Contribution ID: **16** Type: **Contributed Talk**

Constructing a calibration standard for photoneutron measurements by extracting cross sections of the giant-dipole resonance response in the heavy nucleus 169Tm

Monday, 24 November 2025 17:05 (15 minutes)

We are constructing a cross-section calibration standard for photo-neutron reactions, by obtaining high-precision (γ,1n) and (γ,2n) cross sections. Photo-absorption reactions are when a nucleus absorbs electromagnetic radiation of energies around 10-20 MeV, exciting the isovector giant dipole resonance (GDR) response in the nucleus. Most heavy nuclei decay by emitting neutrons which are the experimental signature. However, neutron detection is difficult since they are uncharged and there is sometimes one or two emitted in the reaction meaning that the efficiency can be hard to quantify. Our measurement uses ^{169}Tm as a target since its (γ,1n) and (γ,2n) reactions result in unstable nuclei with well-understood decays with characteristic γ rays: ^{168}Tm and ^{167}Tm, respectively. The photo-activation measurement was carried out at the γELBE Bremsstrahlung-creation facility in Dresden, Germany. Both (γ,1n) and (γ,2n) reactions were observed using irradiations at different electron energies, meaning (γ,1n) and (γ,2n) cross-sections can be determined. Once we extract the cross-sections, this nucleus will be used as a calibration standard for other photo-absorption measurements. An explanation of our project, the experiment, and analysis methods will be given at ANPC.

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Session Classification: Session 4

Track Classification: Nuclear Structure, Reactions and Dynamics