



Contribution ID: 49

Type: Oral

## Comprehensive Test of the Brink-Axel Hypothesis in the Energy Region of the Pygmy Dipole Resonance

Tuesday, 18 July 2023 17:25 (15 minutes)

The validity of the Brink-Axel hypothesis [1,2], which is especially important for numerous astrophysical calculations, is addressed for  $^{116,120,124}\text{Sn}$  below the neutron separation energy by means of three independent experimental methods. The  $\gamma$ -ray strength functions (GSFs) extracted from primary  $\gamma$ -decay spectra following charged-particle reactions with the Oslo method [3] and with the Shape method [4] demonstrate an excellent agreement with those deduced from forward-angle inelastic proton scattering at relativistic beam energies [5].

In addition, the GSFs are shown to be independent of excitation energies and spins of the initial and final states.

The results provide the critical test of the generalized Brink-Axel hypothesis in heavy nuclei, demonstrating its applicability in the energy region of the pygmy dipole resonance. The latter aspect is of particular interest for the study of the effect of the pygmy dipole resonance on the cross-section of the astrophysical neutron capture r-process.

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[3] A. C. Larsen *et al.*, Phys. Rev. C 83, 034315 (2011)

[4] M. Wiedeking *et al.*, Phys. Rev. C 104, 014311 (2021).

[5] S. Bassauer *et al.*, Phys. Rev. C 102, 034327 (2020).

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**Session Classification:** Session 7B

**Track Classification:** Fundamental Symmetries and Interactions