



Contribution ID: 380

Type: **Contributed Oral Presentation**

Reduction of the $Z=6$ spin-orbit splitting in ^{20}O : Probing the effects of the tensor force.

Thursday, 29 May 2025 11:40 (15 minutes)

Shell evolution is an emergent phenomena driven by the residual interactions, in particular by the monopole terms of the nuclear force. One of the most influential ones is the tensor force, which is attractive between antialigned spin orbits (and viceversa), and is well known for the emergence of the $N=16$ in place of the traditional $N=20$ magic number in n -rich Oxygens [1]. Exploring the evolution of other gaps is crucial for a proper understanding of this term. In particular the evolution of the $Z=6$ gap has brought quite attention in recent years, as it has been claimed its prevalence in neutron-rich carbon isotopes [2], a result that contradicts the intuitive effect of the tensor force and theoretical predictions [3]. This result has also been questioned by later measurements [4].

In order to shed more light into this subject, the structure of ^{20}O was investigated through the proton-removal $d(^{20}\text{O}, ^3\text{He})$ reaction. The experiment was performed in 2022 at the LISE3 spectrometer based at GANIL, which delivered a ^{20}O beam at 35 AMeV with an intensity of $2 \cdot 10^4$ pps to the active target ACTAR TPC [5]. The energy of the particles leaving the active volume was measured in the Si pad detectors while the angle was obtained from the reconstruction of the tracks in the gas. The excitation energy spectrum was built with the missing mass technique. This experiment was the first transfer-reaction experiment ever accomplished with ACTAR TPC, and the first $(d, ^3\text{He})$ reaction performed with an active target.

The low-lying structure of ^{19}N revealed multiple π -hole states with $\ell=1$, which was determined from the differential cross-section. The determination of energy and C^2S for all the states allowed a direct determination of the $Z=6$ gap through the Baranger formula. Our results support a reduction of the gap due to the tensor force in agreement with theoretical predictions from [3] using the state-of-the art SFO-tls interaction.

References:

- [1] C. R. Hoffman et al., Phys. Rev. Lett., 100, (2008),152502.
- [2] D.T. Tran et al., Nature Communications, 9, (2018),1594.
- [3] T. Otsuka et al. Phys. Rev. Lett. 95, (2005), 232502.
- [4] I. Syndikus et al., Physics Letters B, 809, (2020), 135748.
- [5] B. Maus et al. Nucl. Instrum. Meth. Phys. Res. A 940, (2019), 01689002.

Primary author: LOIS FUENTES, Juan (FRIB/MSU)

Co-authors: FERNANDEZ DOMINGUEZ, Beatriz (IGFAE/USC); ROGER, Thomas (GANIL)

Presenter: LOIS FUENTES, Juan (FRIB/MSU)

Session Classification: Parallel Session

Track Classification: Nuclear Structure