

Dominant Reaction Mechanisms of Nucleon-Induced Particle Emission into the Continuum

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Pre-equilibrium reactions induced by nucleons in the energy range between about 70 and 200 MeV, in which nucleons are emitted, are very successfully described in terms of a number of roughly equivalent statistical multistep formulations. Evidently it appears to be reasonable to assume that emission of heavier ejectiles such as deuterons, tritons, heliums, alpha particles etc. is closely related to the reaction mechanism which causes nucleon emission. This presumed relationship between reactions leading to nucleon emission and the process responsible for ³He ejectiles, for example, has been the focus of a large number of very successful investigations conducted by a Stellenbosch-iThemba-INRNE-Oxford collaboration.

In strong contrast with our assumed multistep-based reaction mechanism for composite particle emission, a very different mechanism is suggested by recent extrapolation of results from projectile energies in the GeV range to incident energies below 200 MeV. At present it is not clear how this reaction mechanism can be reconciled with our own interpretation.

For (p, α) reactions, apart from knockout of ground-state clusters, sequential decay is a natural consequence of a multistep process. This sequential decay from excited nuclear states is experimentally well-established in exclusive knockout reactions, albeit for only a few target nuclei. It will be shown that this process could, in principle, account for discrepancies between theory and experimental pre-equilibrium emission energy spectra.