Comparison of the reaction mechanisms of $^{136}\mathrm{Xe} + \mathrm{p}$ and $^{136}\mathrm{Xe} +^{12} \mathrm{C}$ at 1 A.GeV

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abstract

Using inverse kinematics at 1 GeV per nucleon, we have investigated the mechanisms of the reactions $^{136}\mathrm{Xe} + \mathrm{p}$ and $^{136}\mathrm{Xe} +^{12} \mathrm{C}$ with the SPALADiN setup of GSI-Darmstadt (Germany) [1]. For both reactions, final states were characterized by the efficient detection in coincidence and on an event-per-event basis of the heavy residues and of the lighter fragments and particles, including the evaporated neutrons. The combination of the inverse kinematics technique and of our large-acceptance detector-setup provides an almost-complete coverage of the phase-space of the deexcitation channels of the reactions. This allows for their detailed study. Moreover, in the two-step scenario of such reactions, i.e. a fast excitation phase governed by series of incoherent nucleon-nucleon collisions (the intranuclear cascade) leading to the formation of an excited nuclear system, the remnant, followed by its deexcitation via collective effects such as evaporation, fission or fragmentation, this combination of kinematics and detection permits an estimate of the excitation energy per nucleon $\langle \mathrm{E}^*/\mathrm{A} \rangle$ of the remnant *independently of the description of the deexcitation phase of the reactions*. This leads to the possibility of studying the reaction mechanisms as a function of the remnant's excitation energy.

In our presentation, we will discuss the *inclusive* observables and underline the similarities and differences in the evolution of the experimental observables as a function $\langle \mathrm{E}^*/\mathrm{A} \rangle$. Such an evolution emphasizes the common features as well as the basic differences of both reactions. In particular, some observables appear to confirm the basic assumption of the two-step scenario on the dependence of the decay widths of the excited channels on the sole global variables describing the remant, such as its total angular momentum, its average excitation energy per nucleon, its mass and its charge and independently of the initial state (the entrance channel). This appears in the data as very similar $\langle \mathrm{E}^*/\mathrm{A} \rangle$ dependences for both reactions. Anyhow, other observables exhibit very different dependences, questioning this scenario. The potential implications of our results on the description of these heavy-ion reactions will be approached.

References

[1] Gorbinet T, Yordanov O, Ducret J-E *et al.*, 2019 *Eur. Phys. J. A* **55** 11