

Mini CSEWG
BNL 5/7,8/2015

Summary of Updated Data at LANL

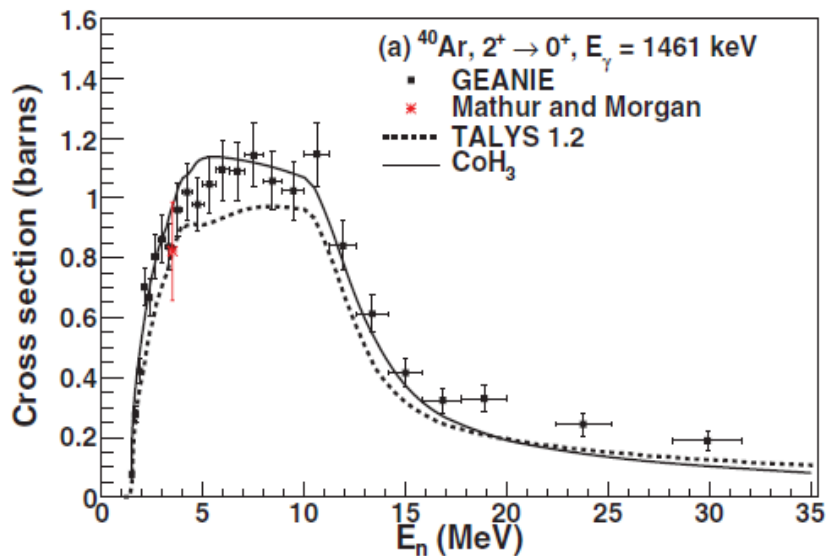
Toshihiko Kawano
LANL, Theoretical Division
T-2, Nuclear Physics

New Cross Section Evaluation Outlook

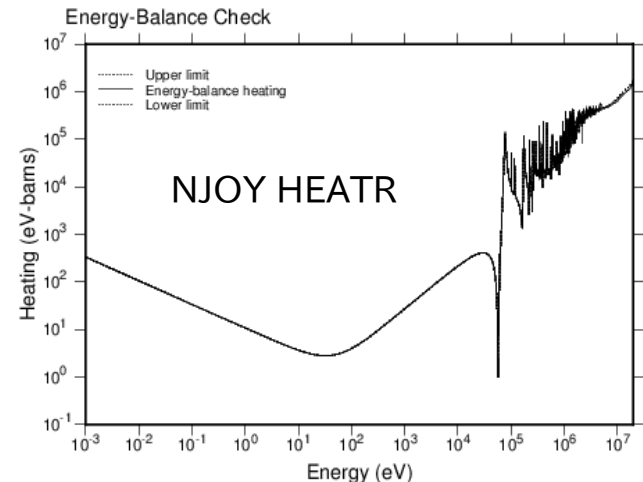
- **Ar-40**
 - new evaluation above resonances, based on GEANIE data
- **Ni-58, 59, 60, 61, 62, 64**
 - new evaluations above resonance regions with CoH3
 - angular distribution for Ni-58 and 60 from the ORNL resonance parameters (WPEC SG35)
- **Cu-63, 65**
 - new evaluation above resonance regions with CoH3
 - see benchmark results by Kahler
- **As-73**
 - LANL local evaluation, to be added to the repository
- **Np-236m**
 - New isotope, new evaluation
 - 60 keV level, half-life of 22.5h
- **K-38 photo-induced reaction**
 - funded by isotope production, ENDF-6 file not yet produced

Ar-40 Evaluation

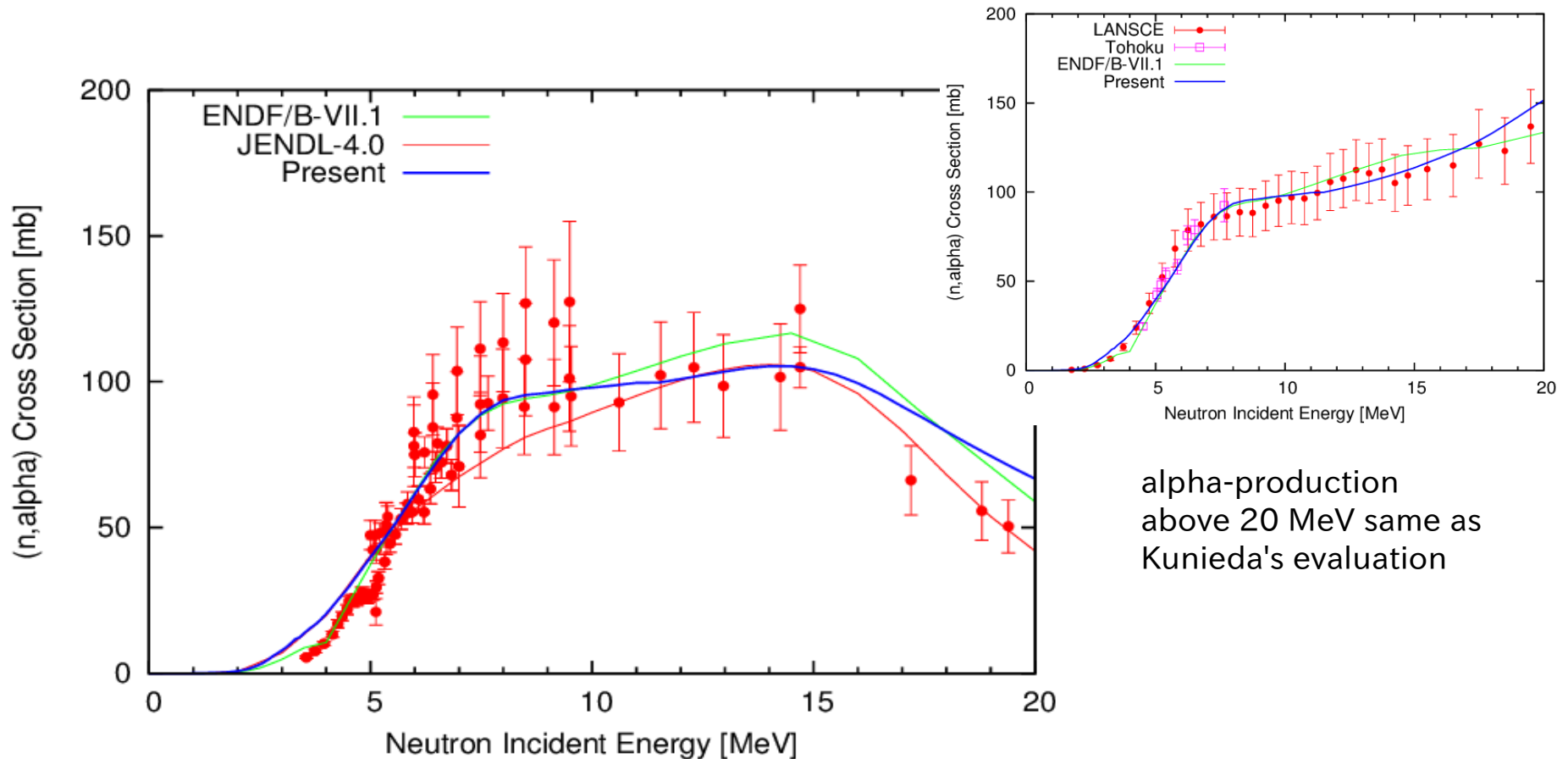
- ENDF/B-VII.1 Ar40 = JENDL-3.2 evaluated in 1994
 - New GEANIE data available [S. MacMullien et al. PRC85,064612 (2012)]
 - TUNL new (n,p) data
 - Issue of EPMAX > Q-values; particle energy spectra given in MF=5



- New evaluation with the CoH3 code
 - Resonance (JENDL-3.2) up to 1.5MeV
 - Cross sections were fitted to available experimental data
 - Angular and energy distributions were recalculated for better energy conservation

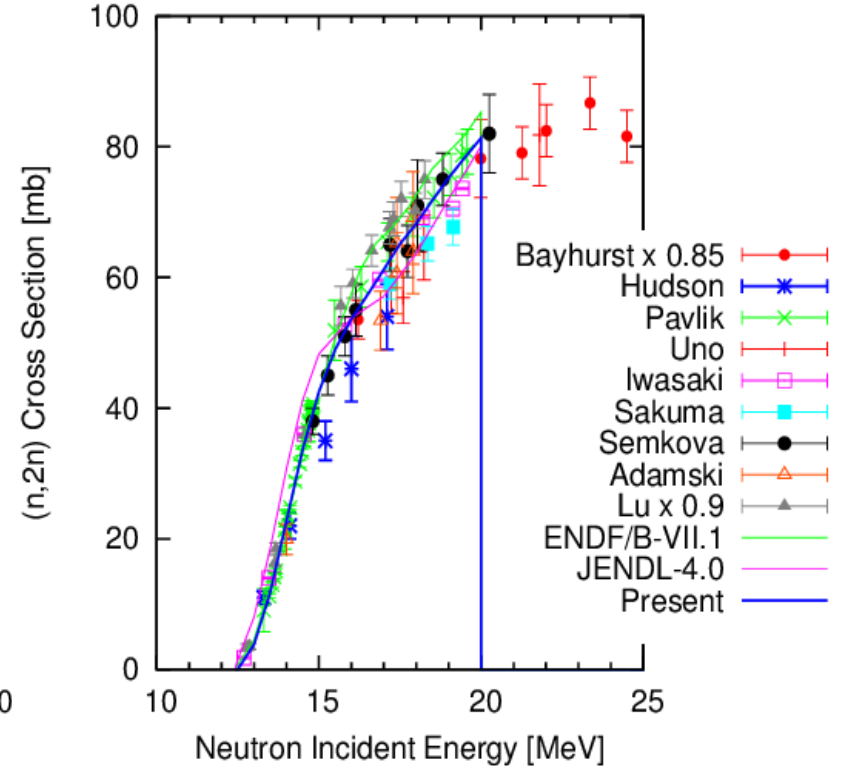
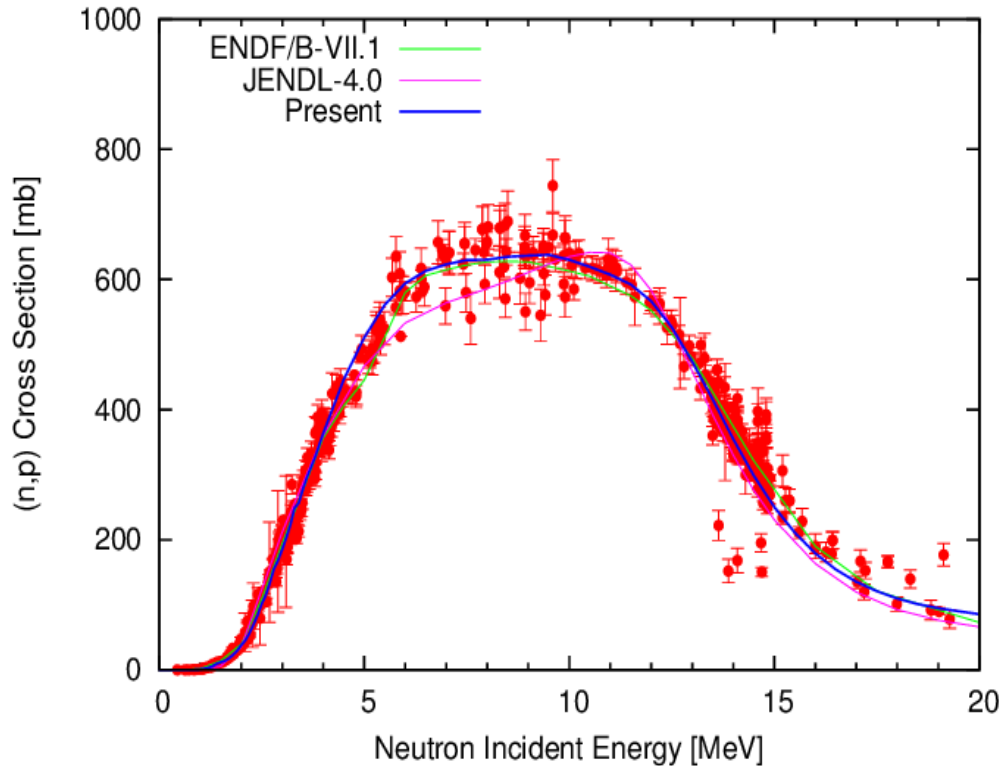


Ni-58(n,alpha) Reaction Cross Section



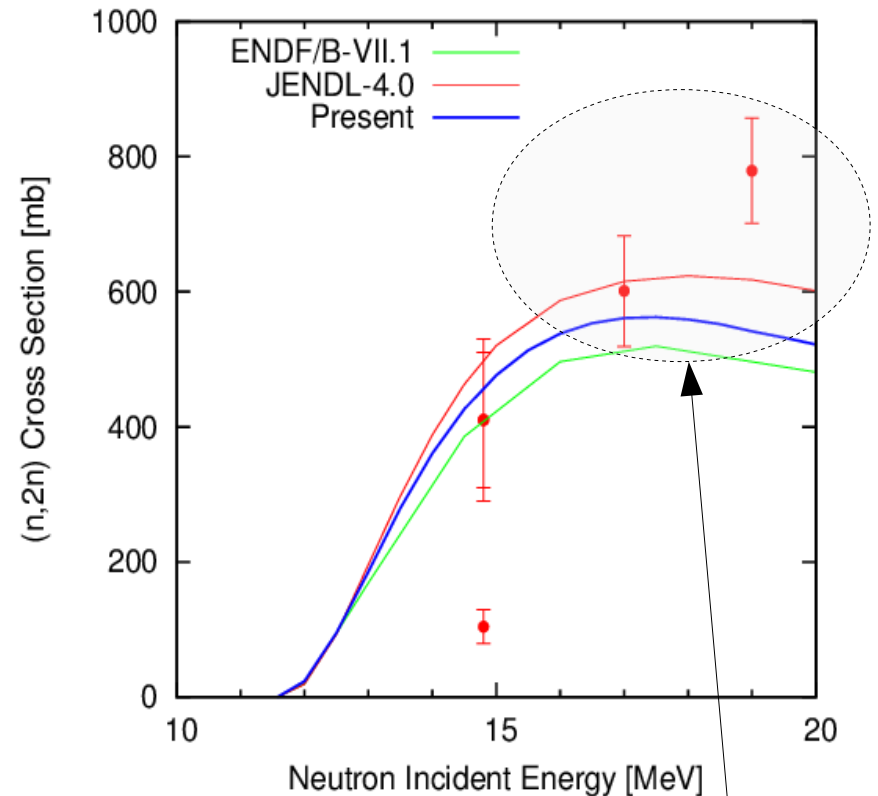
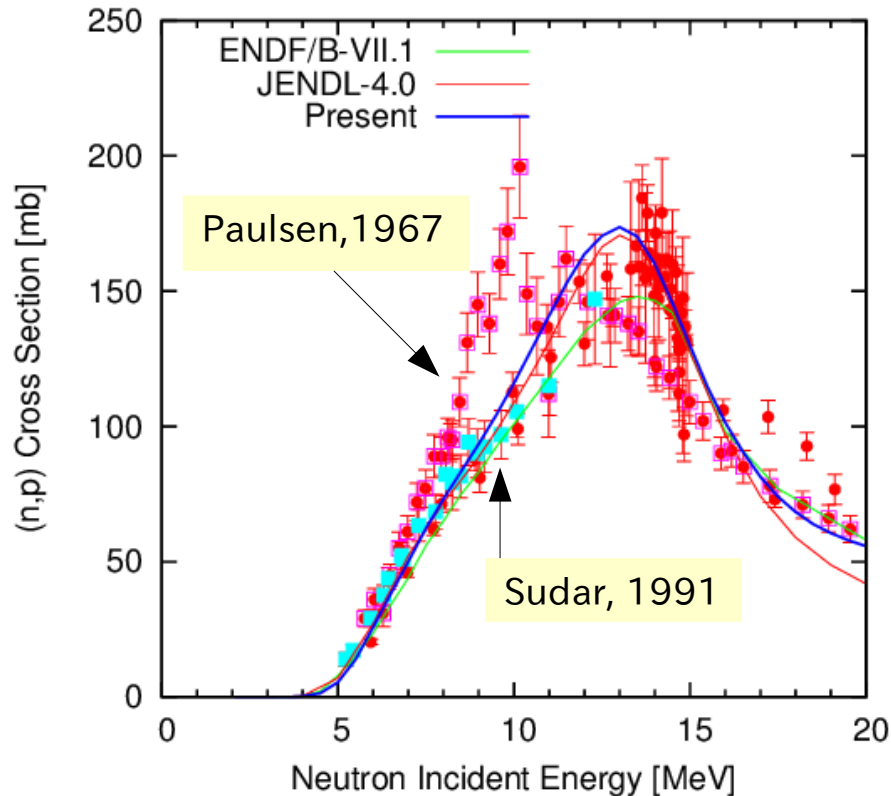
alpha-production
above 20 MeV same as
Kunieda's evaluation

Ni-58(n,p) and (n,2n) Reaction Cross Sections



IRDF2002 is the same as ENDF/B-VII (VI)

Ni-60(n,p) and (n,2n) Reaction Cross Sections

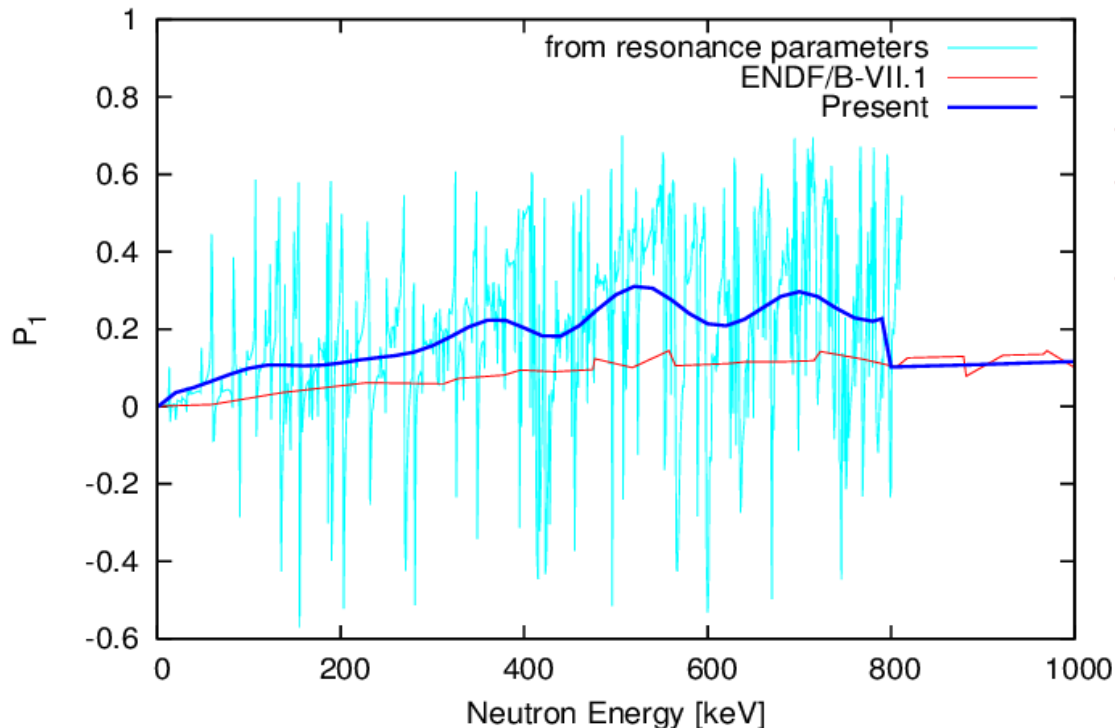


Mass spec data by Wallner, increasing

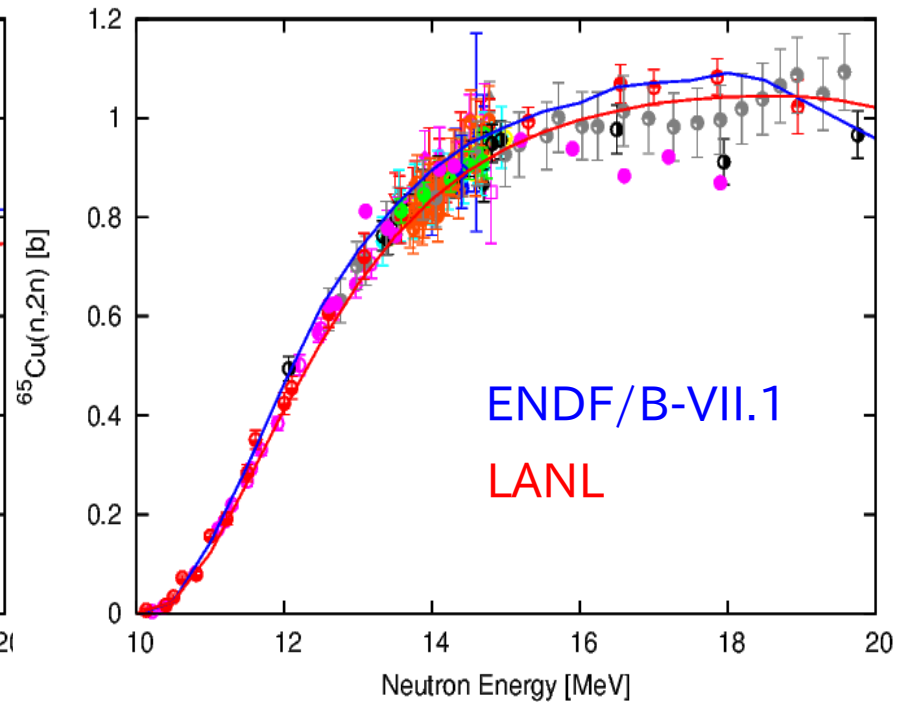
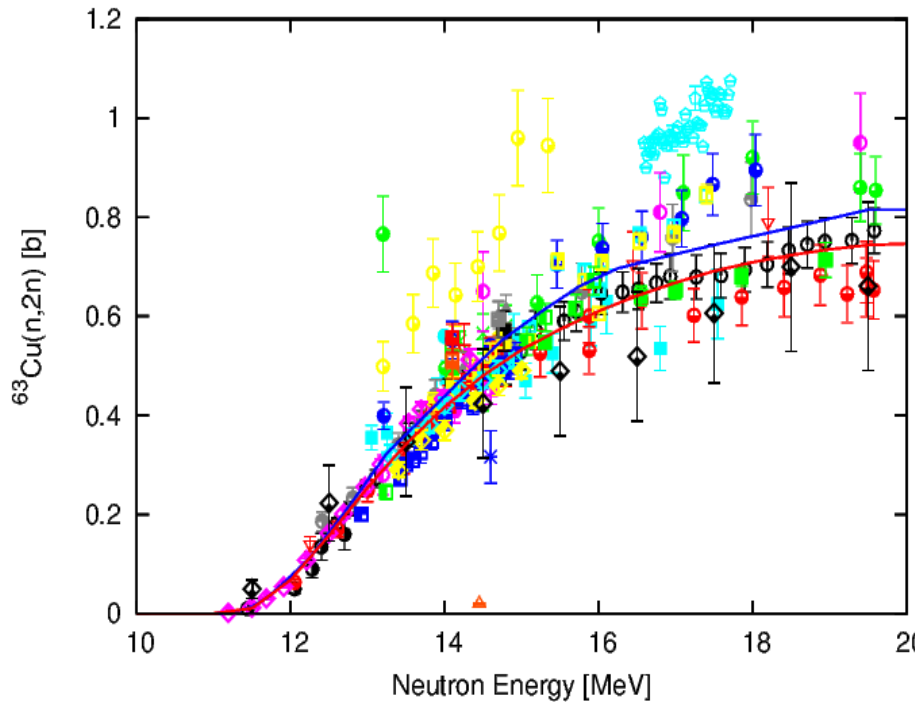
Elastic Scattering Angular Distribution

- Elastic scattering angular distributions at low energies

- Reconstructed from R-M resolved resonance parameters using BB formula, and smoothed
- Ni58 and 60 only
- Produced more forward-peaked scattering ang. dist.
- Method developed under WPEC/SG35 enables us to go beyond RRR

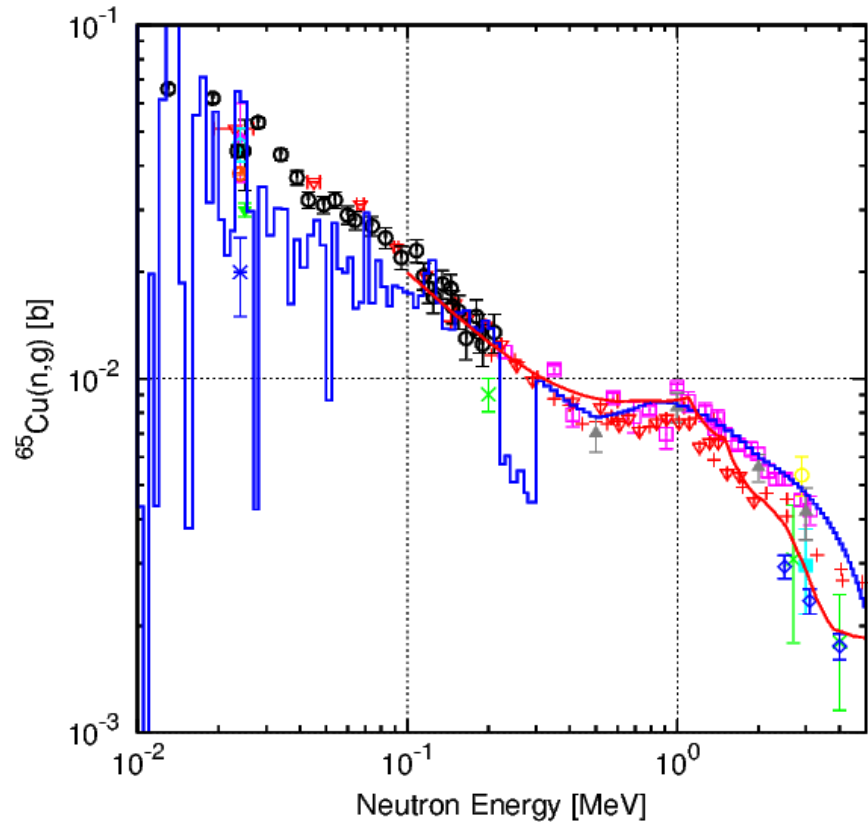
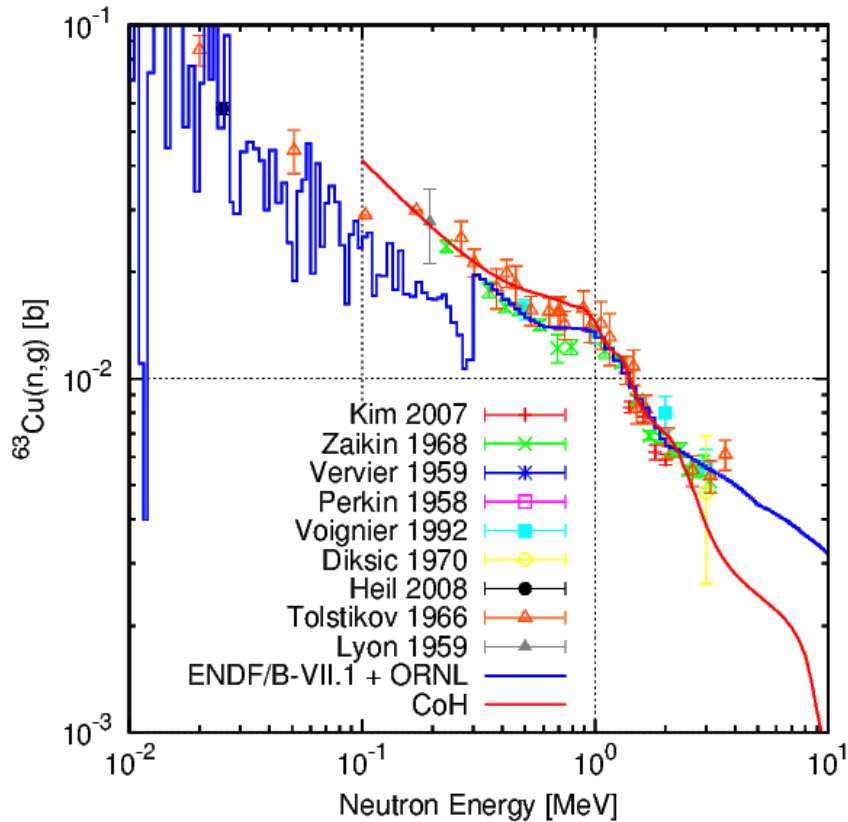


Cu-63, 65 (n,2n) Cross Section

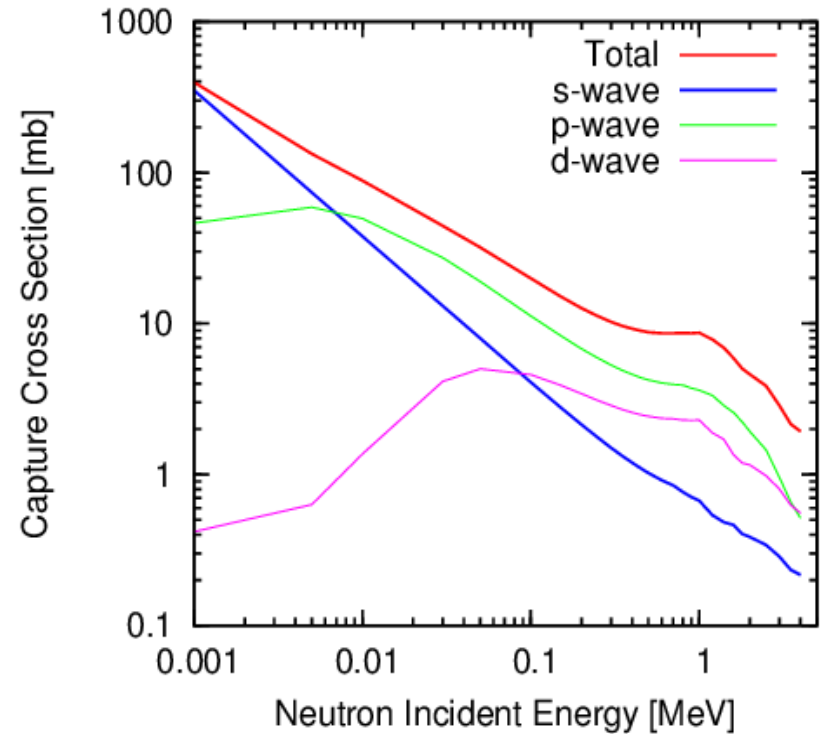
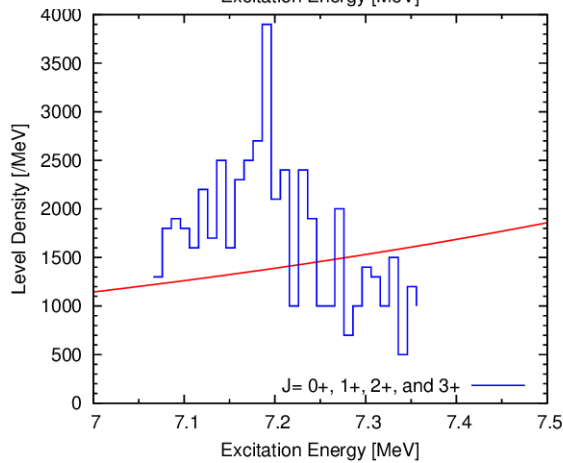
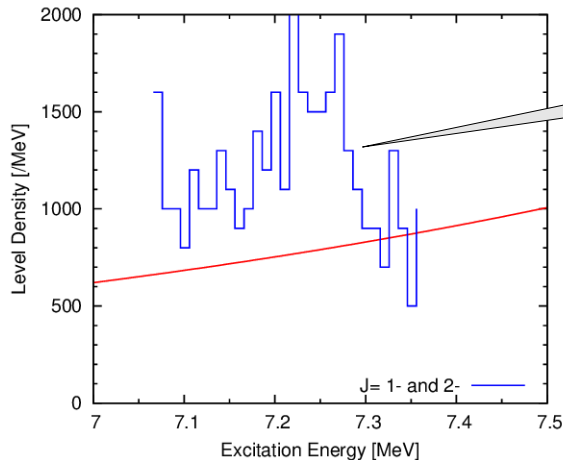


Note: some experimental data were re-normalized

Cu-63, 65 Capture Cross Section

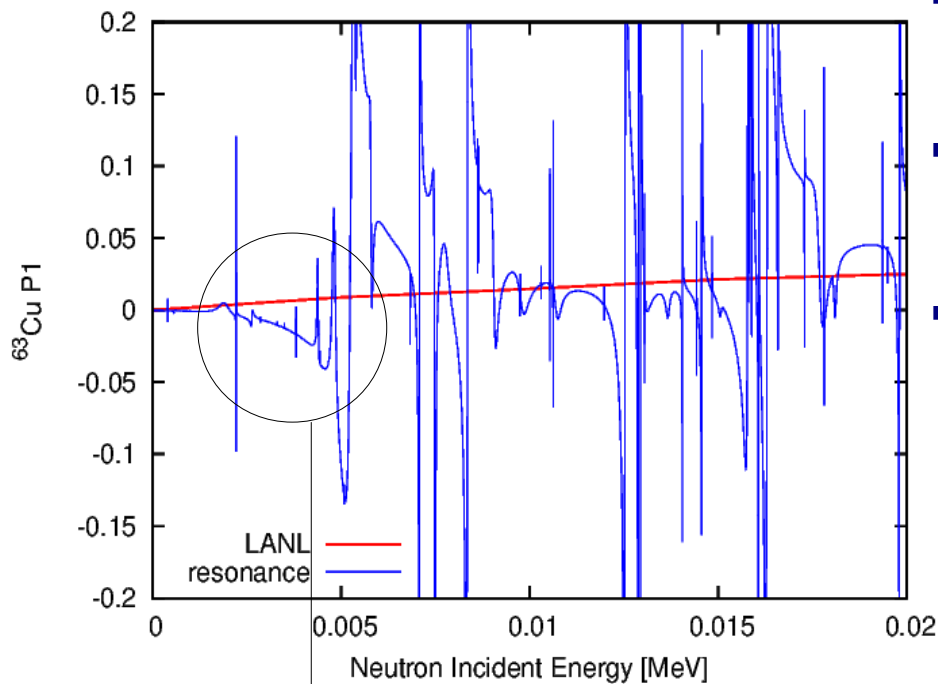


Missing Resonances (Cu-65 case)



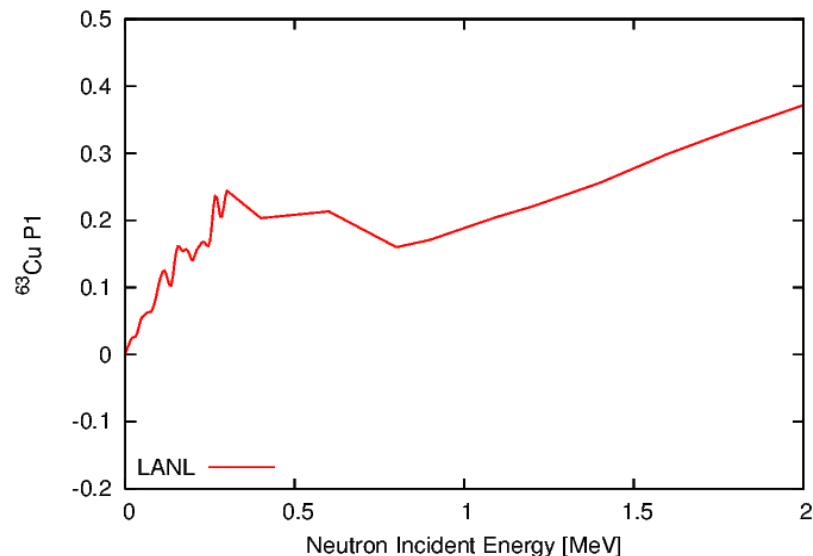
neutron partial wave contribution

Cu-63 Elastic Scattering Angular Distributions



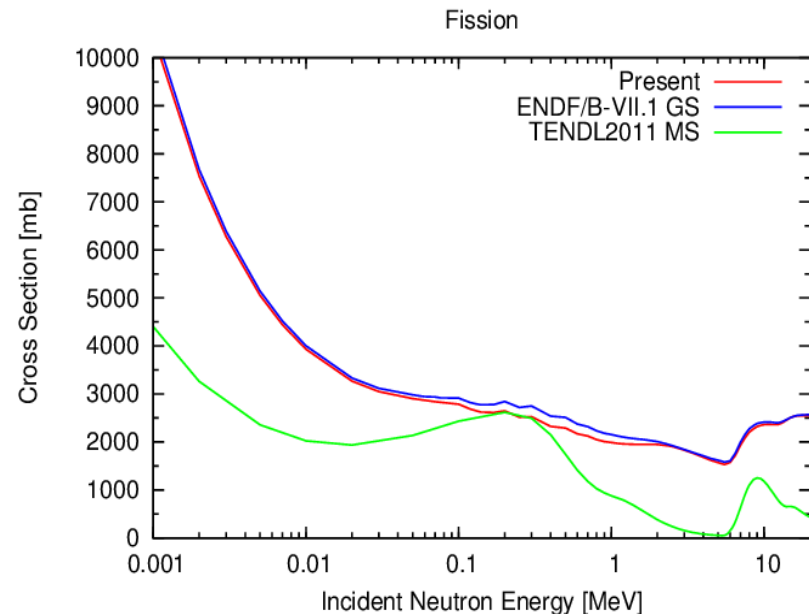
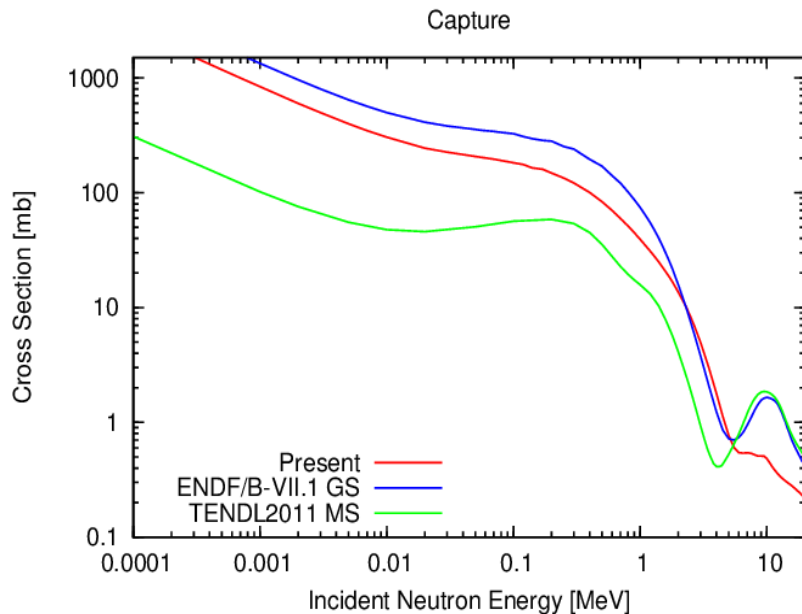
negative P1,
due to a large p-wave
resonance at 5.4 keV

- up to 300 keV
 - from resonance parameters, 5.4 keV p-wave resonance removed, then smoothed
- 300 - 800 keV
 - method developed at WPEC/SG35
 - Kawano, Brown, JNST 52, 254 (2015)
- above 800 keV
 - coupled-channels calculation



Np-236m Evaluation, Excitation Energy of 60 keV

- Short-lived actinides in isomeric state
 - CoH3 calculation adjusted to JENDL-4 Np236g data
 - Change the target state into the first excited state
 - Differences mainly come from different spins



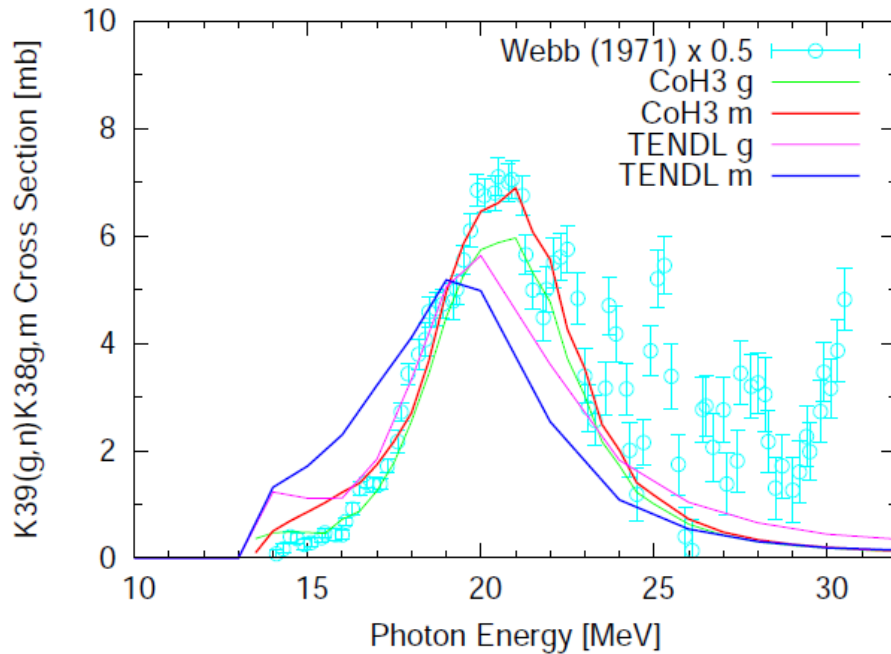
Some Comments on the Reaction Databases

- **ENDF/B-VII.1 Neutron Library**
 - Main focus is radiation transport calculations
 - radio-isotope production cross sections are often not given
 - not capable for material activation calculations
 - no direct link to the decay and structure data libraries
 - excitation energies sometimes inconsistent
 - photon-production data are largely missing
 - High energy data (20 - 150 MeV, LA150)
 - for important materials by Chadwick et al. in late 1990s
 - some updates by Kunieda, but no leading programs to work on it
- **Photon Induced Reaction Data**
 - 163 materials given (in the lumped format)
 - Many of them were evaluated in 1999, KAERI/IAEA/LANL collaboration
 - Some actinide files updated, CEA(Saclay) and LANL in 2005

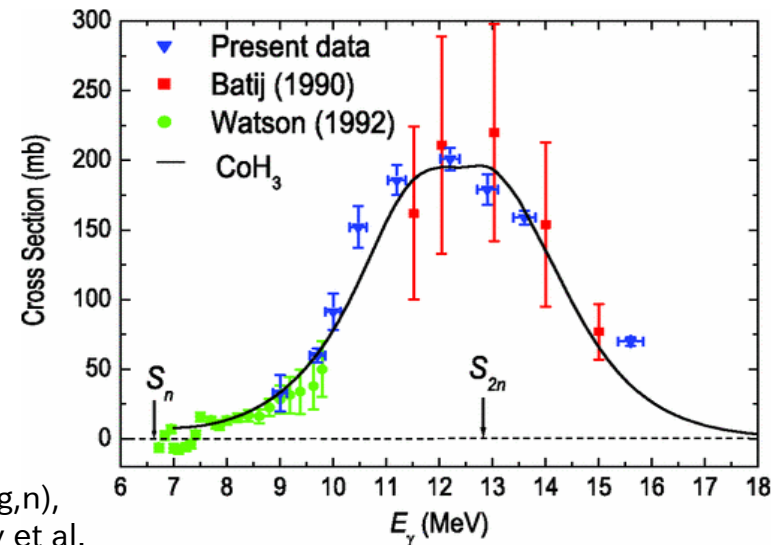
Statistical Hauser-Feshbach Calculation for Photo Reaction

Photo-induced reaction

- All individual reaction channel cross sections given
- Produce all the radio-isotopes in the residual nuclides
 - calculation requires nuclear structure database (RIPL-3) to identify the meta-stable states



Am241(g,n),
 Tonchev et al.
 Phys. Rev. C 82, 054620 (2010)



Other Candidates

- **As-74**
 - LLNL/KAERI file has a format issue
 - ENDF-6 file at LANL available
- **Ne-20, 22**
 - S. MacMullin, PRC 86, 067601 (2012)
- **Re-185,187**
 - format issue
 - GEANIE data analysis underway

