



Contribution ID: 76

Type: Oral presentation

Search for near-threshold multi-neutron resonances in (p,2p) reactions with neutron-rich nuclei at R3B

Thursday, 27 June 2024 11:40 (20 minutes)

In order to constrain the largely unknown multi-neutron interactions, it is necessary to measure the relevant observables sensitive to them. One such property is the possible existence of narrow resonances related to multi-neutron cluster structures and correlations^{[1][2]}. This can be investigated by studying multi-neutron resonances close to the corresponding neutron removal thresholds in neutron-rich light nuclei. Progress over the recent years has presented several evidences of such narrow resonances^{[3][4][5]}, which provides an indication for the generalization of the Ikeda conjecture.

With the aim of systematically studying such resonances and characterizing the corresponding nn-relative system, an experiment was performed at the R³B setup in GSI, within the FAIR Phase-0 program. Quasi-free scattering (*p, 2p*) reactions are studied in inverse kinematics where a radioactive ion “cocktail” beam is impinged on a 5cm LH₂ target. The resulting reaction products are measured in the state-of-the-art setup using a large combination of detector systems providing information of the full reaction kinematics. Since the objective is to reconstruct the relative energies of the neutrons excited to the continuum, it is necessary to detect the corresponding neutrons. This is facilitated by the neutron detector NeuLAND^[6], which thanks to its high resolution and granularity provides access to the detailed study of multi-neutron resonances. A brief description of the first 2-neutron reconstruction will be provided.

In this communication the results of the nn-relative energies for selected isotopes in the “cocktail” beam will be discussed along with relevant spectroscopic information. The discussion will include the analysis of the ¹⁵B(*p, 2p*)¹⁴Be system with the near threshold 2₁⁺ state of ¹⁴Be^{[3][7]} as a standardizing tool. This will be followed by a discussion on the study of ¹⁷B populated via ¹⁸C(*p, 2p*)¹⁷B reaction, serving as an isotope of interest for the current study owing to a previous indication of a possible near threshold state^[8].

[1] K. Ikeda et al. Progress of theoretical physics supplement, E68,(1968) 464-475.

[2] J.Okolowicz et al. Progress of theoretical physics supplement, 196,(2012) 230-243.

[3] T. Sugimoto et al. Phys. Lett. B, 654, (2007) 160.

[4] Y. Kondo et al. Phys. Rev. Lett., 116, (2016).

[5] A. Revel et al. Phys. Rev. Lett., 124, (2020).

[6] K. Boretzky et al. Nucl. Instr. and Meth. A, 1014, (2021) 165701.

[7] B Godoy. Structure and neutron decay of the unbound Beryllium isotopes 15,16Be. Normandie Université, 2019. NNT : 2019NORMC254. tel-02518505.

[8] J. Gibelin. États résonants de noyaux loin de la stabilité. Physique Nucléaire Expérimentale. Université de Caen Normandie, 2018. tel-01729016

Collaboration

R3B Collaboration

Primary author: MOZUMDAR, Nikhil (Technische Universität Darmstadt, Helmholtz Forschungsakademie Hessen für FAIR)

Co-authors: BARRIÈRE, Antoine (Grand Accélérateur National d'Ions Lourds (GANIL)); FEIJOO, Martina (Universidad de Santiago de Compostela(USC)); SORLIN, Olivier (Grand Accelerateur National d'Ions Lourds

(GANIL)(GANIL)); AUMANN, Thomas (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI), Technische Universität Darmstadt, Helmholtz Forschungsakademie Hessen für FAIR)

Presenter: MOZUMDAR, Nikhil (Technische Universität Darmstadt, Helmholtz Forschungsakademie Hessen für FAIR)

Session Classification: Thursday morning 2