Extracting the nuclear level density and γ-ray strength function of ^{90}Zr using the Oslo method

L.T. Bell[1], S. Siem[1], A.C. Larsen[1]

[1] Department of Physics, University of Oslo, Norway

The nuclear physics group at the University of Oslo (UiO) and the Oslo Cyclotron Laboratory (OCL) have developed a method, known as the Oslo method, to extract the nuclear level density(NLD) and Gamma-ray strength function (GSF). These quantities are important because they are inputs that are used in the Hauser-Fesbach statistical model calculations. These calculations are used to predict reaction cross-sections. The experimentally measured quantities can be used as inputs in codes, such as TALYS [1], to calculate/constrain the (n, γ) cross-sections.

An experiment was performed at the OCL using the CATCUS detector array and the $^{90}Zr(p, p'\gamma)^{90}Zr$ reaction was studied. In neighboring zirconium isotopes ($^{91,92,94}Zr$) an M1 resonance was found at 9 MeV [2], and thus the aim of this experiment was to investigate whether this resonance is seen in ^{90}Zr. Therefore, using the Oslo method, the NLD and GSF for this reaction was extracted below the neutron separation energy.

The results from this analysis are presented here. As ^{90}Zr does not have any neutron resonance spacing data available, one can use systematics to estimate the neutron resonance spacing or use the shape method [3] to obtain the slope of the GSF and thus the NLD when using the Oslo method. In this work, the systematics have been used for the normalization and are compared with the Shape method results. Furthermore, the NLD and GSF from this work have been used to calculate the $^{89}Zr(n, \gamma)^{90}Zr$ cross-section using TALYS [1].

References

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