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Possible effects of clustering structure in the competition between fast emission processes and compound nucleus decay

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In the last decades, a renewed attention to clustering in nuclei has emerged due to the study of weakly bound nuclei at the drip lines [1]. Clusters in nuclear systems can be related to their dynamical formation or their structural presence (pre-formation) in nuclei. While for light nuclei several links between cluster emission and its connection with nuclear structure and dynamics have been pointed out [1,2], this is less obvious when moving towards heavier systems, where the determination of pre-formed clusters within nuclear matter is more complicated and there is still a lack of experimental evidences of such structure effects. An interesting way to investigate the structural properties of medium mass systems is to study, in central collisions, the competition between evaporation and pre-equilibrium light particles emission as a function of entrance channel parameters [2].
An experimental campaign has started at the Legnaro National Laboratories using the GARFIELD + RCo multi-detector system [3] with the aim of confirming alpha clusterization in nuclei by comparing pre-equilibrium emission in terms of energy spectra and multiplicities, for different entrance channel parameters like beam velocity, mass asymmetry and structure of the reacting partners.
In particular, the two systems ^{16}O + ^{65}Cu and ^{19}F + ^{62}Ni, leading to the same compound system ^{81}Rb*, have been studied at the same beam velocity (16 AMeV). Angular distributions and the light charged particles emission spectra in coincidence with evaporation residues have been measured up to very forward angles.
The experimental data have been first compared with the predictions of the Moscow Pre-equilibrium Model (MPM) [4] and then with the statistical model GEMINI++ [5]. A comparison with the dynamical models SMF [6] and AMD [7] has also been done. Recent results of the data analysis will be presented. The analysis is still in progress.

1. Phys. Rep. 432, 43-113 (2006) and ref. therein.
2. Phys. Rep. 374 (2003) 1-89.
3. EPJA 49 (2013)12.
4. Int. Jour. Mod. Phys. E 19 (2010) 1134.
5. Phys. Rev. C 82 (2010) 014610.
6. Nucl. Phys. A 642 (1998) 449.
7. Phys. Rev. C 59 (1999) 853.

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