

**Twenty-Eighth Meeting of the
NEA Working Party on International Nuclear Data Evaluation
Co-operation
May 12 – 13, 2016 • Paris, France**

Meeting Summary

SG42

**Thermal Scattering Kernel $S(\alpha, \beta)$:
Measurement, Evaluation and Application**

**A. C. (Skip) Kahler
Gilles Noguere
Ayman Hawari**

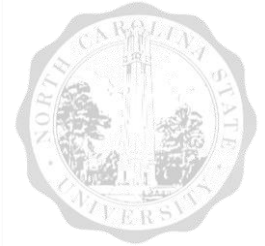
Summary

- **The SG 42 meeting was held May 11-12**
- **Around 20 participants were present discussing**
 - Data evaluations
 - Measurements
 - Theory-measurements connections
 - Benchmarks
 - Data Formats
 - Covariance data
- **The main contributors**
 - North Caroline State University (Aymann I. Hawari)
 - Bettis Atomic Power Laboratory (Jesse Homes)
 - Atomic Center of Bariloche (Florencia Cantargi, Jose Ignacio Marquez Damian)
 - Rensselaer Polytechnic Institute (Emily Liu, Yaron Danon)
 - Nuclear Energy Agency (Carlos Javiez Diez, Oscar Cabellos)
 - NAUSICAA collaboration (Emmanuel Farhi, Vaibhav Jaiswal, Juan Pablo Scotta, Claude Mounier, Gilles Noguere)

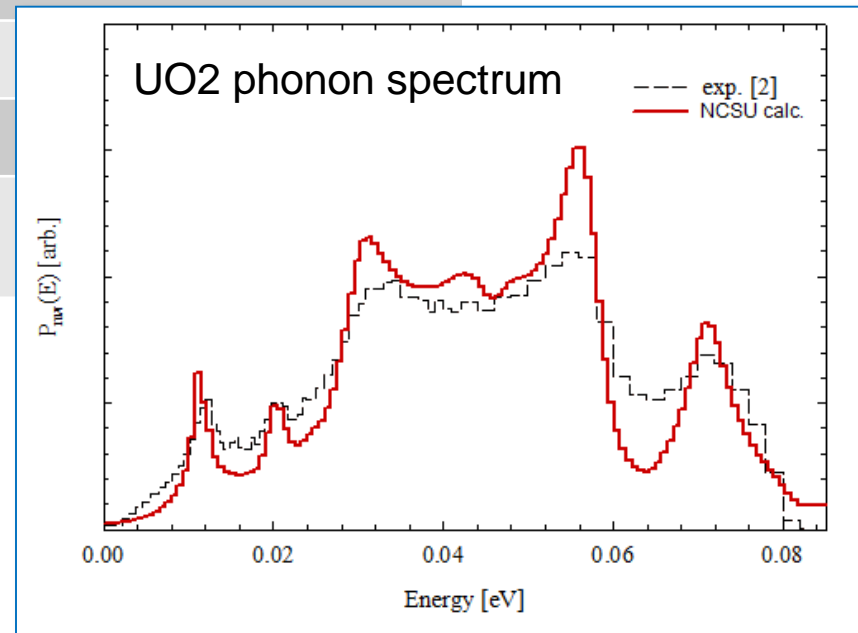
Data Evaluations

Examples of contribution from the North Carolina State University

Material	Comments
$(C_5H_8O_2)_n$	Contributed to NNDC
$(CH_2)_n$	ENDF File 7 ready
Lubricant Oil	On going
BeO	ENDF File 7 ready
UO ₂	ENDF File 7 under preparation
U ₃ Si ₂	On going
FLiBe	Near completion
Reactor-grade (nuclear) graphite	File 7 ready (porous model)



Good agreement between the NCSU calculations (in red) and the experimental data (Pang et al., PRB 2014)



Data Evaluations



Examples of contribution from the Atomic Centre of Bariloche

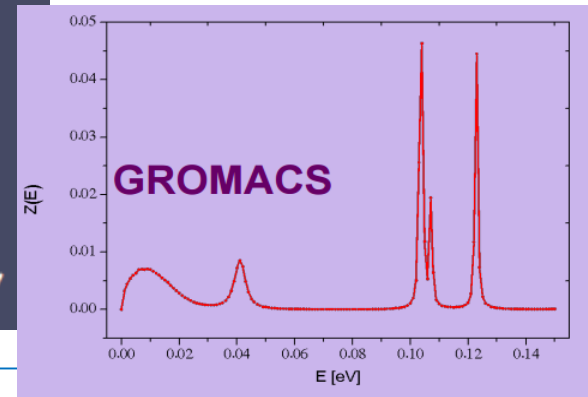
Cryogenic moderators

Argentina -->

Studies on new cold moderators:
ethane, triphenyl methane

First version of scattering kernels ready

Ethane phonon spectrum



Reactor
applications

Libraries for:

H-1 bound in H_2O (`ts1-HinH2O.endf`).
H-2 bound in D_2O (`ts1-DinD2O.endf`).
O-16 bound in H_2O (`ts1-OinD2O.endf`).

Temperatures: 283 - 600 K.

H^+ ions present in acid solutions (particularly, HNO_3) have a different dynamics than H bound in H_2O . Assuming that H^+ dissociate from the NO_3 and are free in the solution*, ions have:

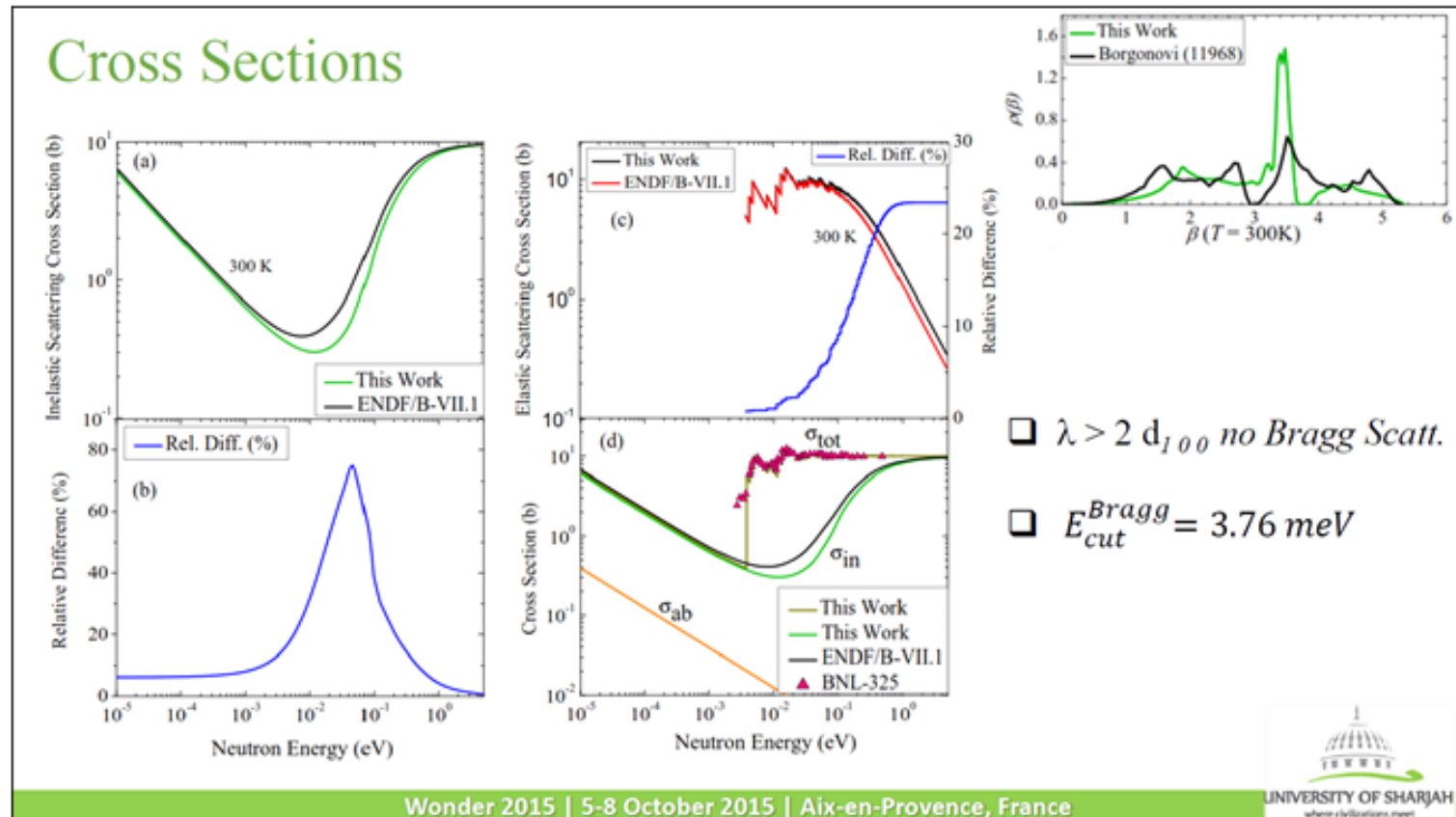
No rotation,
No vibrations,
Only diffusion

To be used in some
ICSBEP benchmarks

Data Evaluations

Examples of contribution from the Nuclear Energy Agency

New BeO file produced by Iyad Al-Qasir (University of Sharjah) was tested by Colleagues of the NEA data bank on a selected set of ICSBEP benchmarks



⇒ Benchmark results show a **systematic decrease** of the reactivity compared to existing library

Measurements

- **Measured data was discussed for several materials**

TOF chopper spectrometers at

- Spallation Neutron Source ORNL
- High Flux Reactor ILL

⇒ Polyethylene, Light water, Heavy Water, ...

⇒ For light water, an excellent agreement is obtained between the SNS measurements and the TSL generated with the CAB model

- **An important work is needed to isolate corrections and for data interpretation**

Theory-Measurements Connections

Measurements and computations can be compared meaningfully if :

- **Computational results are corrected for approximations**
 - Quantum Mechanic effects (if TSL is derived from classical simulations)
 - Model assumptions (e.g., incoherent approximation)

- **Measured data are corrected for experimental effects**

Main Instrument effects :

- Resolution of the spectrometer
- Dynamic range
- Detection efficiency
- Sample effects

⇒ Difficult to satisfy these criteria when old data and evaluations are studied

Benchmarks

- **Benchmarks presented for**

- **Light water** : tests of the TSL generated with the CAB model
- **Beryllium oxide** : tests of the TSL generated by Iyad Al-Qasir (University of Sharjah)

⇒ Promising results were obtained in both cases

- **Benchmarks selection**

- Benchmarks should be selected for maximum sensitivity and, if possible, isolate the effect of the TSL data
- A selected set of benchmarks for water and BeO was established with the **DICE tool**.

Data Formats

- **TSL data in GND format in connection with SG-38 activities**
 - GND ready to accept current File 7 data
 - Awaiting comments to improve GND format if needed
 - Would like a representative TSL covariance data set
- **TSL beyond thermal region**
 - Doppler broadening could be performed using typical File 7 data
 - Such a strategy is already used for the resonance analysis
 - Models were implemented in the shape analysis codes SAMMY, REFIT and CONRAD

Covariance Data

- **Current strategy for generating Covariance data**
 - TSL Covariance data can be produced using standard methods applied for analyzing neutron cross sections above the thermal cut-off
 - Final TSL uncertainties should reflect the experimental cross section uncertainties
- **Future consideration for generating Covariance data**
 - ⇒ Uncertainties due to models used in generating cross sections (e.g., capability of the model to reproduce thermophysical properties) should be taken into account

Upcoming Activities

- **New evaluations will be released within the next 12 months.**
 - ⇒ Some of them are already available in the “ENDF/B-VIII.0β1 Thermal Kernels” web page: <https://ndclx4.bnl.gov/gf/project/endl/frs/>
- **New experimental activities are planned (or under discussions):**
 - Further work are planned on cryogenic Cold Neutron Source materials
 - Further work on Uranium Oxide in hot power conditions
 - Further work on light water to explore “critical point conditions”
- **Upcoming release of the new version of NJOY**
 - Fix known issues in TSL related modules
 - This new version is needed to correctly process some of the new TSL files