Contribution ID : **79** Type : **oral contribution**

Probing the rapid onset of deformation below 68Ni through the beta decay of 67Mn

Monday, 27 May 2024 18:20 (20)

One of the best-known divergences from the independent-particle shell model description is the existence of islands of inversion [1]. The IoI of the region N=40 draws particular attention since the neutron number 40 was postulated as a non-traditional "magic" number and N = 40 represents the boundary between the negative-parity pf shell and the positive-parity g shell. In stable nuclei, the
neutron $g_{9/2}$ orbital is close enough to the pf shell to reduce this shell gap resulting in a more stable subshell closure at N = 50. Measurements of B(E2) values and E(2^+) in the neutron-rich region show increased collectivity through the N = 40 shell gap, with the clear exception of ^{68}Ni [2,3].
Deformation and shape coexistence have been identified in the area, LNPS calculations predict triple shape coexistence for ^{67}Co (N=40), with three rotational bands [4]. And, recent experiments on ^{67}Fe (N=41) propose a spin-parity of $5/2^+$ or $1/2^-$ for its ground state [5] which indicates a significant deformation. In addition, shape coexistence is also expected for ^{67}Fe. Despite the high interest in the region, very limited information is available, to this end, an experiment was performed at the TRIUMF-ISAC facility utilizing the GRIFFIN spectrometer [6], where the β and βn decay of ^{67}Mn populated the ^{67,66}Fe, ^{67,66}Co and ^{67,66}Ni isotopes.
This data set contains orders of magnitude more statistics than previous studies allowing us to build for the first time a complete level scheme of ^{67}Fe and ^{67}Ni, and to improve upon the known β- decay level schemes of ^{67}Co, by expanding the number of transitions and levels, as well as by improving the precision of branching ratios and ground-state half-life measurement. In addition, measurements of level lifetimes down to the picosecond range will allow us to investigate the band structure in these nuclei. For the 67Fe isotope, a good level of statistics will make it possible to measure the energy of the identified isomeric state and improve the lifetime measurement.
These results can provide further insight into the structure of the states by comparison to simple models and large-scale shell model calculations to confirm or refute the shape coexistence picture predicted by LNPS calculations and the shrinking of the N=40 gap just one proton below ^{68}Ni.
Preliminary results from the analysis will be presented and discussed.
References
[1] B. A. Brown. Physics, 3:104 (2010).
[2] S. Naimi et al.,Phys. Rev. C 86 (2012), p. 014325
[3] M. Hannawald et al., Phys. Rev. Lett. 82 (1999), pp. 1391–1394.
[4] F. Recchia et al.,Phys. Rev. C, 85:064305 (2012)
[5] M. Sawicka et al., The European Physical Journal A - Hadrons and Nuclei, 16(1):51–54, 2003
[6] Garnsworthy et al., Nucl. Inst. Meths. A 918, 9 (2019)

Primary author(s) : VEDIA, Victoria (TRIUMF); Dr. GARNSWORTHY, Adam B (TRIUMF); OLAIZOLA, Bruno (Grupo de Física Nuclear - Universidad Complutense de Madrid, España); Prof. SVENSSON, Carl (Guelph); Mrs. UMASHANKA, Rashmi; Dr. HACKMAN, Greg

Presenter(s) : VEDIA, Victoria (TRIUMF)

Session Classification : Session 4