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Strolling through strontium: Approaching the neutron drip line

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Addressing gaps in nuclear data for thousands of radioactive isotopes is a daunting challenge. We focus on the need for cross sections for neutron-induced reactions involving short-lived fission products relevant for nonproliferation and forensics applications, supporting the science-based U.S. stockpile stewardship mission, and advancing our understanding of basic nuclear physics and cosmogenic nucleosynthesis. Developments in radioactive beam facilities, detector systems, and indirect techniques have enabled us to experimentally-constrain previously inaccessible cross sections. In addition, these advancements have improved predictive reaction theory for unstable nuclei, which assists to bridge some gaps. The A=95 mass region will be addressed in this talk, presenting the first experimentally-determined neutron-induced reaction rates on exotic strontium isotopes from this multi-institutional collaboration. We performed a radioactive beam experiment at CARIBU at Argonne National Laboratory and used the β-Oslo method to constrain the ^{93,94,95}Sr(n,γ)^{94,95,96}Sr cross sections. By leveraging Rb beams to populate highly excited states in ^{94,95,96}Sr and using a total absorption spectrometer (TAS) known as the Summing NaI(Tl) (SuN) to measure the total energy emitted by the γ rays, we experimentally determined the nuclear level density (NLD) and γ-ray strength function (γSF). These extracted statistical nuclear properties are key ingredients in Hauser-Feshbach calculations of neutron-capture reaction rates. The NLD, γSF, and cross sections for these short-lived neutron-rich Sr isotopes will be presented. The analysis toolkit developed for this new measurement serves as a pivotal foundation for future measurements of heavy-mass fission products far from stability.

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