

# Neutron Cross-Section Evaluations for $^{70,72,73,74,76}\text{Ge}$

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# Motivation

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- Photon production data for Ge requested by MCNP community and Ge detector users.
  - Important for MCNP simulations of detector systems using Germanium in presence of neutrons
  - Important for broad range of applications including Homeland Security

# Current Status

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- No photon data in major data libraries
  - ENDF/B-VI: evaluated in 1974, no photon data, obsolete
  - JEFF-3.0: taken from ENDF (see above)
  - JENDL-3: evaluated in 1994, no photon data
  - **Recent evaluation by Koning, photon data included, proposed for JEFF-3.1**

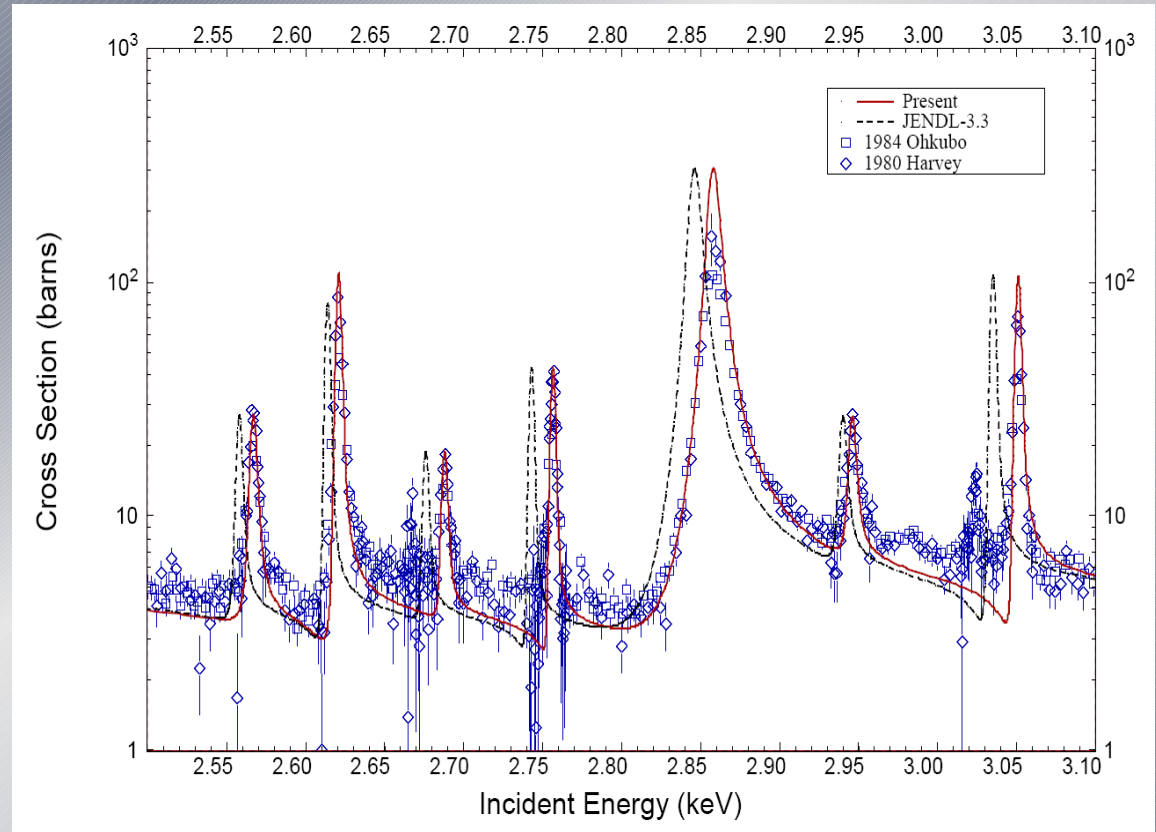
# Present work

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- Entirely new evaluation
  - 5 Ge isotopes:
    - $^{70,72,73,74}\text{Ge}$  stable,
    - $^{76}\text{Ge}$  long-lived
  - from thermal energy up to 20 MeV
  - focus on photon production

# Resonance Region

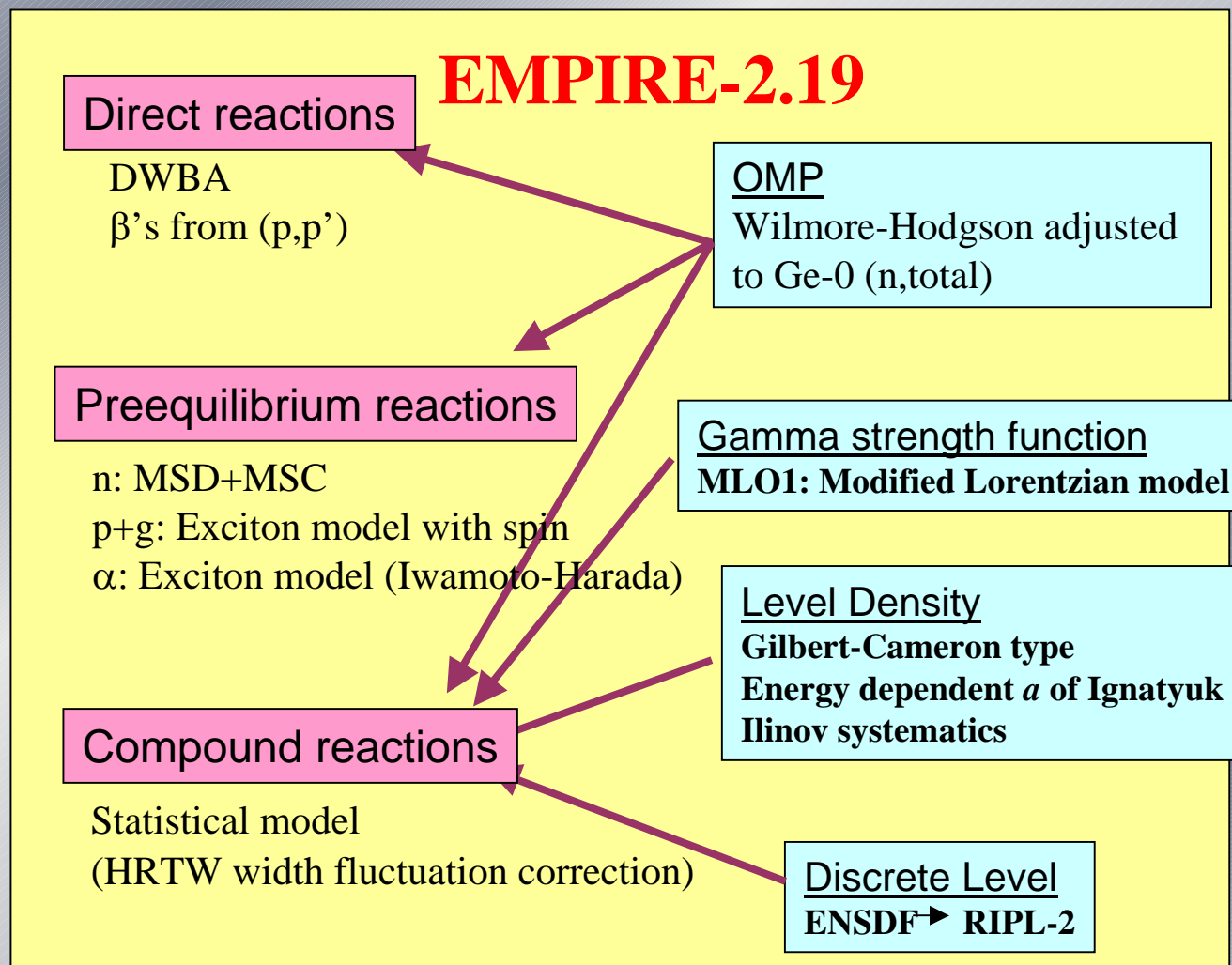
- All new experimental data taken into account
- Multi-level Breit-Wigner
- Energies:
  - Thermal
  - Resolved resonance region (up to 42, 40, 0.9, 65, 49 keV for Ge-70,72,73,74,76)
  - Unresolved resonance region (up to 1<sup>st</sup> excited level)



# Fast Neutron Region

Several improvements for photon production

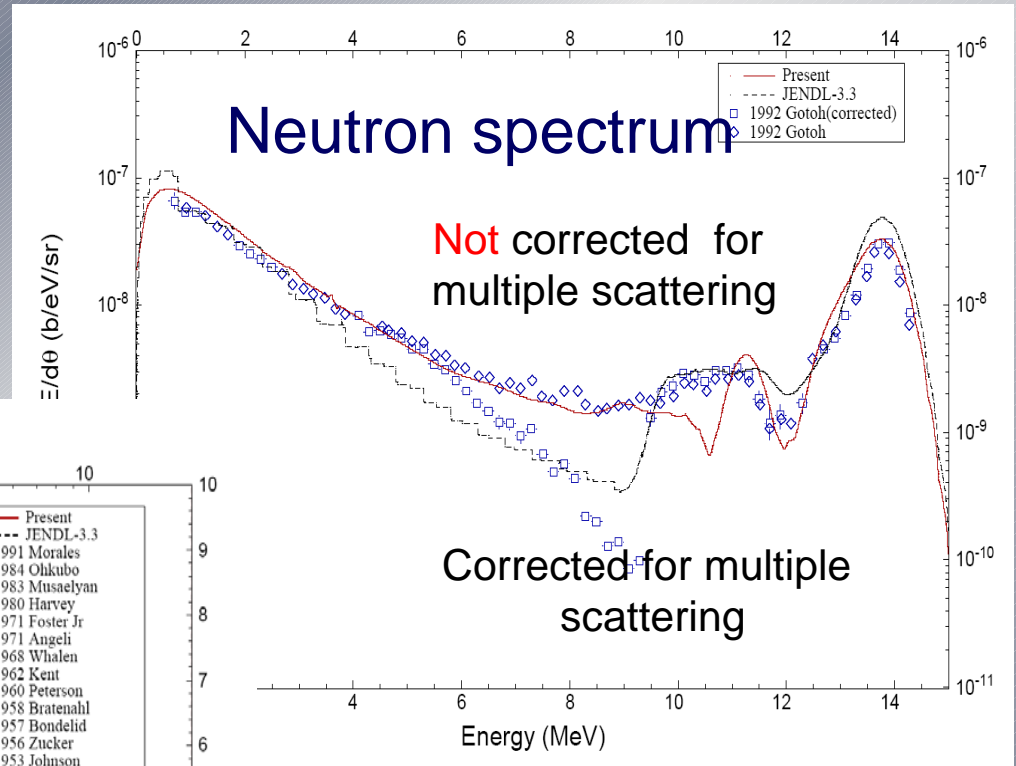
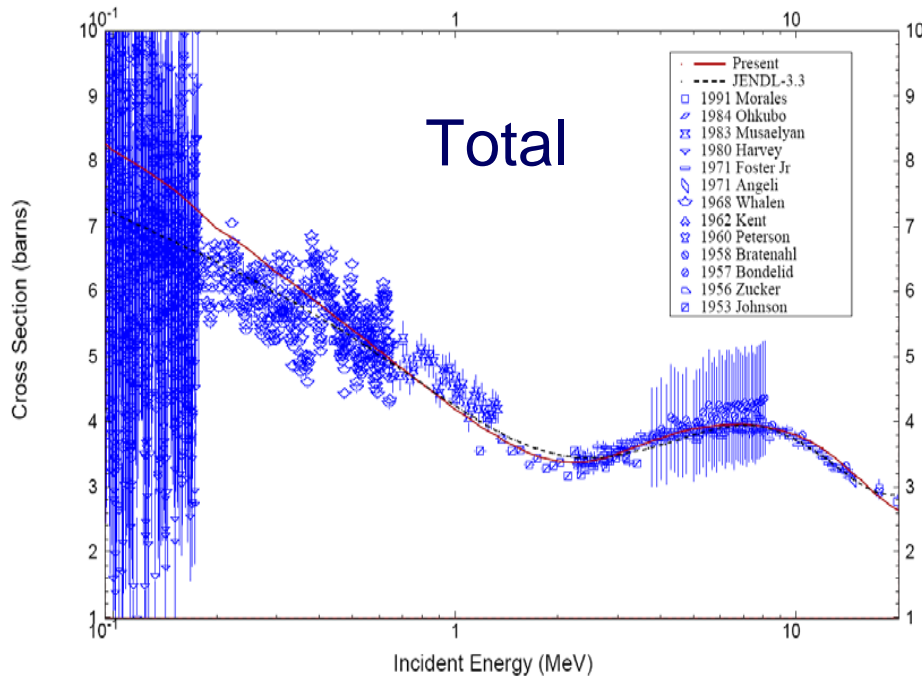
- Complete photon production formatting
- Suite of  $\gamma$ -ray strength functions from RIPL-2



# Comparison with experimental data

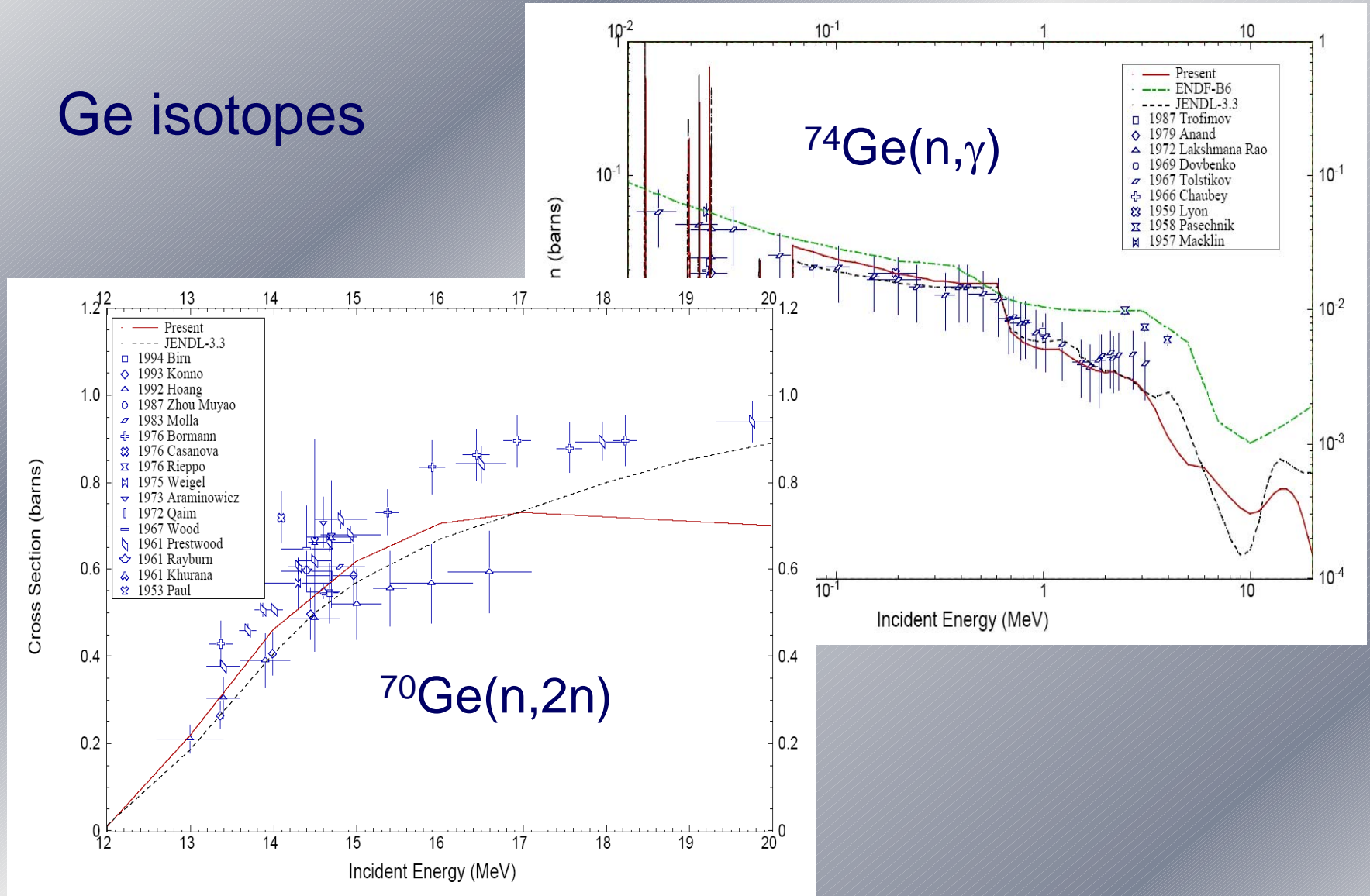
Natural Ge  
(sum of isotopic evaluations)

Ge-0(n,tot)



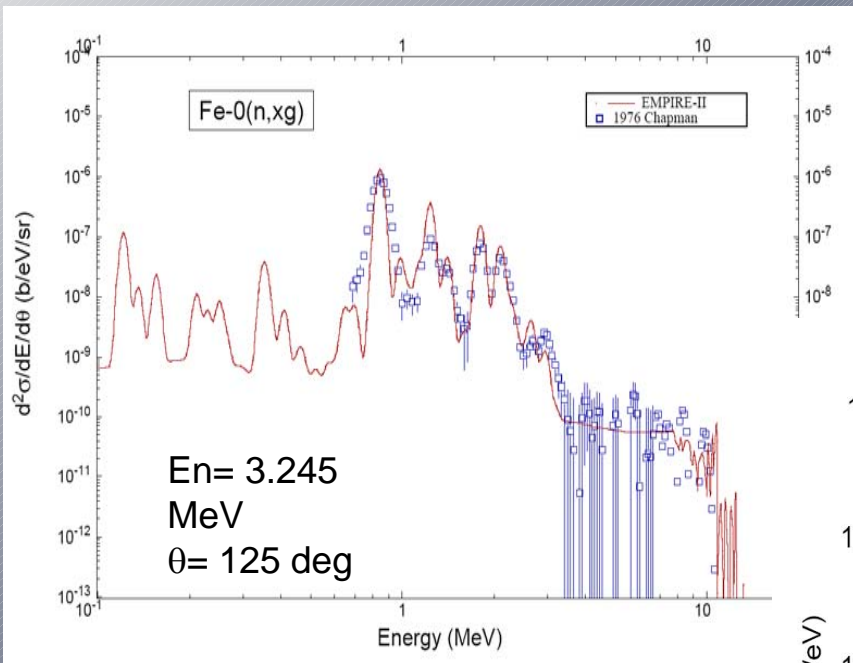
# Comparison with experimental data

## Ge isotopes





# Photon production



Validation against  
experimental data  
on  $^{nat}\text{Fe}$

Photon production  
spectra on  $^{nat}\text{Ge}$

