CAB Activity Report:

Thermal Scattering Libraries for non-Traditional Materials

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Argentina

WPEC SG-42 second meeting
May 9th-10th, 2016
OECD- Paris
France

Who we are: Thermal scattering nuclear data group at Centro Atomico Bariloche

Rolando Granada

Scattering theory and advanced neutron sources

Florencia Cantargi

Cold moderator materials and neutron filters

Ignacio Marquez

Nuclear reactor applications and benchmarking

The Neutron Physics Department at Centro Atómico Bariloche has more than 40 years of continuous experience working in neutron scattering applied to nuclear data and nuclear engineering.

As part of the Neutron Physics Department, our main activity is the generation of S(α,β) in ENDF format and thermal neutron scattering cross sections in ACE format for our R&D activity or by demand of other groups from Argentina (CNEA and INVAP) and also from other countries.

RA-10 Reactor Project

It is a multipurpose 30 MW reactor which includes a cold neutron source.

Our group responded to demands of **thermal scattering libraries** for the design of the reactor and the cold neutron source

We are currently working on a project to strengthen the scientific community and prepare the users for the reactor

Jose Antonio Balseiro School 2015 on Neutron Scattering Techniques.

We included a workshop on thermal scattering libraries and Monte Carlo simulation

Paul Scherer Institute

Joint CAB- PSI Project

Seed Money Grant / Latin America 2015 / Application Form

Latin America - Exploratory Mandate

SEED MONEY GRANTS
APPLICATION FORM

PART 1: GENERAL INFORMATION

1) Basic Data

Project title	Neutron Filter cross-section libraries and components for MCNP and McStas simulations
Keywords	Neutron filters, MCNP thermal cross-section libraries, McStas filter components, sapphire cross-sections, silicon cross-sections, beryllium cross-sections
Swiss institution	Paul Scherrer Institute (PSI)
Latin American institution	Centro Atómico Bariloche (CNEA)
Partner country	-
Short summary *(5 lines)*	This project aims to enrich the MCNP code's cross-section library suite with libraries of materials used as neutron filters, and similarly expand the McStas code with neutron filter components.
Total funding requested *(in CHF)*	22,270CHF

I hereby confirm that all the information given in this application and the attachments is correct to the best of my knowledge

26/05/2015 — *Place, date*

Emmanouela Rantsiou — *Swiss Principal Investigator*

26/05/2015 — *Place, date*

Florencia Cantargi — *Latin American Principal Investigator*

"Neutron Filters cross-section libraries and components for MCNP and McStas simulations"

- McStas School in February 2016 in Bariloche.
- Development of McStas components: filters and monocromators

IAEA-NDS

Participation as a member of INDC

- IAEA supports our participation in WPEC

2015+2016

INDC meeting in 2014 recommendations

- Inclusion of thermal scattering theory in the ICTP workshops in Trieste

Lecturer in the ICTP School

"Nuclear Data Measurements for Science and Applications" in 2015

- EXFOR compilation

Participation in the IAEA-NDS Consultancy Meeting "EXFOR compilation of thermal neutron scattering data" + implementation

IAEA-CRP (F12026)

We participate in the IAEA Coordinated Research Project

"Advanced Moderator for Intense Cold Neutron Beams in Materials Research " (2014-2018)

Participation of 16 countries

Argentina -->

Studies on new cold moderators:

ethane, triphenyl methane

First version of scattering kernels ready

Proposal sent to measure total cross sections (ISIS, 2016)

Cross section library generation with NJOY

Frequency spectrum (FE)

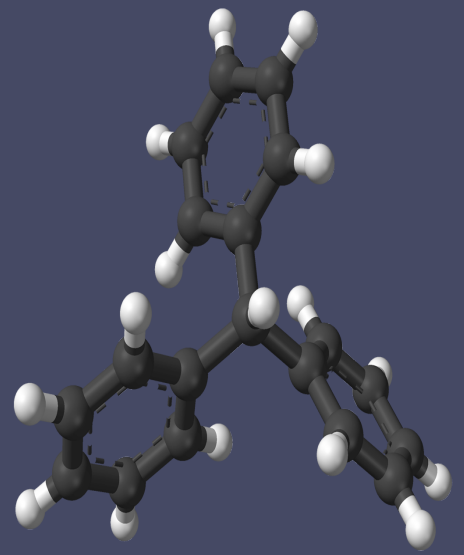
Data from experiments

Data from theory

Combination from both

Triphenylmethane

FE from neutron spectrometry (Dubna)



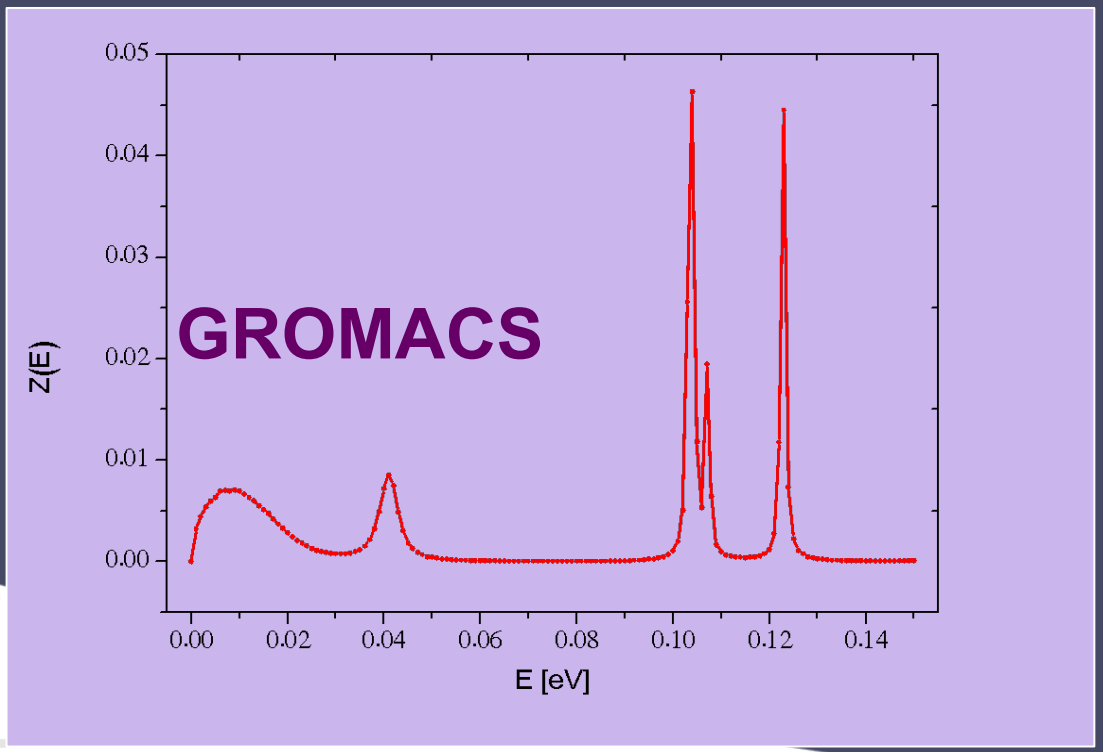
Ethane (C_2H_6)

Advantage: liquid from 90 K to 186 K

- Diffusive component calculated Egelstaff-Schofield model

  m_{diff} = 3 m_{mol}= 90 g/mol and D = 0.71 10^{-5} cm^2/s, $w_{traslac}$=0.0111

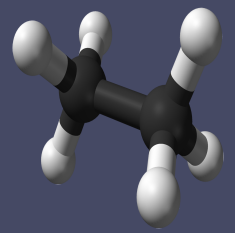
- Continuous frequency spectrum representing rotations and internal vibrations of the molecule w_{cont}=0.3859



- Two Einstein oscilllators

  $h\nu_1$= 0.18 eV w_1=0.299

  $h\nu_2$=0.37 eV w_2=0.304



(data for ethane @ 100 K)

Other Applications

- BIOLOGICAL APPLICATIONS

Neutron thermalization for neutron dosimetry in BNCT

(Ricardo Ramos, Centro Atomico Ezeiza).

- SCIENTIFIC APPLICATIONS

Scattering kernel development for inelastic scattering corrections in neutron diffractometry

(Luis Rodriguez Palomino, Centro Atomico Bariloche)

1-Propanol and 1-Butanol in hydrogenated and deuterated variants

Final Remarks

At the Neutron Physics Department (Centro Atómico Bariloche), the thermal scattering data group has the capability of producing S(α,β) in ENDF format and thermal neutron scattering cross sections in ACE format.

Validation: cross sections are compared with experimental data from EXFOR or from our own measurements at the e-LINAC at Centro Atómico Bariloche

Our cross section libraries are available in ENDF-6 and ACE format in the webpage of the Neutron Physics Department
http://www.cab.cnea.gov.ar/nyr/tsl_eng.html

We are also including neutron scattering theory in training courses for graduated and post-graduated students.