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

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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 ($\approx 50\%$ each), respectively known as the s- and r- processes [1]

The neutron capture reactions ^{192}Ir(n,γ)^{193}Ir and ^{193}Ir(n,γ)^{194}Ir are indirectly studied by analysing data obtained from the Oslo Cyclotron Laboratory (OCL). These data will allow for the study of ^{193,194} Ir isotopes, from the ^{192}Os(α,tγ) and ^{192}Os(α,dγ) reactions, respectively. The ^{193}Ir(n,γ)^{194}Ir cross sections which will be constrained by our measurement will provide a comparison to existing (n,γ) measurement data [2].

In addition, the ^{192}Ir(n,γ)^{193}Ir 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 ^{192}Ir(n,γ)^{193}Ir 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, S_n, 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 ^{192}Os(α,dγ)^{194}Ir reaction which will be used as inputs in the code TALYS to calculate cross-sections of ^{193,194}Ir.

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