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Complete decay spectroscopy of neutron-rich Cl isotopes with FDSi

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Nucleon-nucleon correlaRons lead to changes in shell structure, such as the islands of inversion. The N=28 shell gap has been frequently probed in nuclei south of 48Ca, finding that intruder configuraRons, which correspond to neutron excitaRons across the gap, play an important role in those neutron-rich isotopes at low energy. The locaRon of the states is related to the neutron shell structure, and has been studied as a driver for the deformaRon of 44S and 42Si. On the other hand, higher-lying states corresponding to proton excitaRon across the Z=20 shell gap havebeenunchecked. ConvenRonally,innucleiwithN~28andZ<20,theFermisurfacesfor neutrons and protons are located within the pf and sd shells, respecRvely. The selecRvity of beta-decay moRvates decay strength measurements to probe the nuclear shell effects of the parent and daughter nucleus. States populated by the conversion from a pf neutron to a pf proton in the Gamow-Teller transformaRons give good insight into the Z=20 shell gap, while also playing a crucial role in determining fundamental beta-decay properRes.

In this contribuRon, I will present the first complete measurement of the beta-decay strength distribuRon of chlorine isotopes performed at FRIB. The measurements uRlized the two focal plane system of the FRIB Decay StaRon IniRator (FDSi[1]), with a combinaRon of high-resoluRon neutron (NEXTi) and gamma-ray (DEGAi) spectroscopy data alongside total absorpRon spectroscopy data (MTAS). The complete decay strength is extracted for argon isotopes and compared to large-scale shell model calculaRons using the SDPF-MU interacRon. In the decay of 45Cl, this sensiRve approach found that a reduced Z=20 shell gap best reproduced the data. The experimental findings exemplify the ability of Gamow-Teller transiRons to populate states associated with proton excitaRon across major shells, allowing for the first benchmark of the Z=20 shell gap along N=28 below 48Ca.

[1] heps://fds.ornl.gov/iniRator/

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