Statistical Description of Cluster Emission Including Direct Reactions [*]

Emil Běták[1,2],
[1] Institute of Physics, Slovak Academy of Sciences, 84511 Bratislava, Slovakia.
[2] Faculty of Philosophy and Sciences, Silesian University, 74601 Opava, Czech Rep.

Whereas the emission of nucleons in the continuum region at energies below the pion threshold can be nicely described using statistical models (compound nucleus plus pre-equilibrium), that of the complex particles, i.e. light clusters up to α's, is far from satisfactory state. The main reason is — apart of very specific properties of the clusters themselves — that different types of direct reactions, like pickup, knockout and others, play an essential role, that is not restricted to the reaction leading to discrete states [1]. In the absence of more justified approaches, phenomenological ones were frequently applied, with very little (or no) physics in their background. We have suggested a statistical description which is essentially based on the Iwamoto-Harada-Bisplinghoff coalescence model [2, 3], but which is capable to incorporate the main features of direct reactions leading to the cluster emission [4]. Obviously, as in any other statistical approach — one has to pay for this generality by loosing details of nuclear structure and their manifestation in individual reactions. At the same time, the phenomenological models underwent substantial elaboration and they have gained necessary physical background and are rather succcessful in decsribing the data [5]. The coalescence idea of the Iwamoto-Harada-Bisplinghoff model has been also further developed and the cluster spectra compared to the data, the links to both the statistical models and to the direct reactions have been envisaged and we also embrace possible connection to other pre-equilibrium approaches.

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