Dynamical collective clusterization in hot and rotating nuclei

Raj K. Gupta[1], M. Balasubramaniam[1], Rajesh Kumar[1], Dalip Singh[1], C. Beck[2], W. Greiner[3]

[1] *Panjab University, Chandigarh-160014, India*
[2] *IReS, IN2P3/ Uni. Louis Pateur, F-67037 Strasbourg, France*
[3] *J.-W. Goethe Universitaet, D-60326 Frankfurt/Main, Germany*

The hot and rotating nuclei, formed in light heavy-ion reactions, decay subsequently by the emission of mainly light-particles (LPs, with A$\leq$4, Z$\leq$2) and a small fraction (5-10%) of complex intermediate mass fragments (IMFs, with 4<A<20, Z>2), also called clusters. In order to understand this phenomenon, a collective clusterization model [1] is developed, which treat both the LPs and IMFs as the dynamical collective mass motion of preformed clusters through the barrier. Interestingly, within the same dynamical model treatment of both LPs and IMFs, without invoking any statistical model considerations, the LPs are shown to have different characteristics as compared to the IMFs. It is for the first time that a non-statistical dynamical description is developed for the emission of LPs from a hot and rotating compound system. The model is worked out in terms of only one parameter, namely the neck-length parameter, which is related to the total kinetic energy TKE(T,ℓ=0) at temperature T and angular momentum ℓ=0 of the hot compound nucleus, defined in terms of the binding energy of the hot compound nucleus and the ground-state binding energies of the finally emitted fragments. The systematic variations of the cross-section for the emission of LPs and IMFs, calculated on this, so-called, dynamical cluster-decay model (DCM) is similar to that predicted by the statistical fission models. The model is applied to the decay of ^{116}Ba* formed in ^{58}Ni+^{58}Ni reaction at various incident energies. Also, the average $\overline{TKE}$ are calculated.

REFERENCES

1. R.K. Gupta, et al., Phys. Rev. C **65**, 024601 (2002); Phys. Rev. C **68**, 014610 (2003); J. Phys. G: Nucl. Part. Phys. **29**, 2703 (2003).

Email: gupta_rajk@hotmail.com