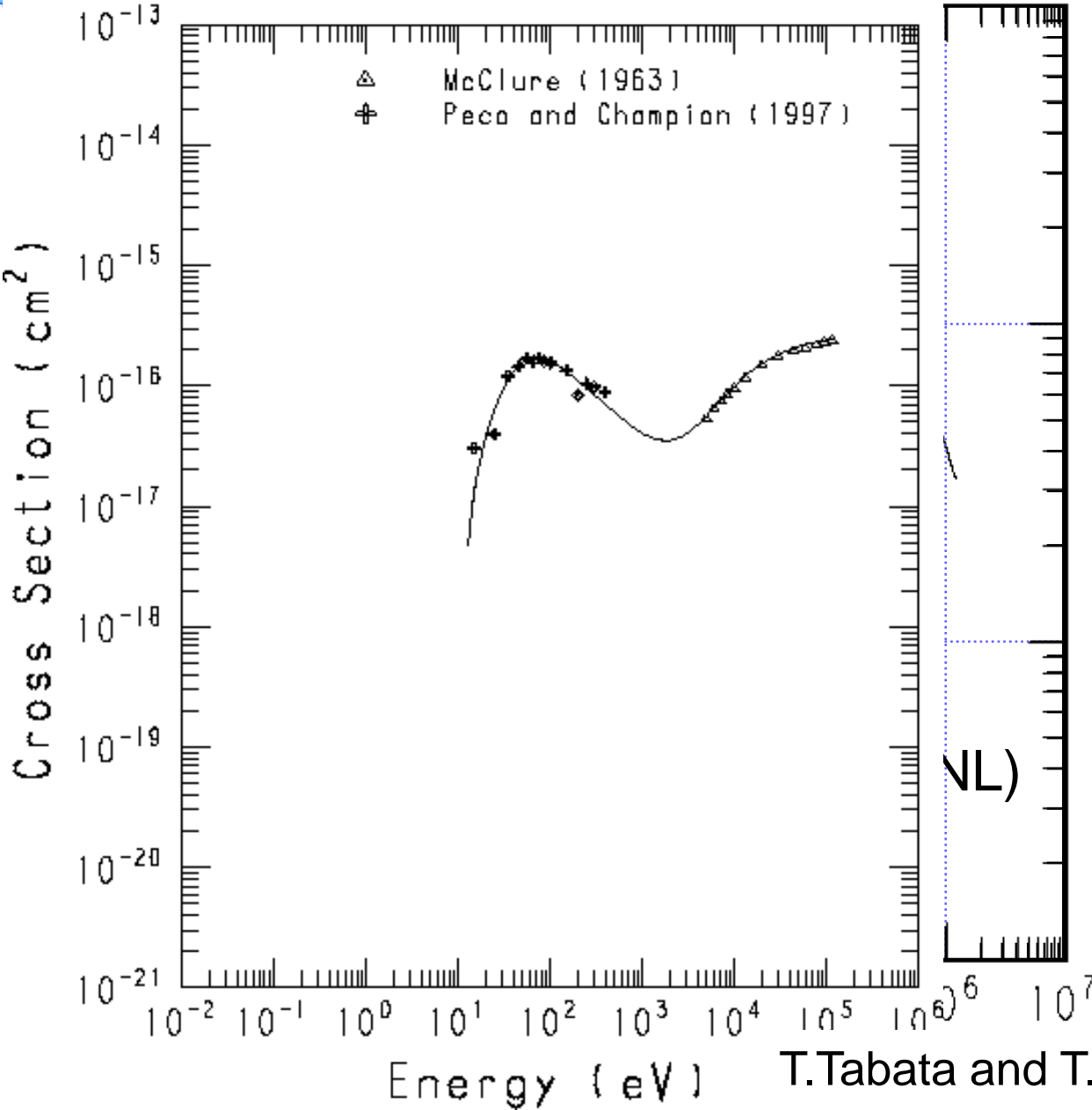
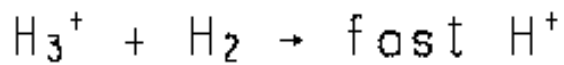
Significant difference
at low energy
=> Which to choose?

Evaluation of experimental data



The same collision system
but different products

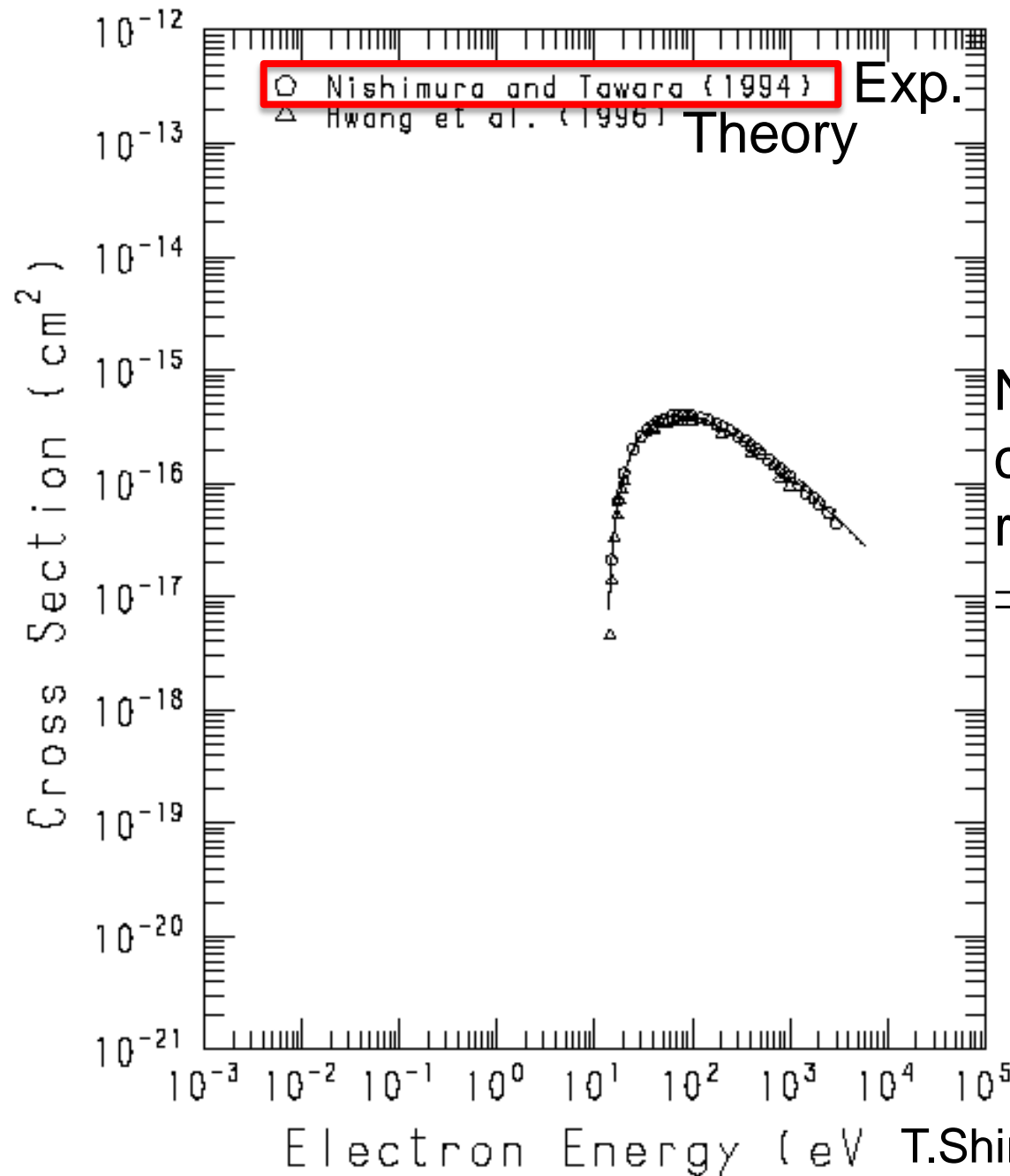
Peco data connects with another data smoothly
 \Rightarrow Peco data is preferred



Significant difference
at low energy
 \Rightarrow Which to choose?
Peco's data

Total Ionization/ CH_4

Systematic measurement preferred



Nishimura's ionization cross section of CH_4 is reliable

$\Rightarrow \text{C}_2\text{H}_4, \text{C}_2\text{H}_6, \text{C}_3\text{H}_6, \text{C}_3\text{H}_8$ ionization cross sections are also reliable

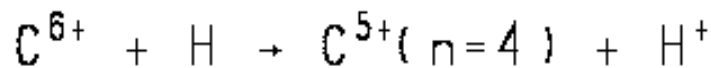
Evaluation of *theoretical* data

Criteria for theoretical partial cross-sections:

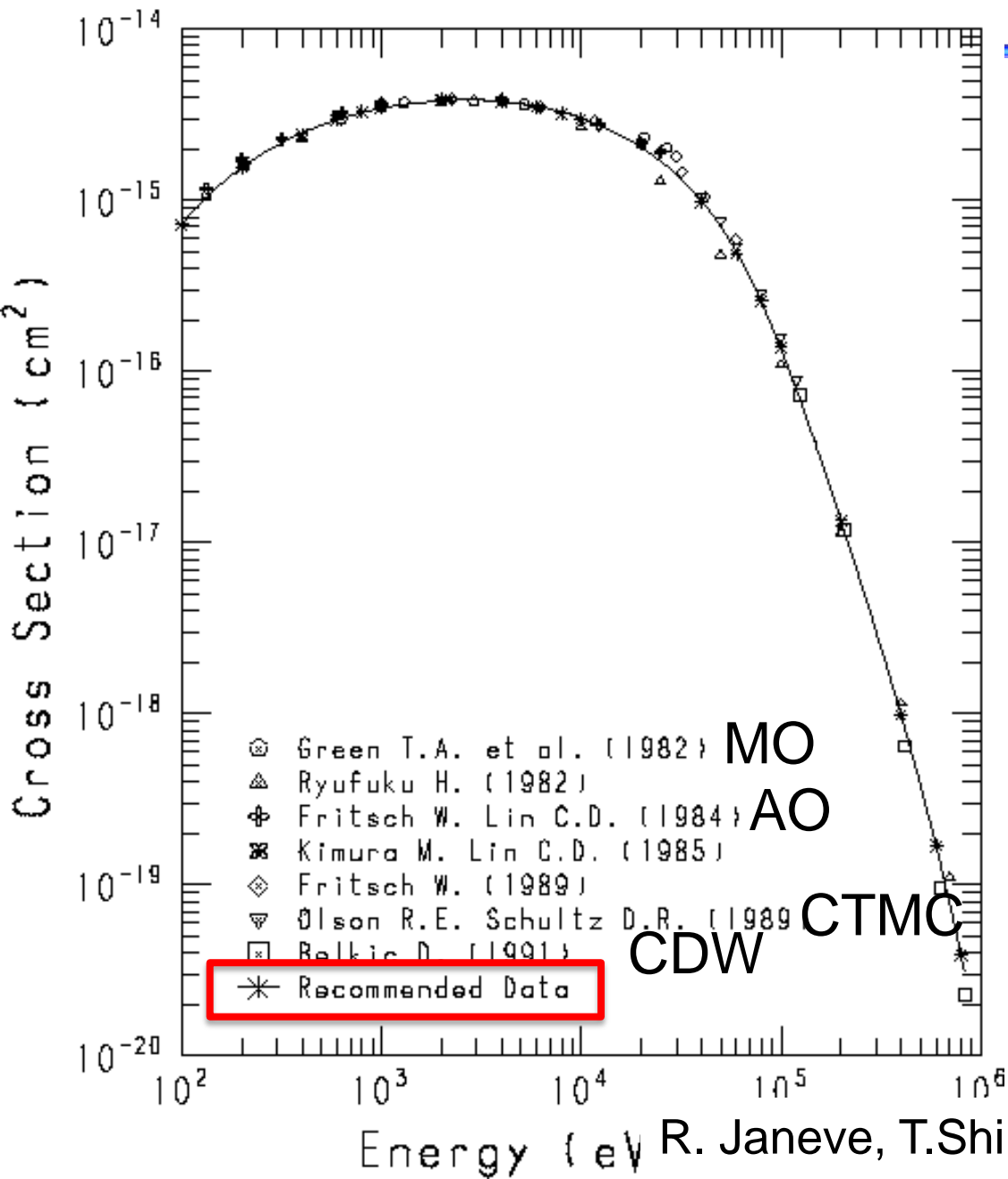
- (i) **Intrinsic validity** of the applied calculation method
- (ii) **Level of sophistication** of calculation (ex. number of states)
- (iii) **Degree of agreement** of the calculated *total* cross section with exp. data
- (iv) **Consistency** with other exp. observation

- $C^{6+} + H \Rightarrow C^{5+}(nl) + H^+$
- $O^{8+} + H \Rightarrow O^{7+}(nl) + H^+$

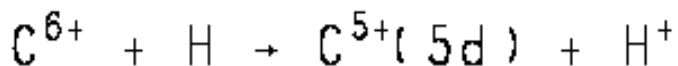
$E < 20$ keV/u	MO	} Due to criteria (ii) and (iii) agrees with each other
$20 < E < 50$ keV/u	AO	
$50 < E < 140$ keV/u	CTMC =>	agrees with CDW in 100-140 keV/u
$200 < E$	CDW =>	agrees with UDWA in > 200 keV/u



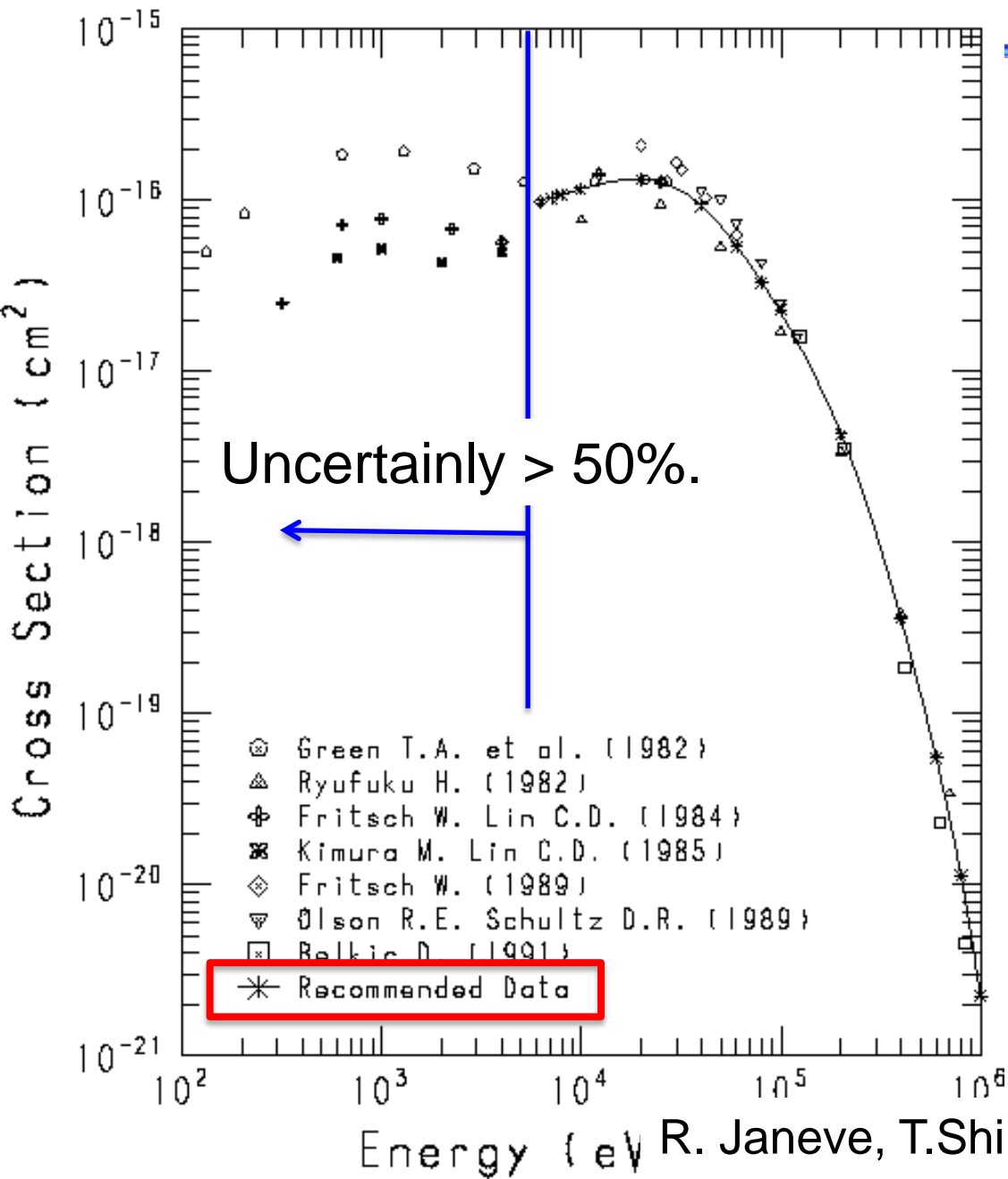
Dominant channels:
 $\text{C}^{5+}(n=4)$ production



Recommended data is provided in full energy



Non dominant channels:
 $\text{C}^{5+}(n=5)$ production



How to determine
the uncertainly is
not clear

Summary



From the survey of T. Shirai's papers, my opinion is

- **Experimental data evaluation**

Consistency between data is important

Systematic measurement is preferred

- **Theoretical data evaluation**

Level of sophistication of calculation (ex. number of states)

Degree of agreement of the calculated *total* cross section
with experimental data