Electron- and photon-atomic reaction data at LLNL

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Electron and Photon Interaction Cross-sections

- LLNL has provided this EPICS data for several decades now
 Including spectra from products after final relaxation process.
- Evaluator Red Cullen:
 - 'evaluated evaluations' from various reaction models
 - Collated a uniform set for Z=1-100, E=10 eV 100 GeV
 - Provided to LLNL in ENDL format, nationally in ENDF format: ENDF/B-VIII
 - Not validated to experiment data directly, only to other models.
- For cold, neutral, isolated atoms
 - NOT: high temperatures, or ions, or molecules or liquids or solids
 - However, high density and low temperature conditions typically approach cold material properties.
- Cullen has now retired.
 - Other LLNL codes can be adapted for this purpose
 - Experimental validations (eg. with extended EXFOR) still needed.





LLNL develops codes to model photon interactions with matter

- Basic atomic cross-sections
- Detailed line-accounting codes
- Statistical line-accounting codes
- Hybrid statistical/detailed codes
- We are currently developing a new hybrid opacity code that utilizes modern machine architecture, parallelization, and UQ.
- Main interest in high energy density (HED) and warm dense matter (WDM) conditions (X-rays).
- Charged particle d*E*/dx in cold and plasma media.
- However, high density and low temperature conditions typically approach cold material properties.







Way Forward

- Validate codes and library data by comparisons with differential experimental data. (atomic EXFOR would be useful).
- See how other groups validate their evaluation libraries.
- Translate existing libraries to modern GNDS format

 Check completeness
- Apply LLNL codes as needed for cold-neutral-isolated atomic data.



