ENDF Manual Changes/ ENDF Format Change Discussions

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4 November 2022
CSEWG part of Nuclear Data Week 2022

ENDF Manual Changes

Two corrections this FY

Equation (D.24): mistaken factor of 2

reduces to the familiar form:

$$\sigma_{nn}(E) = \frac{\pi}{k^2} \sum_{l=0}^{NLS-1} \sum_{s=\left|I-\frac{1}{2}\right|}^{I+\frac{1}{2}} \sum_{J=|l-s|}^{l+s} g_J \left|1 - U_{lsJ,lsJ}\right|^2 . \tag{D.24}$$

Missing parenthesis, p. 346

D.1.2 Multilevel Breit-Wigner (MLBW, LRF=2)

The equations are the same as **SLBW**, except that the equation for elastic scattering of l-wave neutrons is $\sigma_{n,n}^l(E) = \sigma_{n,n}^{l(S)}(E) + \sigma_{n,n}^{l(R)}(E)$ where $\sigma_{n,n}^{l(S)}$ is the **SLBW** contribution given by equation D.2 and $\sigma_{n,n}^{l(R)}$ is the resonance-resonance interference term defined by:

3

New dev/resParameterRevisions branch

Created by Mark Paris to collect resonance documentation clarifications

- **First pass at resonance parameter revisions**

- Main focus here are LRF=7 corrections
- KRL=1 description in Appendix D
- Clarification of LRF=3 limitations in Appendix D
- Clarification of how LRF=7 subsumes LRF=1,2,3
- Other minor edits.

D.1.   THE RESOLVED RESONANCE REGION (LRU=1)

D.1.3   Reich-Moore (R-M, LRF=3)

Evaluators should be aware that the full Reich-Moore formalism [Reference 2] is more general than its ENDF implementation under LRF=3, which is a limited subset of the Reich-Moore capabilities. In particular, the LRF=3 format is permitted only for incident neutrons, allows no threshold reactions, and supports only two elastic neutron channels per spin group as well as fission and capture channels; competitive reactions are not supported in LRF=3. For a more general treatment than that afforded by the LRF=3 Reich-Moore formalism see Section 2.2.1.5 on R-Matrix Limited format (LRF=7).

This description of the ENDF Reich-Moore formalism differs from previous versions by using notation in closer agreement with References 1 and 3. The dependence of all quantities on channel spin has been made explicit, to support a format extension which permits specifying the individual channel-spin components of the neutron width.

Partial cross sections may be obtained from a collision matrix U_{ab}, which connects entrance channels a with exit channels b. In ENDF, the formalism is applied to neutron

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- First pass at

I encourage this development!
Appendix D is a bit of a mess.

We would like to port this description to GNDS specifications when ready

- Main focus
  corrections

- KRL=1 des
  Appendix

- Clarification of LRF=3
  limitations in Appendix D

- Clarification of how LRF=7
  subsumes LRF=1,2,3

- Other minor edits.

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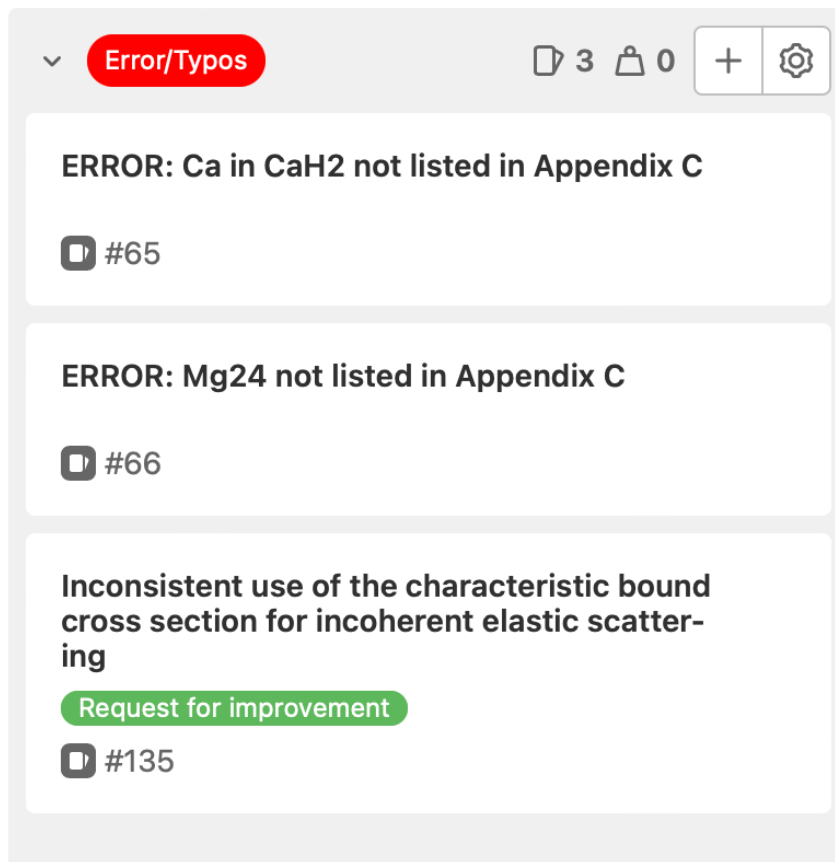
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ENDF Format Change Discussion(s)

No new proposals, which is good because there is a lot to do

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24 Open Issues: 3 Error/Typos

Error/Typos 3 0 + ⚙

ERROR: Ca in CaH2 not listed in Appendix C
#65

ERROR: Mg24 not listed in Appendix C
#66

Inconsistent use of the characteristic bound cross section for incoherent elastic scattering
Request for improvement
#135

All TSL issues

2 are "we ran out of MAT number issues"

Dave promised a fix but hasn't provided one

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24 Open Issues: 13 Requests for Improvement

Request for improvement 📄 13 🔔 0 + ⚙

Add MLBW angular distribution discussion
📄 #12

Clarify differential cross section notation
📄 #24

Reserve MAT=9 for the new NNL hydrogen bound in uranium hydride (H-UH3) TSL
📄 #25

Clarify meaning of MT=51,90
📄 #108

Request for improvement 📄 13 🔔 0 + ⚙

ENDF electro-atomic data clarification needed
📄 #111

Improve description about MF=10 to allow for elemental targets.
📄 #122

W: Fake residual specified for fission
Format Proposal
📄 #138

Rutherford cross section questions
📄 #129

Request for improvement 📄 13 🔔 0 + ⚙

Reframe mean values and covariance formats in framework of Gaussian Process Regression
📄 #131

Primary Gamma Confusion
📄 #134

Inconsistent use of the characteristic bound cross section for incoherent elastic scattering
Error/Typos
📄 #135

Remove LTP=15 from section 6.2.7
📄 #136

Needed better description and references for N-body phase spaces in different reference frames
📄 #137

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Reserve MAT=9 for the new NNL hy...
bound in uranium hydride (H-UH3) ...

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Remove LTP=15 from section 6.2.7

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🗋 #137

Most require moderate edits, but some are very close to an actual format proposal

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Volunteers?

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24 Open Issues: 10 Format Proposals

✍️ provisional approval, actions pending (mostly writing)

🤷‍♂️ kinda got forgotten

🚧 lots of work needed

🥌 looks easy, but it's not

Format Proposal   📋 10   🛍 0   +   ⚙️

FORMAT PROPOSAL: Temperature specification in the ENDF file:
📋 #106 🤷‍♂️

FORMAT PROPOSAL: Allow elements to use file 10 ✍️
📋 #107

FORMAT PROPOSAL: Angular distribution of nucleon emission from deuteron breakup reaction ✍️
📋 #112

FORMAT PROPOSAL: Format change to include Brune parameters ✍️
📋 #113

FORMAT PROPOSAL: W: Fake residual specified for fission
`Request for improvement` ✍️
📋 #138

Format Proposal   📋 10   🛍 0   +   ⚙️

FORMAT PROPOSAL: Allow MF=4/5 for incident gamma evaluations 🚧
📋 #92

FORMAT PROPOSAL: Include R_ext Term in RRR LRF=7 Format ✍️
📋 #101

FORMAT PROPOSAL: New MT's to support IRDFF 🤷‍♂️
📋 #102

FORMAT PROPOSAL: Clarify the formalism to used for relativistic R-Matrix for LRF=7 ✍️
📋 #103

FORMAT PROPOSAL: URR interpolation 🥌
📋 #105

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24 Open Issues: 10 Format Proposals

✍️ Provisionally accepted resonance-related proposals:

- Brune (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/113) – action on Marco, Ian
- R_ext (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/101) – action on Wim, Jesse
- KRL (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/103) – action on Mark, Ian

✍️ Provisionally accepted IRDFF-related proposals:

- MF10 (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/107) – action on Andrej, Dave
- W (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/138) – action on Andrej, Dave

✍️ Provisionally accepted Kalbach-Mann proposal:

- d breakup (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/112) – action on Arjan, Dave

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24 Open Issues: 10 Format Proposals

🤷 Forgotten proposals:

- Temp (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/106) – submitter is Andrej
- MT's (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/102) – submitter is Andrej

🥌 Unexpectedly hard proposal:

- URR (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/105) – submitter is Andrej
  This should be easy, but we keep going around and around

🚧 Ones maybe we should just drop?

- MF4/5 (https://git.nndc.bnl.gov/endf/format/endf6man/-/issues/92) – submitter is Andrej
  Requires information not present in ENDF files to make practical