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Low-Energy Enhancement of the Photon Strength Function

Over the last decade several measurements in light- and medium-mass nuclei have reported an enhanced ability for the absorption and emission of gamma radiation (photon strength function PSF) at low energies. The impact of this effect may have profound implications on neutron capture reaction rates which are not only responsible for the formation of elements heavier than iron in stellar and supernova environments [1] but are also of central importance for advanced fuel cycles in nuclear reactors [2]. The results were received with significant skepticism by the community mainly due to the lack of any known mechanism responsible for such an effect but also because another established experimental technique failed to confirm the measurement. Now, a new experimental method which is free of model input and systematic uncertainties has been developed to determine the PSF. It is designed to study statistical feeding from the quasi-continuum (below the particle separation energies) to individual low-lying discrete levels. A key aspect to successfully study gamma decay from the region of high-level density is the detection and extraction of correlated high-resolution particle-gamma-gamma events which is accomplished using an array of Clover HPGe detectors and large area segmented silicon detectors. The excitation energy of the residual nucleus produced in the reaction is inferred from the detected proton energies in the silicon detectors. Gating on gamma-transitions originating from low-lying discrete levels specifies the states fed by statistical gamma-rays. Any particle-gamma-gamma event satisfying these and additional energy sum requirements ensures a clean and unambiguous determination of the initial and final states of the observed gamma rays. With these constraints the statistical feeding to discrete levels is extracted on an event-by-event basis. In this talk the latest results for ⁹⁵Mo [3] are presented and compared to PSF data measured at the University of Oslo [4]. In particular, questions regarding the existence of the low-energy enhancement in the photon strength function will be addressed.

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