

γ -ray strength function method and applications

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Radiative neutron capture cross sections are of direct relevance for the synthesis of heavy elements referred to as the s-process and the r-process in nuclear astrophysics and constitute basic data in the field of nuclear engineering. The surrogate reaction technique is in active use in the latter field to indirectly determine radiative neutron capture cross sections for unstable nuclei. We have devised an alternative method based on the γ -ray strength function (γ SF), a nuclear statistical quantity that interconnects photoneutron emission and radiative neutron capture in the Hauser-Feshbach model calculation. We outline the γ SF method and show applications of the method to zirconium, palladium, and tin isotopes. Radiative neutron capture cross sections for the following radioactive nuclei are presented: ^{93}Zr ($T_{1/2} = 1.53 \times 10^6$ yr); ^{95}Zr (64 d); ^{107}Pd (6.5×10^6 yr); ^{121}Sn (27 h); and ^{123}Sn (129 d).