

Connection between the Reference Parameter Input Library RIPL, GND and nuclear reaction evaluations

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RIPL: The result of 3 IAEA CRP's



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RIPL – Reference Input Parameter Library for Calculation of Nuclear Reactions and Nuclear Data Evaluations

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R IPL segments

1. Masses
 2. Discrete levels
 3. Neutron resonances
 4. Optical model
 5. Level densities
 6. Gamma-ray strength functions
 7. Fission
- **All** of these segments are important for nuclear model codes
 - **Some** of these segments are important for a particle database.
 - **Recommendation**: “force” link of particle database with nuclear reaction evaluation
 - **Recommendation**: try to work with defaults that can be overruled
 - **Warning**: Unification of the RIPL format has been recommended before by a RIPL-participant. Maybe the time is right now!

Masses

- Everyone (I think) agrees we should adopt experimental masses from the Atomic Mass Evaluation, when available
- People, especially astrophysicists, disagree on theoretical masses (FRDM, HFB models, Duflo-Zuker formula).
- RIPL also stores relative isotopic abundances = BNL Nuclear Wallet Cards.
- Link with nuclear reaction evaluations (NRE):
 - Agree on the (RIPL) default: if no mass is given in the NRE, link to the particle database
 - Allow to overrule default mass choice in NRE.
 - Should Q-values remain implicit (are completely determined by mass choice) or be explicit in an NRE?
 - How to deal with “old” masses from ENDF-B, JEFF, JENDL, etc.?
- Any new evaluation made with (at least) TALYS or EMPIRE, uses consistent RIPL values for masses

Discrete levels

- There is one generally adopted source for discrete level information, ENSDF, and in RIPL this is translated into a discrete level database.
- Unfortunately, less well-defined, or well-agreed, than masses:
 - Unknown energies
 - Unknown spins and parities
 - Unknown branching ratios
 - ~10 units away from stability line: no info at all
 - Do we get halfives from here or from the Decay Data File?
- Filling these omissions for nuclear reaction evaluations is subjective, e.g. TALYS uses HFB level densities to fill it all.
- Existing nuclear reaction evaluations often disagree on the level energy and number (!) Can/should we impose the RIPL default on this?

Neutron resonance parameters

- Direct connection with current MF2, also for the **average** resonance parameters.
- Evaluators will disagree more than for masses and discrete levels
- Outside RIPL: bring The Atlas of Neutron Resonances also under the GND umbrella.

Optical model parameters

- All OMP parameterizations must first be used in nuclear model calculations, so no direct link with format issues of nuclear reaction evaluations.
- Bringing OMP parameters under GND umbrella may be difficult since special software is required to retrieve the parameters.

Level density parameters

- All these parameterizations must first be used in nuclear model calculations, so no direct link with format issues of nuclear reaction evaluations.
- All tables can be brought under GND umbrella, either for level density parameters or tabulated level densities.

Gamma-ray strength functions

- All these parameterizations must first be used in nuclear model calculations, so no direct link with format issues of nuclear reaction evaluations.
- All tables can be brought under GND umbrella, either for gamma-ray parameters or tabulated gamma-ray strength functions .

Fission parameters

- All these parameterizations must first be used in nuclear model calculations, so no direct link with format issues of nuclear reaction evaluations.
- All tables can be brought under GND umbrella, either for fission parameters or tabulated fission level densities, etc.

Conclusions

- Try to bring large nuclear-structure related databases under GND umbrella: RIPL, Atlas, Radioactive Decay Data file, NUBASE etc.
- This will allow users to choose from a variety of sources without (?) caring about read formats.
- Question for the link to nuclear reaction evaluations: should we establish defaults for (almost) everything to minimize errors?
(a bit like a TALYS input file.....)