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Neutron Transfer Reactions for Deformed Nuclei Using Sturmian Basis States[1] VESSELIN G. GUEORGUIEV, Ronin Institute, Montclair, NJ 07043, USA, JUTTA E. ESCHER, Lawrence Livermore National Laboratory L-414, Livermore, CA 94551, USA, PETER D. KUNZ, FRANK S. DIETRICH, Retired — Transfer reactions leading to nuclear excitations of several MeV are of interest to indirect measurements of cross sections. The spin-parity distribution P(Jπ,E) of ^{156}Gd excited states above the neutron separation energy Sn = 8.536 MeV expected to be populated via a 1-step neutron pickup reaction ^{157}Gd(^{3}He,^{4}He)^{156}Gd are studied. Excited states in ^{156}Gd are viewed as rotational excitations built on intrinsic states consisting of a neutron hole in the ^{157}Gd core; that is, a neutron removal from a deformed Woods-Saxon type single-particle states. The reaction cross section to each excited state is calculated as coherent contribution using a standard reaction code based on spherical basis states. The spectroscopic factor associated with each state is the expansion coefficient of the deformed neutron state in a spherical Sturmian basis along with the spherical form factors. The total cross section is generated using Lorentzian smearing distribution function. Our calculations show that, within the assumptions and computational modeling, the reaction has a smooth formation probability P(Jπ,E) within the energy range relevant to the desired reaction. The formation probability P(Jπ,E) resembles a Gaussian distribution with centroids and widths that differ for positive and negative parity states.

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