Experimental report

30/04/2019

Proposal: 3-17-20 **Council:** 4/2018

Title: Study of highly-excited low-spin states in 118,120Sn using (n,gamma) reactions

Research area: Nuclear and Particle Physics

This proposal is a new proposal

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Samples: 117Sn
119Sn

Instrument	Requested days	Allocated days	From	To
FIPPS	14	7	04/06/2018	11/06/2018

Abstract:

We propose to investigate the shape coexistence and the Pygmy Quadrupole Resonance in the neutron-rich 118,120Sn nuclei through a high-statistics (n,g) measurement on enriched 117,119Sn targets. The multipolarity of the weak gamma rays previously observed in the EXILL experiment could then be established exploiting the angular correlation and especially the polarization deduced from the scattering of gamma rays among the Ge crystals of the clover detectors of the FIPPS setup. We performed a successful (n,g) measurement for 124Te in early 2017, which will allow to assign spins/parities to many transitions around the band-head of the 2p-2h intruder band. We will study 116Sn in the autumn of 2017. The measurement of 118,120Sn will complete the study of the unique sequence of 116,118,120Sn semi-magic nuclei.
The sub-commitee encouraged us to re-submit the proposal for 118,120Sn, suggesting to start with 116Sn only, and to submit a continuation proposal in a later round. As the accepted proposals of the present call will be scheduled in 2018, we re-submit the proposal to measure using FIPPS and (n,g) reactions the angular correlations and polarization of the transitions of 118,120Sn.

The measurement for the proposal 3-17-9, ”Multitude of discrete states observed in 116,118,120Sn from neutron capture reactions: evidence for pygmy quadrupole resonance”, has been performed successfully on the FIPPS instrument at ILL, Grenoble in the periods 22.03.2018-28/03.2018 for 116Sn and 04.06.2018 – 11.06.2018 for 118,120Sn.

We performed measurements with three targets, one of 115Sn of 10 mg, 50% enrichment, one of 117Sn of 300 mg, 97% enrichment, and one of 119Sn with a total mass of 500 mg (250 mg with 95% enrichment, 100 mg with 93% enrichment and 150 mg with 84% enrichment).
The setup for the measurement on 115Sn was composed of 8 clovers HPGe at 9 cm from the target position (without AC)+16 LaBr3 (1.5"x1,5").

The FIPPS instrument worked very well and the neutron beam was as required.
The data are sorted into various 2-and 3-D histograms to extract experimental information on the new identified transitions, including angular correlation and polarisation. The lifetime data obtained on the measurement on 115Sn have been already analyzed and allowed the extraction of the lifetime of the second transition of the 2p-2h intreuder band of 116Sn, confirming the assignment of the 0+_3 state as bandhead. The results were published in Phys. Rev. C 99 (2019) 024303.

The data analysis is in good progress, being performed by two PhD students from Simon Fraser University, Burnaby, Canada.