Decay Competition in IMFs Production in the Collisions \(^{78}\text{Kr}+^{40}\text{Ca}\) and \(^{86}\text{Kr}+^{40}\text{Ca}\) at 10 AMeV

B. Gnoffo\(^1,2\), S. Pirrone\(^2\), G. Politi\(^1,2\), M. La Commara\(^3,4\), J.P. Wieleczko\(^5\), E. De Filippo\(^2\), P. Russotto\(^2\), M. Trimarchi\(^2,6\), G. Ademard\(^7\), M. Vigilante\(^3,4\), L. Auditore\(^2,6\), C. Beck\(^8\), I. Berceanu\(^9\), E. Bonnet\(^2\), B. Borderie\(^2\), G. Cardella\(^2\), A. Chibii\(^5\), M. Colonna\(^10\), S. De Luca\(^2,6\), A. D’Onofrio\(^6,11\), J.D. Frankland\(^3\), G. Lanzaione\(^10,12\), P. Lautesse\(^13\), D. Lebhartz\(^5\), N. Le Neindre\(^14\), I. Lombardo\(^2,6\), N.S. Martorana\(^1,10\), S. Norella\(^2,6\), K. Mazurek\(^5\), A. Pagano\(^2\), E.V. Pagano\(^1,10\), M. Papa\(^2\), E. Pisecki\(^15\), F. Porto\(^7\), L. Quattrocchi\(^1,2\), F. Rizzo\(^1,10\), G. Spadaccini\(^3,4\), A. Trifirò\(^2,6\), G. Vicedomini\(^7\)

\(^1\)Dipartimento di Fisica e Astronomia, Università di Catania, Italy \(^2\)INFN Sezione di Catania, Italy \(^3\)Dipartimento di Fisica, Università Federico II Napoli, Italy \(^4\)INFN Sezione di Napoli, Italy \(^5\)GIANIL Caen, France \(^6\)Dipartimento di Fisica, Università di Messina, Italy \(^7\)IN2P3 - IPN Orsay, France \(^8\)NCP - IHPC Strasbourg, France \(^9\)IPNE, Bucharest, Romania \(^10\)INFN Laboratori Nazionali del Sud, Italy \(^11\)Dipartimento di Matematica e Fisica - Seconda Università di Napoli, Caserta, Italy \(^12\)Università Kore, Enna, Italy \(^13\)IN2P3 - IPN Lyon, France \(^14\)IN2P3 - LPC Caen, France \(^15\)University of Warsaw, Poland

The Program - Isospin Effects on CN Decay

The collisions in the, so called, low energy domain (E=15 AMeV ) are characterized by the competition between fusion process and dynamical binary processes. The compound nucleus disexcitation modes produce particles in a wide mass range; in particular the production of the Intermediate Mass Fragments, IMFs, is very interesting because of many features that are not well understood yet. The N/Z ratio, strongly correlated to the isospin degree of freedom, has important effects on the characteristics of the fragments production and it is expected to play a crucial role in the competition among the different decay channels. Formation and decay modes of composite systems have been studied in the reactions \(^{78}\text{Kr}+^{40}\text{Ca}\) and \(^{86}\text{Kr}+^{40}\text{Ca}\) at 10 AMeV at INFN-LNS in Catania [1,3]. The experiment complements the data already obtained at 5.5 MeV/A for \(^{78,82}\text{Kr}+^{40}\text{Ca}\) reactions studied at GANIL by using the INDRA detector [4].

The Results - IMF Characteristics

The IMF production shows strong differences in the relative abundance of elements with Z<Z\(_{9}\) in the two systems. The mean value of the velocity in CM frame, nearly independent of the emission angle and the angular distributions that follow a 1/sin\(^3\) behavior suggest a strong relaxation of the degrees of freedom. The odd – even staggering effect is stronger for the n-poor system in the charge distribution; on the contrary it is more pronounced for the n-rich system in the yields vs N. Yields are compared to the theoretical prediction of the GEMINI++ model [7].

The Results - Comparison in the \(^{78}\text{Kr}+^{40}\text{Ca}\) at two different energies

The comparison between the results of the IMFs cross section production in the reaction \(^{78}\text{Kr}+^{40}\text{Ca}\) at 10 MeV and 5.5 MeV bombarding energy, shows a stronger production of IMFs at higher energy. This result could be due to secondary emissions by the light IMFs as suggested by a preliminary analysis of the relative velocity of alpha and IMF, projected in the fragment frame.

References