Evaluation of the neutron capture reaction on ^{79}Se via a surrogate reaction of d(^{79}Se, p) reaction at OEDO

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^{79}Se placed on the path of s-process nucleo-synthesis is important as a stellar thermometer because of the direct β decay channel from the isomeric state in ^{79}Se [1]. The neutron capture reaction cross section on the nucleus must be evaluated to determine the reaction path more directly. However, it has never been attempted due to difficulty to fabricate a radioactive target of ^{79}Se.

For the (n,γ) reaction on ^{79}Se at the astrophysical energy, the compound reaction channel is dominant. Up to date, as an indirect method to determine the (n,γ) cross section of compound reaction channel, the surrogate technique in which the corresponding compound state is populated via an alternative transfer reaction has been employed with measuring the γ rays from the compound state to determine the γ emission channel [2]. Although many studies to determine the transition path from the unbound state have been carried out, the final result was model-dependent.

Instead of measuring γ rays, we have measured the (d, p) reaction on ^{79}Se in inverse kinematics with the OEDO beam line which can provide the low-energy RI beam with a small beam spot size at RIBF [3]. The recoiled particles were analyzed with the SSD-CsI(Tl) telescope array TiNA, which determined the excitation energy of the compound state. The residual nuclei were analyzed via the SHARAQ spectrometer. The γ emission channel was deduced by comparing the amount of ^{80}Se with all the reaction products of (d, p) reaction because γ emission means that the residual nucleus didn't change either proton nor neutron number. With the experimental γ emission probability, the neutron capture reaction on ^{79}Se were evaluated as a function of the neutron energy. In this talk, the detailed experimental setup and result will be discussed.

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[2] A. Ratkiewicz, et al., PRL 122, 052502 (2019) and references therein.
[3] S. Michimasa et al., PTEP accepted (2019).