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Spectroscopic studies of the structure of neutron-rich isotopes ^{129}Sn and ^{133}Sn

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The study of radioactive isotopes is key to understanding the fundamental building blocks of matter. These investigations require state-of-the-art experimental stations, which exist only in select facilities around the world. The Gamma Ray Infrastructure For Fundamental Investigations of Nuclei (GRIFFIN), at the ISAC facility of TRIUMF is a powerful decay spectrometer that can be used to study β decaying species. The tin isotopes are an important part of the nuclide chart due to their magic proton number, $Z = 50$, a stable configuration analogous to the noble gases. They span a total of forty isotopes, two neutron shell closures, at $N = 50$ (^{100}Sn) and $N = 82$ (^{132}Sn), and extend up to $N = 89$ (^{139}Sn), making them an important testing ground for nuclear structure theory. Furthermore they are important in the rapid neutron capture process (r-process), responsible for the production of the heaviest elements in our universe. An isotope of tin with 79 neutrons, ^{129}Sn, was studied via the β decay of its indium parent, ^{129}In, at the GRIFFIN station. So far the analysis of the decay spectroscopy data has uncovered twenty new transitions and seven new excited states, never before seen in this nucleus. The ^{133}Sn nucleus was also studied at the GRIFFIN spectrometer, though the data was dominated by the βn decay of the ^{133}In parent into ^{132}Sn. Newly outfitted with BGO shields for Compton suppression, the GRIFFIN spectrometer has entered into a new phase; a reduction in the Compton continuum will allow for the observation of very weak transitions, offering a more detailed look into the tin isotopes. Results from the study of ^{129}Sn and ^{133}Sn, detection mechanisms and potential implications will be discussed.

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