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Photon Strength Function Studies: Progress and Outlook

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Significant progress has been made in the study of photon strength functions (PSF) over the last few years. The nature of the so-called low-energy enhancement of the PSF is being unraveled. In addition, PSF and nuclear level density (NLD) measurements have provided unprecedented constraints on nucleosynthesis processes through much improved neutron capture cross sections. The successful development of novel experimental and analytical techniques now allows for the investigations of previously inaccessible nuclei and improved reliability of results.

In this presentation, I will review recent experimental and analytical developments to study PSFs and NLDs at radioactive and stable ion beam facilities with a particular focus on the inverse-Oslo [1] and Shape methods [2]. The latter determines the functional form of the PSF and the slope of the NLD, which can be obtained simultaneously, even in the absence of neutron resonance spacing data.

I will further discuss the current understanding of the underlying nuclear structure responsible for the low-energy enhancement and will demonstrate the power of PSF and NLD measurements to constrain nucleosynthesis processes and astrophysical environments for the production of 180Ta [3] and 138La [4] p-nuclei. In light of the many new and improved experimental facilities and capabilities now available across the world, I will conclude by exploring prospects for future PSF measurements.

[1] V.W. Ingeberg et al., Eur. Phys. J. A 56, 68 (2020).
[2] M. Wiedeking et al., Phys. Rev. C 104, 014311 (2021).
[3] K.L. Malatji et al., Phys. Lett. B 791, 403 (2019).
[4] B.V. Kheswa et al., Phys. Lett. B 744, 268 (2015).

Primary author: Prof. WIEDEKING, Mathis (iThemba LABS and University of the Witwatersrand)

Presenter: Prof. WIEDEKING, Mathis (iThemba LABS and University of the Witwatersrand)

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