Contribution ID: **280** Type: **Oral**

Testing indirect experimental methods for constraining the 193,194Ir(n,γ) cross sections

Wednesday, 29 November 2023 15:05 (15 minutes)

Abstract

As much as nucleosynthesis or element formation is concerned, almost all the nuclei heavier than iron have been made in part by the slow neutron capture and the rapid neutron capture processes (≈ 50% each), respectively known as the s- and r- processes [1].
The neutron capture reactions 192Ir(n,γ)193Ir and 193Ir(n,γ)194Ir are indirectly studied by analysing data obtained from the Oslo Cyclotron Laboratory (OCL). These data will allow for the study of 193,194 Ir iso- topes, from the 192Os(α,tγ) and 192Os(α,dγ) reactions, respectively. The 193Ir(n,γ)194Ir cross sections which will be constrained by our measurement will provide a comparison to existing (n,γ) measurement data [2].
In addition, the 192Ir(n,γ)193Ir reaction is a branching point in the s-process making it very interesting, but it is challenging to measure the (n,γ) cross section directly since 192 Ir is unstable. Therefore the OCL data may provide very valuable information on the 192Ir(n,γ)193Ir cross section by indirectly constraining it with the experimental nuclear level density (NLD) and γ-strength function (γSF).
An array of Sodium Iodine (NaI)Tl detectors, called CACTUS, detected γ-rays and the silicon particle telescope array, called SiRi, was used to detect charged particles in coincidence. The NLDs and γSFs are being extracted below the neutron separation energy, Sn, using the Oslo Method [3]. Furthermore, the NLDs and γSFs will be used as inputs in the open-source code called TALYS to calculate cross-sections of 193,194 Ir. I will provide preliminary results of the measured NLDs and γSFs from the 192Os(α,dγ)194Ir reaction which will be used as inputs in the code TALYS to calculate cross-sections of 193,194Ir.

[1] Arnould, M., Goriely, S., and Takahashi, K. (2007). Physics Reports, 450(4-6), 97-213.
[2] Zerkin, V. V., and Pritychenko, B. (2018). The experimental nuclear reaction data (EXFOR) 888, 31-43.
[3] Schiller, A., Bergholt, L., Guttormsen, M., Melby, E., Rekstad, J., and Siem, S. (2000). Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 447(3), 498-511.

This work is based on the research supported by the National Research Foundation of South Africa (Grant Number:PMDS22070734847) and SAINTS Prestigious Doctoral Scholarship.

Attendance Type

In-person

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Session Classification: Session 3

Track Classification: Nuclear Structure, Reactions and Dynamics