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COMPOUND NUCLEUS DECAY AND TRANSIENT FISSION

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The de-excitation chain of the compound nucleus (CN) at high energies is treated, including the transient character of the fission process. The equations can handle all types of emission and take into account all the nuclei of the decay chain. The equations are based on the model of Ref. 1. ($\hbar=1$)

$$dP_s(t)/dt = \Sigma\, k_{i,s-i}\, \Gamma_{i,s-i}\, P_{s-i}(t) - (\Gamma_{f,s}(t) + \Sigma\, \Gamma_{i,s})\, P_s(t)$$

$$s=1,sx \quad , \quad \Gamma_{i,o}=0 \quad , \quad \Gamma_{i,sx}=0 \quad , \quad P_s(t=0)=\delta_{s,1}$$

$P_s(t)$ is the probability for the CN to reach the step s in the (Z,A) plane by taking a path described by the counters $k_{i,s}$. These are defined by the branching ratios of the various particles in a random manner. $\Gamma_i, \Gamma_f(t)$ are particle emission widths and time dependent fission width.
The particle multiplicities are:

$$p = \sum_{s=2}^{sx} \left(\sum_{i=1}^{s-1} k_{p,i} \right) F_s \Big/ \sum_{s=1}^{sx} F_s \quad ; \text{ where } \quad F_s = \int_0^{+\infty} dt\, \Gamma_{f,s}(t)\, P_s(t)$$

sx is the maximum number of particles in the decay chain. The calculations are done for the nucleus ^{166}Er, E=191 MeV, J=65 $\hbar$. Fig.1 shows the neutron and proton multiplicities versus the transient time. The neutron feels more strongly the transient regime due to the relation $\Gamma_n > \Gamma_p$. In the lower part of the figure, the transient is much more profitable to the proton due to the absolute values of the multiplicities and to phase space constraints. The neutron and proton multiplicities can be used simultaneously to determine the transient time and the parameters of the statistical model underlying the model.

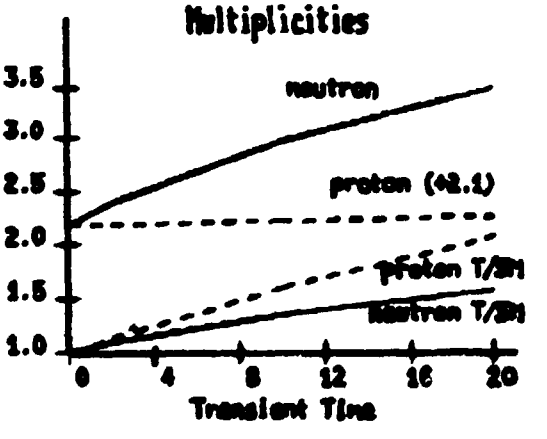

Fig. 1. Transient Time is in units of 10^{-21} s, T/SM means increases of the Transient with respect to the Statistical Model Results.

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