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Constraining Neutron-Capture Cross Sections with Quasi-Continuum Nuclear Data

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The gamma-ray decay of nuclear states in the quasi-continuum provides significant constraints on neutron-capture cross sections. In particular, measurements of Nuclear Level Densities (NLDs) and Photon Strength Functions (PSFs) have and will continue to play a central role as these are inputs for the statistical Hauser-Feshbach model. This facilitates the extraction of neutron-capture cross-section data even for nuclei where direct measurements are not feasible. Now, PSF and NLD measurements in previously inaccessible regions of the nuclear chart have become possible due to many facilities worldwide offering enhanced or new state-of-the-art research infrastructure. These range from significant increases in efficiencies for particle and gamma-ray detectors to new or upgraded radioactive ion beam facilities. In parallel, several new experimental and analytical techniques have been developed, enabling more reliable PSF and NLD studies. This collective progress leads to unprecedented insight not only into the structure of nuclei but also to provide experimental constraints relevant to fundamental research and applications. In this presentation, I will provide an overview of the most significant advances made and how these have laid the foundation for novel and ambitious measurements of PSFs and NLDs. Furthermore, I will discuss how neutron-capture reaction rates, constrained through the measurement of PSFs and NLDs, improve our understanding of observed isotopic abundances.

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