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The Oslo Method at iThemba LABS

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The Oslo Method is a powerful tool that allows for detailed studies of the Nuclear Level Density (NLD) and γ -ray strength function (γ SF) at energies below the neutron separation energy. In the last decade, several Oslo Method experiments have been performed at iThemba LABS, most notably with inverse-kinematics. Coupling the Oslo Method with inverse kinematics allows for study of nuclei that otherwise would have been inaccessible due to chemical properties or short half-life.

The first ever inverse-Oslo method experiment was performed at iThemba LABS in 2015 where an ⁸⁶Kr beam impinged on a deuterated polyethylene target [1]. Following the success of this experiment two more inverse-kinematics experiments was performed with ⁸⁴Kr and ¹³²Xe beams, to study the NLD and γ SF of ⁸⁵Kr and ¹³³Xe, respectively.

It has been suggested that for very hot plasmas the nucleus should interact with electrons (Nuclear Plasma Interaction/NPI), as the level spacing within the quasi-continuum would be on a similar scale as the electron energies [2]. The strength of the interaction would be strongly affected by the magnitude of the γ SF at low energy and accurate measurement of the low energy region of the γ SF is critical to give accurate theoretical estimates for the magnitude of this effect. The effect of NPI has been tested on ¹³³Xe at Lawrence Livermore National Laboratory [2], which is the main motivation for measuring the γ SF and NLD of ¹³³Xe.

The reason for investigating the NLD and γ SF of 85 Kr is due to the significant structural changes that nuclei near magic numbers typically undergo. By examining NLD and γ SF data for N = 49 and N = 51 isotopes of Kr, valuable information about these structural changes can be revealed. Additionally, the mass region around A ~ 80 is important for nucleosynthesis, as 85 Kr functions as a branching point nucleus for the s-process, and nuclei within this range can have an impact on the weak r-process. Therefore, the existence of a low energy enhancement in this region could have a significant impact on nucleosynthesis models [3].

In this talk I will present the results of inverse-Oslo experiments performed at iThemba LABS, as well as the NLD and γ SF of 63 Ni, which has been measured with the Oslo Method with normal kinematics at iThemba LABS [4].

[1] V. W. Ingeberg et al., EpJ A 56, 68 (2020)

- [2] D. L. Bleuel et al., Plasma and Fusion Research 11, 3401075 (2016)
- [3] A. C. Larsen and S. Goriely, Phys. Rev. C 82, 14318 (2010)
- [4] V. W. Ingeberg et al., Phys. Rev. C 106, 054315 (2022)

Attendance Type

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