Neutron Cross Section Libraries for moderator materials

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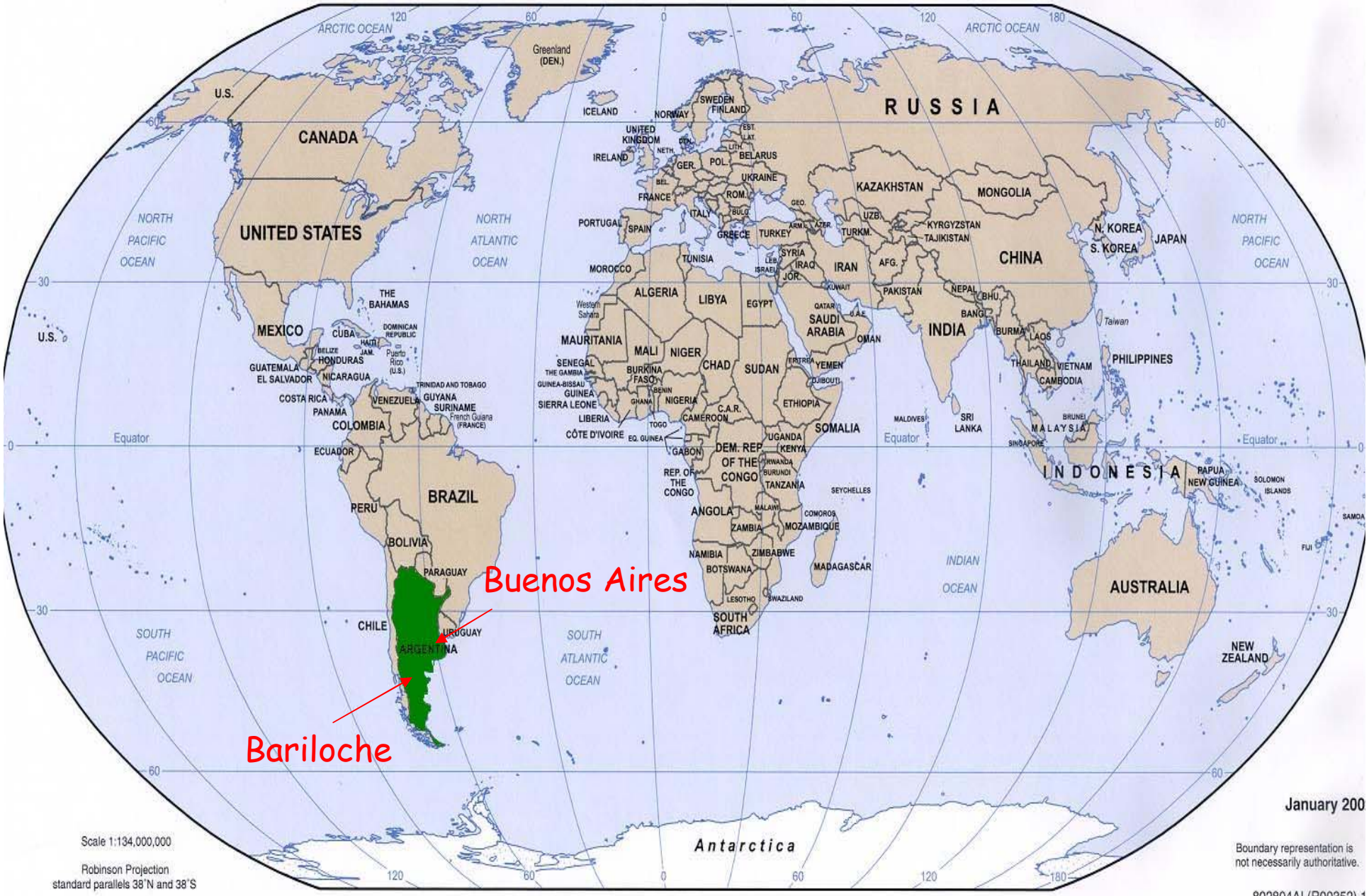
Universidad Nacional de Cuyo

ARGENTINA


Buenos Aires
Bariloche
ARCTIC OCEAN
Greenland (DEN.)
U.S.
CANADA
UNITED STATES
MEXICO
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CHINA
INDIA
BRAZIL
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PERU
BOLIVIA
PARAGUAY
URUGUAY
COLOMBIA
VENEZUELA
ECUADOR
GUYANA
SURINAME
French Guiana (FRANCE)
ALGERIA
LIBYA
EGYPT
SUDAN
CHAD
NIGERIA
ETHIOPIA
SOMALIA
KENYA
TANZANIA
ANGOLA
ZAMBIA
MOZAMBIQUE
ZIMBABWE
NAMIBIA
BOTSWANA
SOUTH AFRICA
MADAGASCAR
KAZAKHSTAN
MONGOLIA
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IRAQ
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MALAYSIA
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AUSTRALIA
NEW ZEALAND
JAPAN
N. KOREA
S. KOREA
Taiwan
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
Equator
Antarctica
Scale 1:134,000,000
Robinson Projection
standard parallels 38°N and 38°S
January 200
Boundary representation is not necessarily authoritative.
802804AI (R00352) 1


Centro Atómico Bariloche

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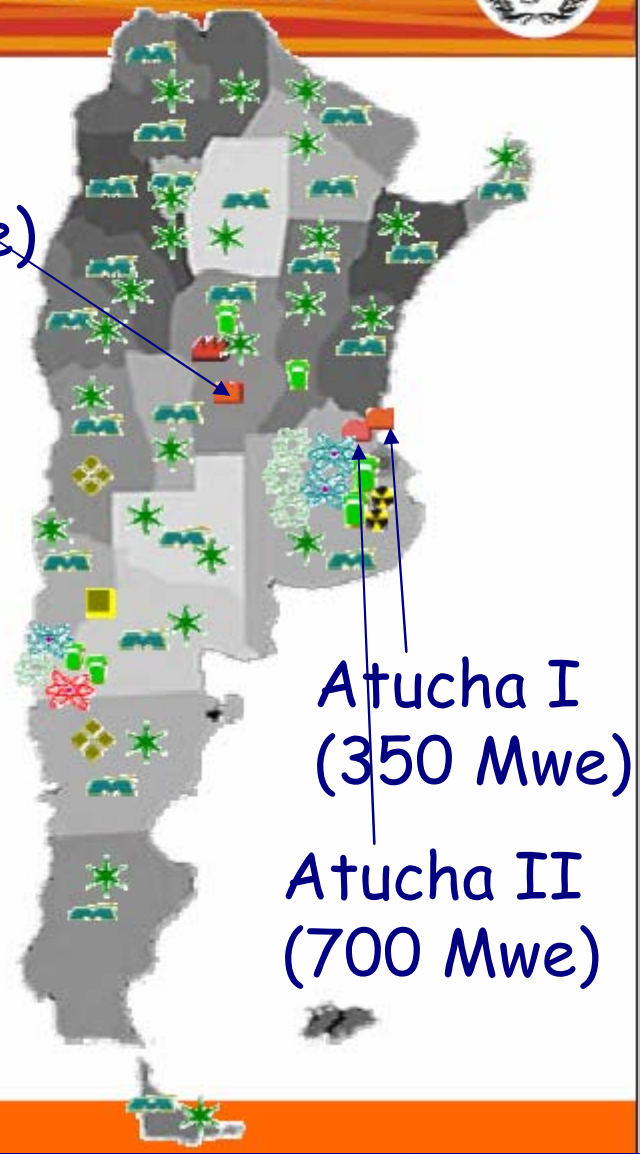
R & D in issues related to the peaceful use of nuclear energy

Geographical distribution of activities

- 2 NPP in operation
- 1 NPP in construction
- 6 Research Reactors
- 2 Irradiation Plants
- 1 Heavy Water Production Plant
- 2 Uranium Mines
- 4 Particles Accelerators
- 1 Uranium Purification Plant
- 376 Installations with Industrial Appl.
- 3 Atomic Centers
- 1 Technological Center
- **NUCLEAR MEDICINE:**
  - 3 Nuclear Medicine Schools
  - 68 Cobalt Therapy Centers
  - 57 Braquitherapy Centers
  - 309 Nuclear Medicine Centers
  - 45 Linear Accelerators for Medical Uses
  - 408 Laboratories for Radio immune Tests

Total: 1243 Radioactive Material Users



Molecular and solids structures

↓

Frequency spectra

(information about the dynamics of the scattering system)

↓

NJOY

Nuclear Data Processing System

↓

Cross Section Libraries for MCNP

(validated with total cross section measurements performed at the LINAC of Centro Atómico Bariloche using the TOF technique)

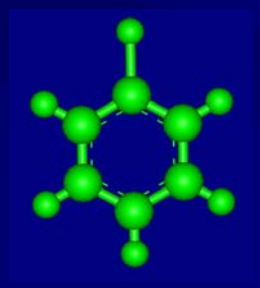
COLD MODERATORS

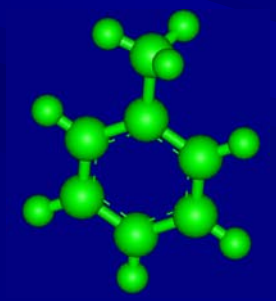
Materials studied: Methane

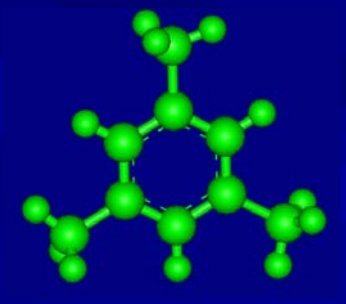
Liquid hydrogen

Light water ice

Aromatic hydrocarbons





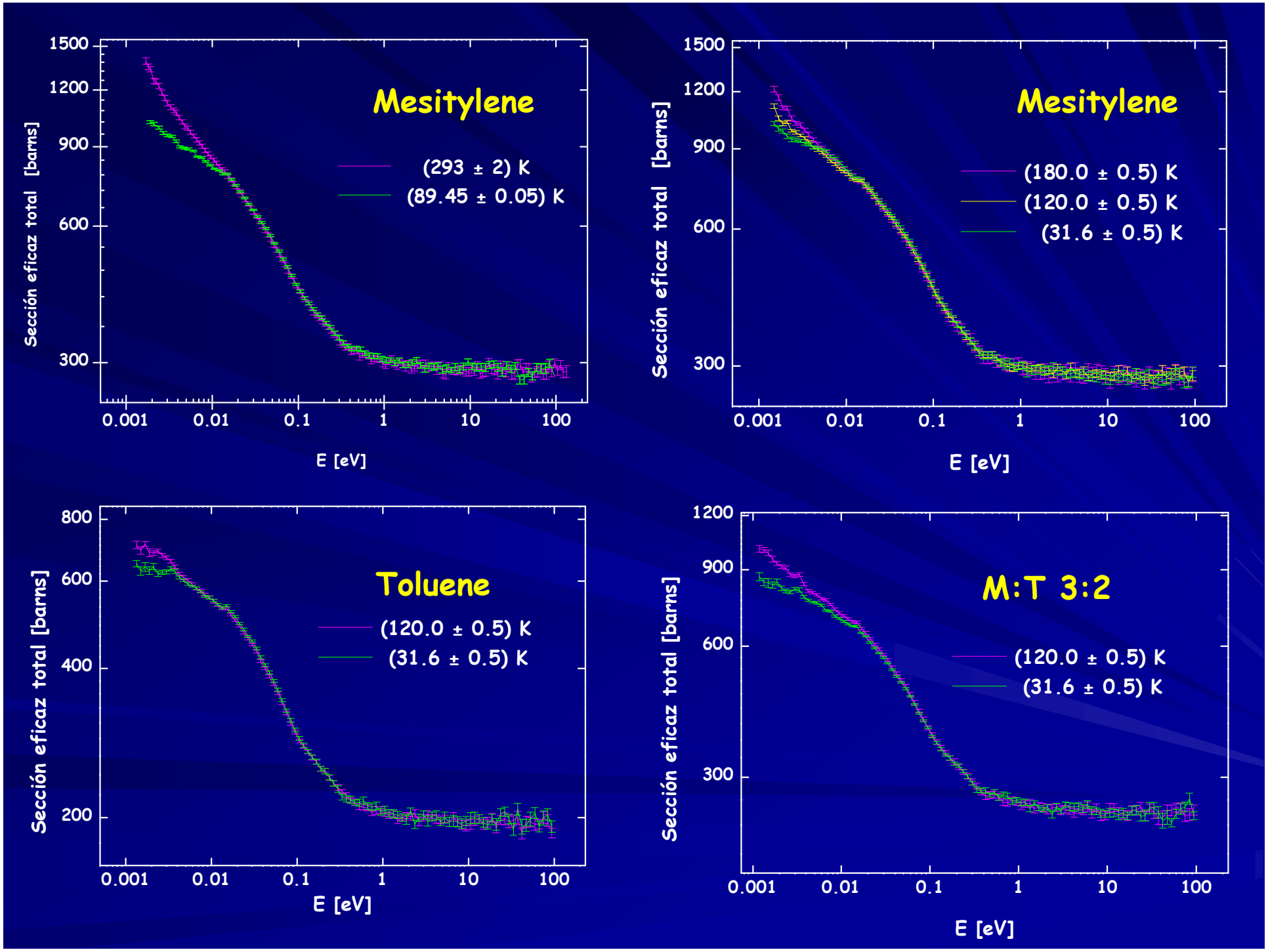


Benzene Toluene Mesitylene

Mesitylene:Toluene
3:2

25 MeV e-LINAC

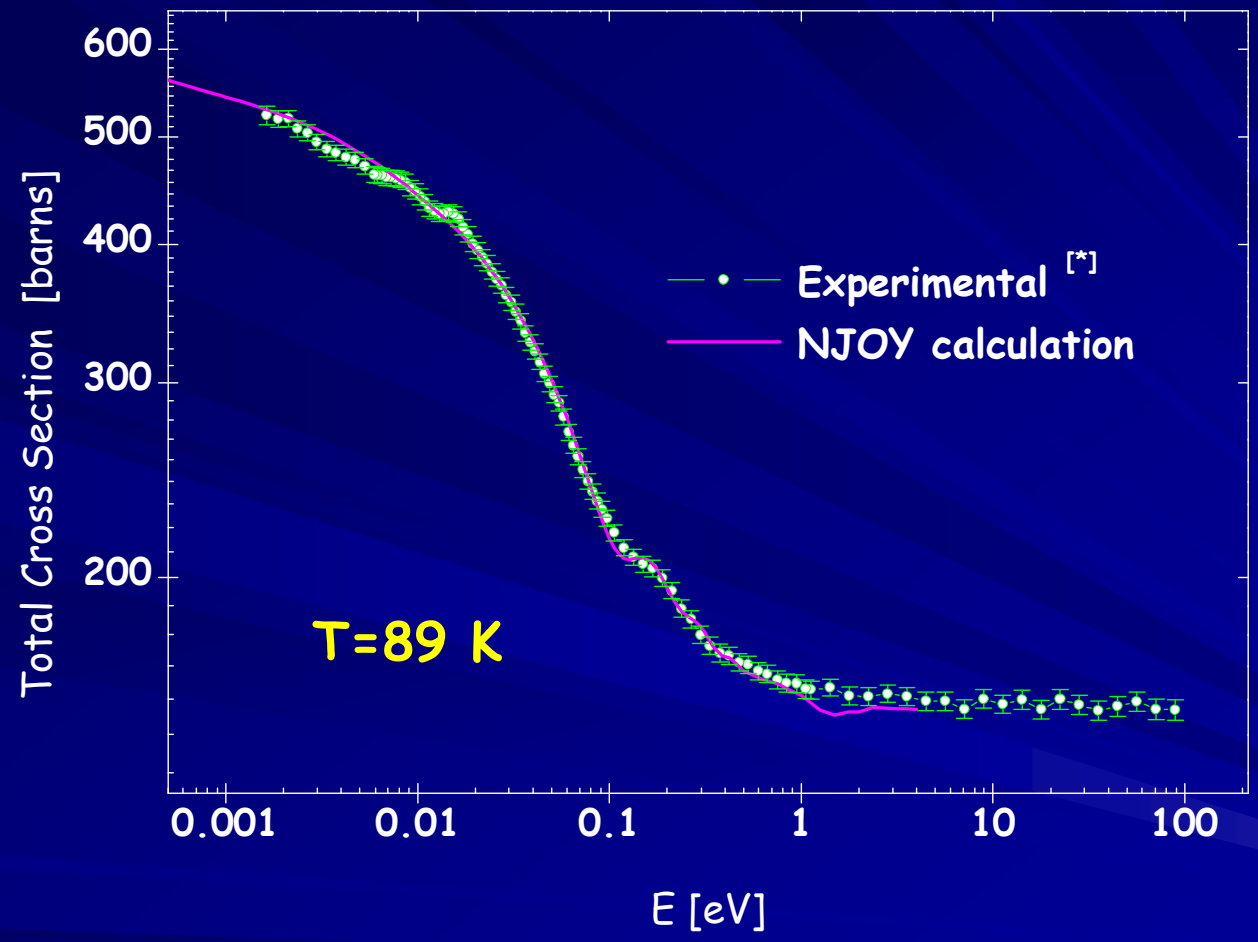

PROHIBIDO
FUMAR
PELIGRO
INFLAMABLES
01.11.2005 09:38


Mesitylene
(293 ± 2) K
(89.45 ± 0.05) K
Sección eficaz total [barns]
E [eV]
Mesitylene
(180.0 ± 0.5) K
(120.0 ± 0.5) K
(31.6 ± 0.5) K
Sección eficaz total [barns]
E [eV]
Toluene
(120.0 ± 0.5) K
(31.6 ± 0.5) K
Sección eficaz total [barns]
E [eV]
M:T 3:2
(120.0 ± 0.5) K
(31.6 ± 0.5) K
Sección eficaz total [barns]
E [eV]

CROSS SECTION LIBRARIES:

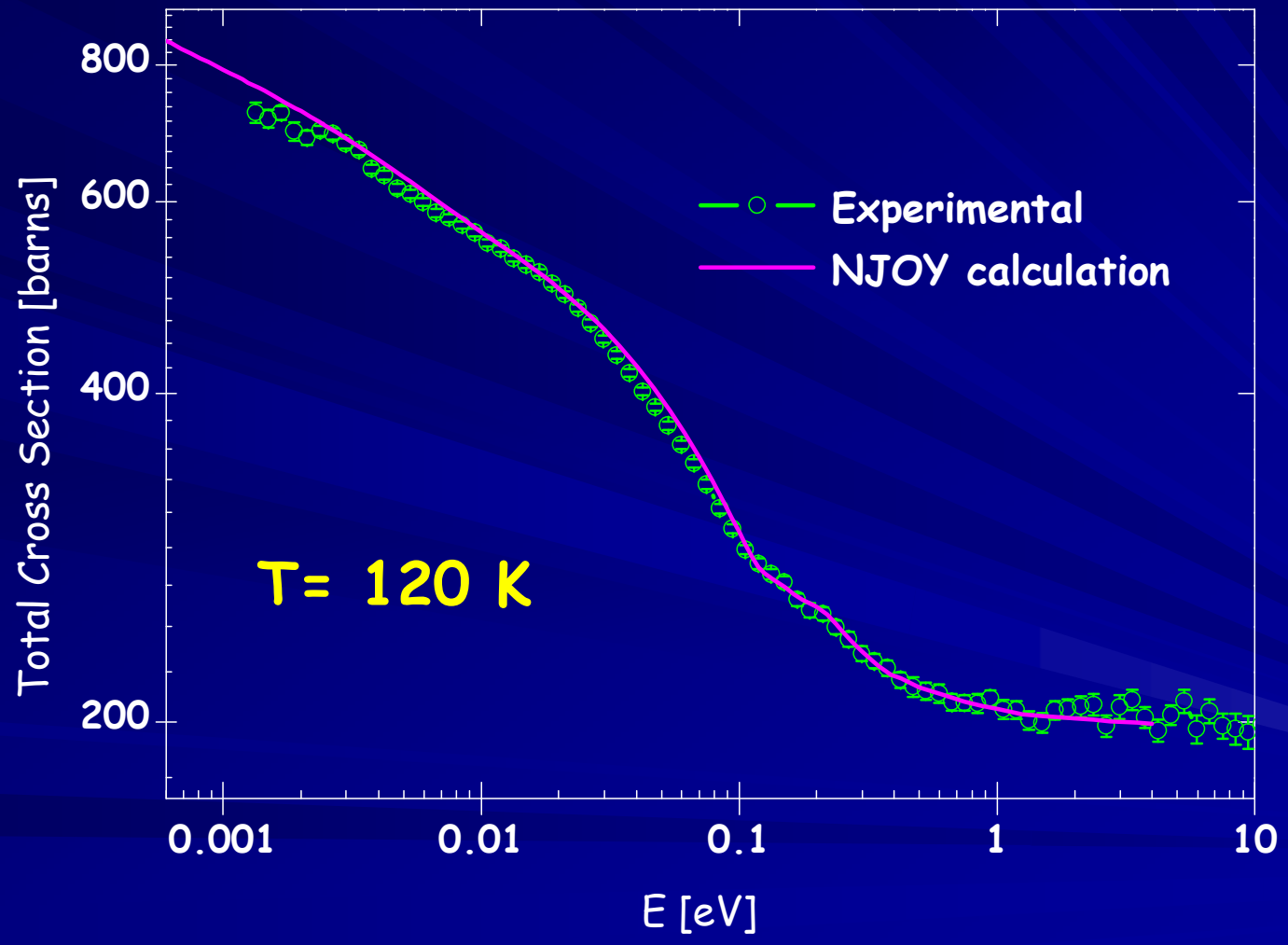
GENERATION AND VALIDATION

BENZENE

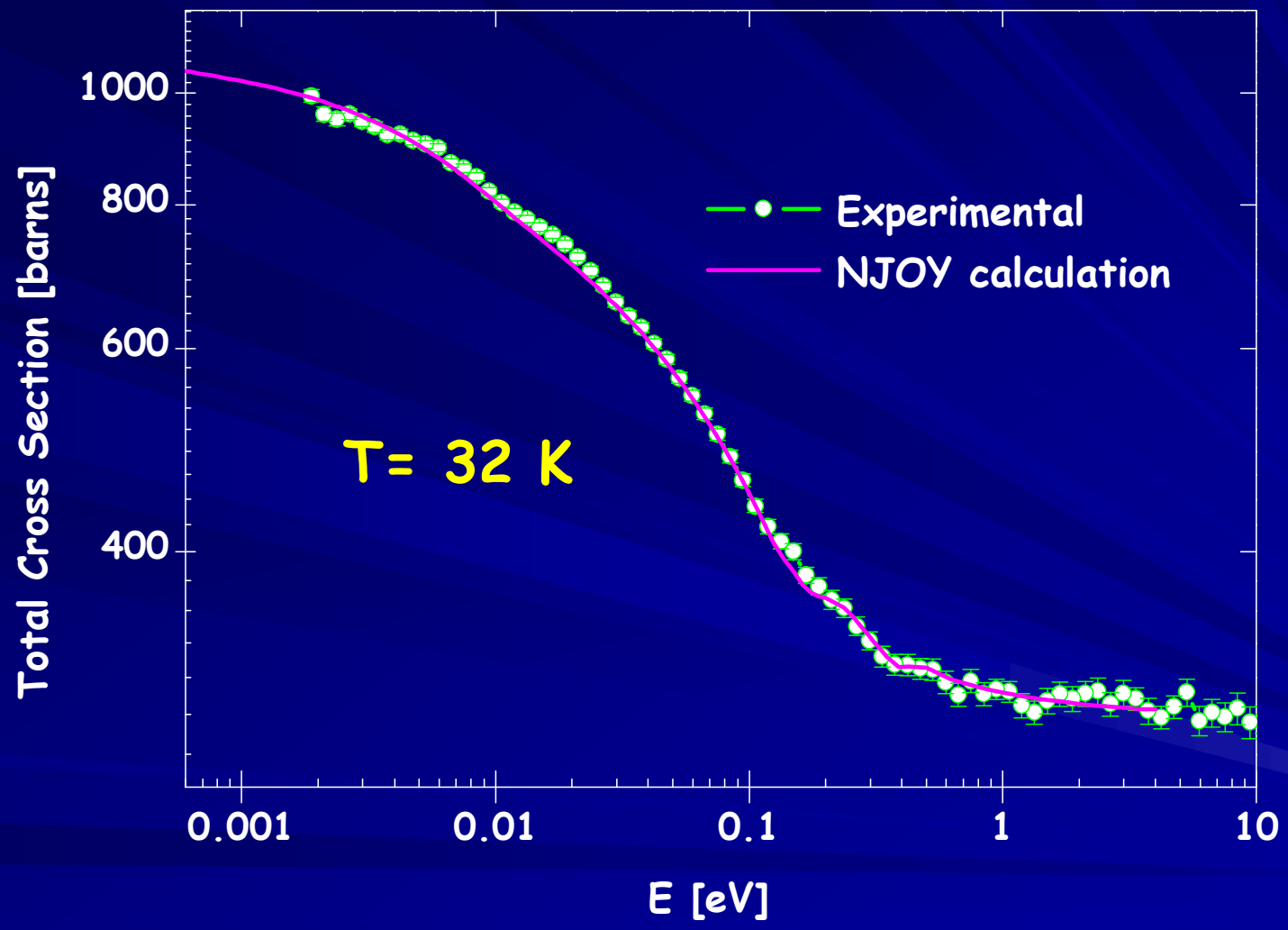


[*] L.Torres et.al NIMB 251 (2006) 304-305

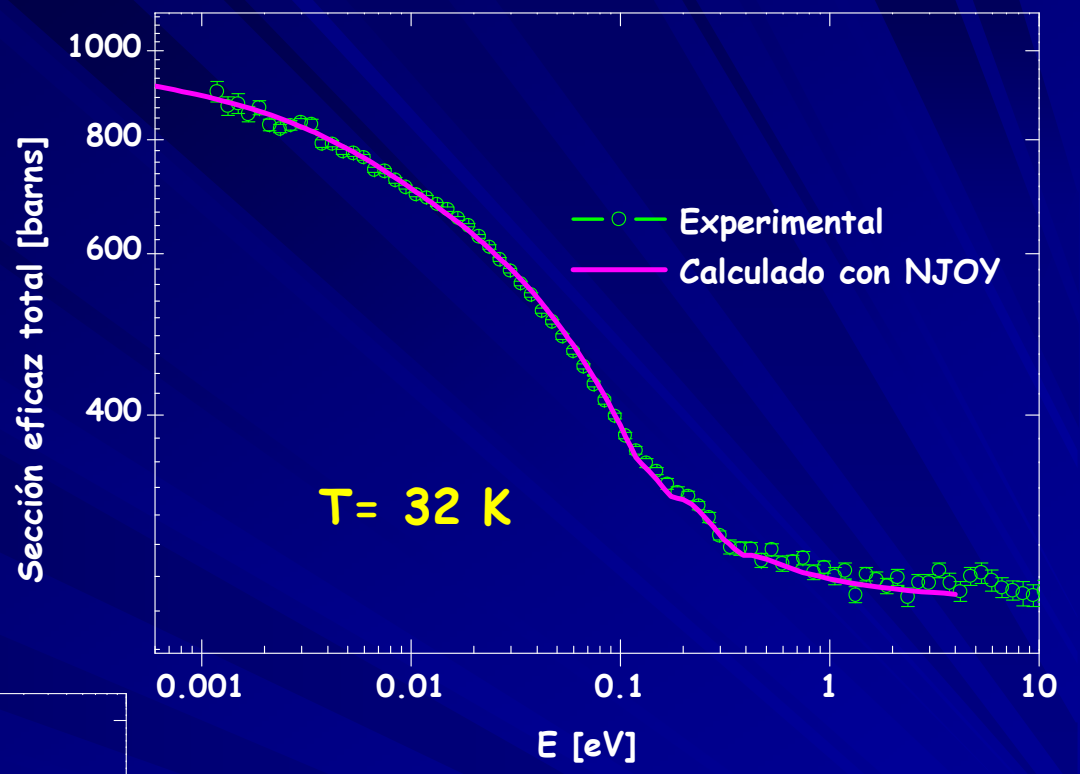
TOLUENE

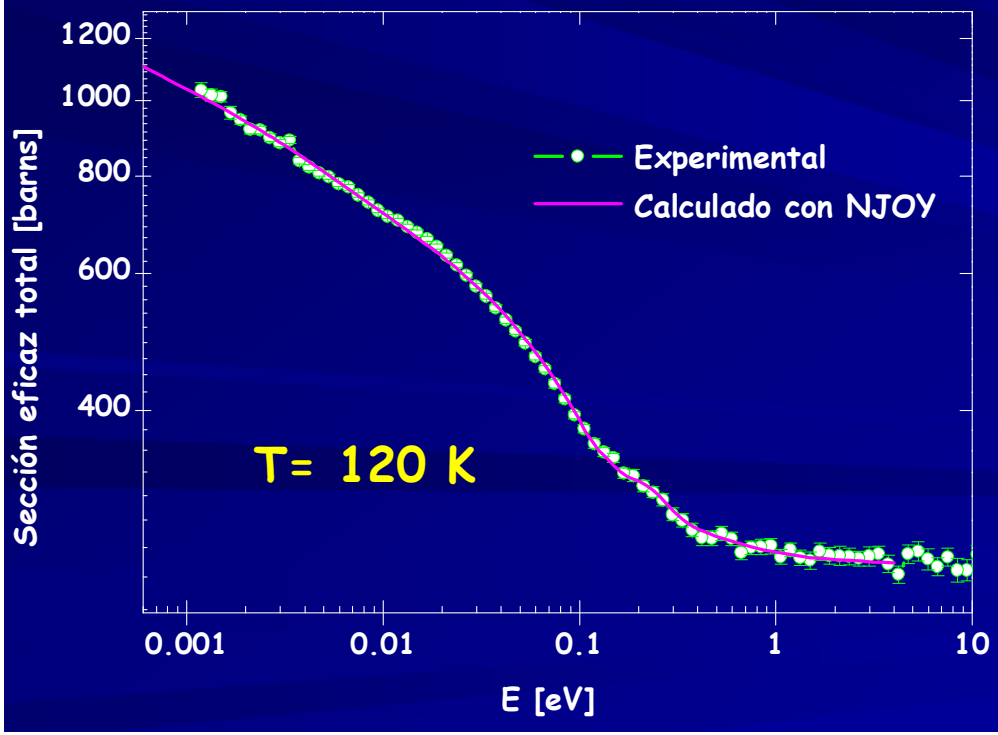

800
600
400
200
Total Cross Section [barns]
0.001
0.01
0.1
1
10
E [eV]
Experimental
NJOY calculation
T= 120 K

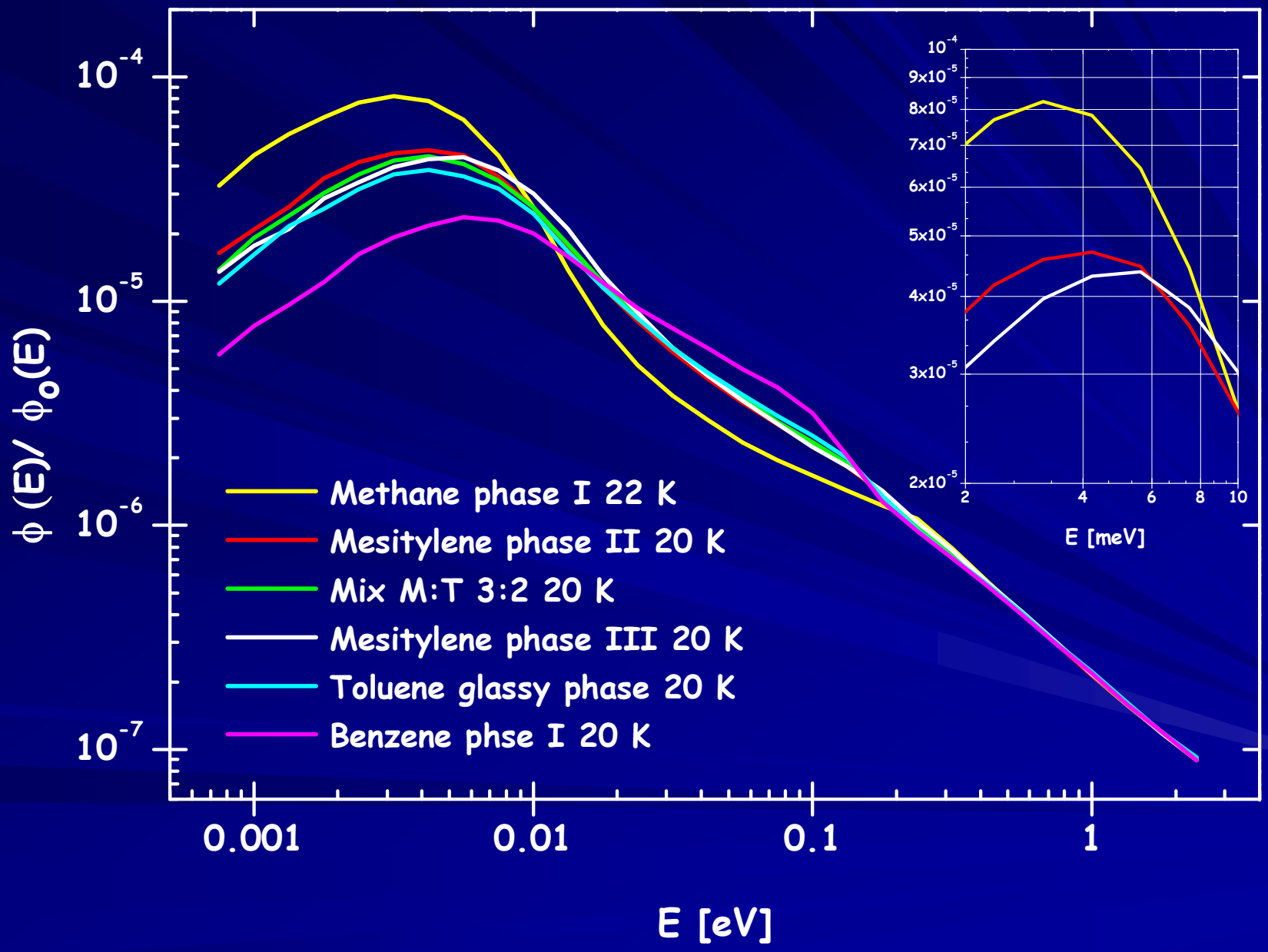
MESITYLENE

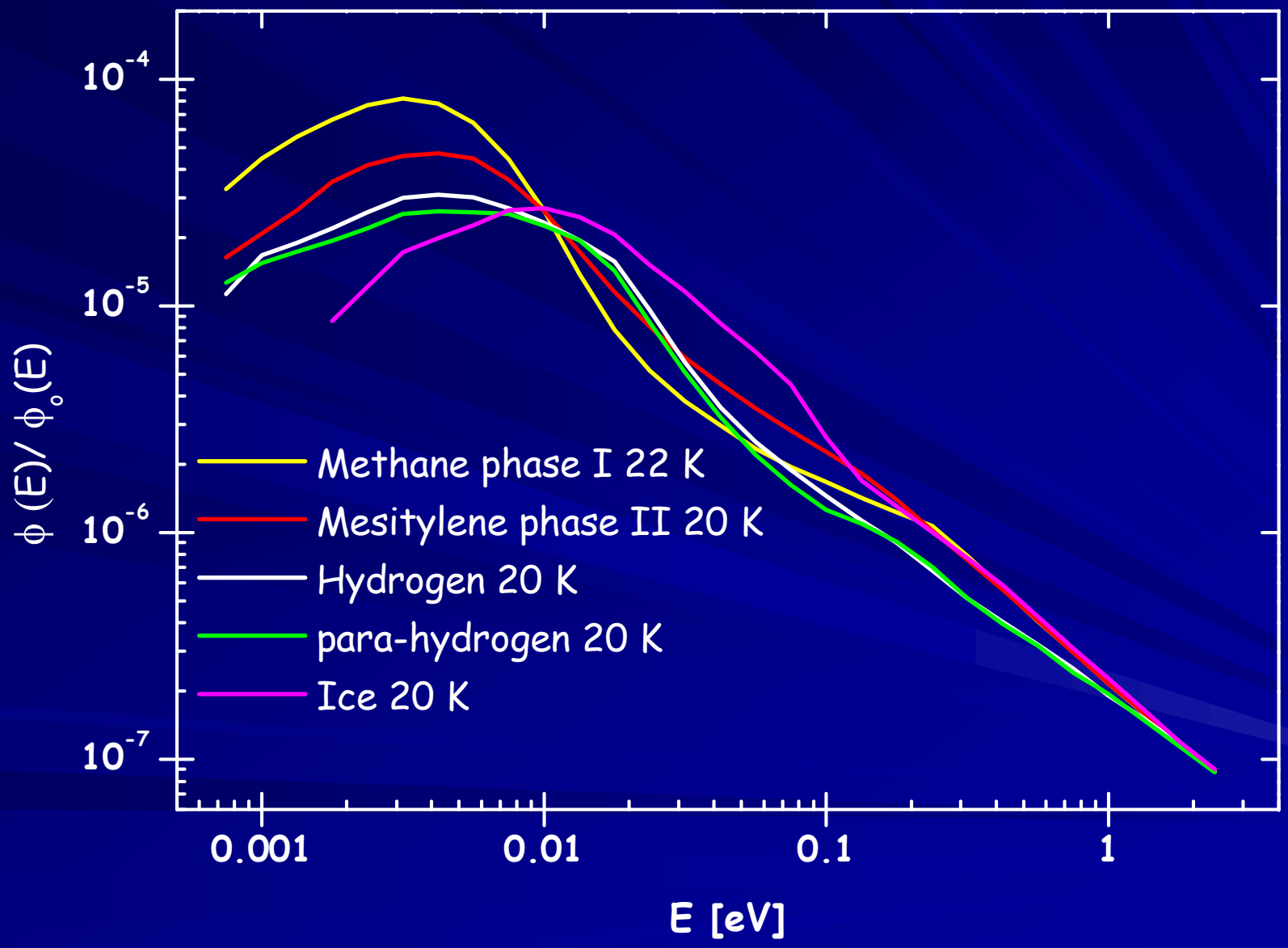

Total Cross Section [barns]
1000
800
600
400
0.001
0.01
0.1
1
10
E [eV]
Experimental
NJOY calculation
T= 32 K

MIX 3:2 M:T


1000
800
600
400
Sección eficaz total [barns]
Experimental
Calculado con NJOY
T= 32 K
0.001
0.01
0.1
1
10
E [eV]


1200
1000
800
600
400
Sección eficaz total [barns]
Experimental
Calculado con NJOY
T= 120 K
0.001
0.01
0.1
1
10
E [eV]


10^{-4}
10^{-5}
10^{-6}
10^{-7}
$\phi(E)/\phi_o(E)$
0.001
0.01
0.1
1
E [eV]
Methane phase I 22 K
Mesitylene phase II 20 K
Mix M:T 3:2 20 K
Mesitylene phase III 20 K
Toluene glassy phase 20 K
Benzene phse I 20 K
10^{-4}
9×10^{-5}
8×10^{-5}
7×10^{-5}
6×10^{-5}
5×10^{-5}
4×10^{-5}
3×10^{-5}
2×10^{-5}
2
4
6
8
10
E [meV]


10^{-4}
10^{-5}
10^{-6}
10^{-7}
$\phi(E)/\phi_o(E)$
Methane phase I 22 K
Mesitylene phase II 20 K
Hydrogen 20 K
para-hydrogen 20 K
Ice 20 K
0.001
0.01
0.1
1
E [eV]

CONCLUSIONS

Cross section libraries of hydrogen bounded in benzene, toluene, mesitylene y a solution 3:2 by volume of mesitylene and toluene were generated at different temperatures, in particular at 20K.

The Neutron Physics Group has the capability of producing cross section libraries for different materials and validating them performing total cross section measurements with the pulsed neutron source based on a LINAC at Centro Atómico Bariloche.


THANKS FOR YOUR ATTENTION !!

Perito Moreno Glacier

Perito Moreno Glacier

Perito Moreno Glacier

Cerro Fitz Roy (Chalten)

Punta Tombo