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(G*) β-decay of 68Mn: Probing the N=40 Island of Inversion

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Although the shell model forms the backbone of our understanding of nuclear structure, the breakdown of traditional magic numbers far from stability gives insight into the nature of the underlying nuclear interactions and acts as a tool to test existing models. Islands of inversion (IoI) in the nuclear landscape are characterized by the presence of deformed multi-particle multi-hole (*npnh*) ground states instead of the $0p0h$ configurations predicted by spherical mean-field calculations. In the N=40 region, the relatively large energy gap separating the *pf* shell from the neutron $g_{9/2}$ orbital points towards a strong sub-shell closure at N=40, which has been supported by the observation of a high-lying 2^+ state and low $B(E2)$ value in ^{68}Ni (Z=28) [1]. However, systematics of $E(2^+)$ and $B(E2)$ values have indicated a sudden increase in collectivity below Z=28 when approaching N=40, evidenced in the rapid drop of $E(2^+)$ in Fe (Z=26) and Cr (Z=24) isotopes [2,3]. This increase in collectivity around N=40 and Z<28 is thought to be due to the neutron occupation of intruder states from a higher shell, similar to the island of inversion around N=20 [4,5]. Recent studies also suggest the occurrence of a new IoI at N=50 and a proposed merging of the N=40 and N=50 IoIs, equivalent to the one observed between N=20 and N=28 [6,7]. Detailed spectroscopic information of the Fe, Co, and Ni isotopes will be crucial to understand the structure of nuclei near and inside the N=40 IoI and map the bridge between N=40 and N=50. To this end, an experiment was performed at TRIUMF-ISAC using the GRIFFIN spectrometer that utilized the β and βn decay of ^{68}Mn to populate excited states in ^{67,68}Fe, ^{67,68}Co and ^{67,68}Ni. Preliminary results from the analysis which includes an expanded ^{68}Fe level scheme will be presented and discussed.

[1] O. Sorlin et al. PRL (2002)
[2] S. Naimi et al. PRC (2012)
[3] M. Hannawald et al. PRL (1999)
[4] S. M. Lenzi et al. PRC (2010)
[5] Y. Tsunoda et al. PRC (2014)
[6] C. Santamaria et al. PRL (2015)
[7] E. Caurier, F. Nowacki, and A. Poves. PRC (2014)

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