

# NUCLEAR LIFE-TIMES BY SK MODEL INCLUDING CHARGE EQUILIBRATION

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We have developed a unified fission model (SK model) [1] for studying alpha decay, cluster radioactivity and spontaneous fission to obtain nuclear life-times using a realistic potential. This model uses a cubic potential in the pre-scission region connected by a Coulomb and Yukawa plus exponential potential for the post-scission region. In such decays, charge equilibration occurs when charge densities of the parent, daughter and the emitted fragment vary. In order to take care of this, we have modified [2] the potential in the post-scission region suitably so as to allow the required charge redistribution among the daughter and the emitted fragment in the region between sharp contact and the point up to which the finite range effect persists. This model is now applied for the study of various nuclear decays in different mass regions of the periodic table. Super heavy nuclei as well as nuclei far off beta stability are also considered. Q values for the decays are taken from the GSI table[3]. Half-lives obtained are presented for about 10,000 nuclei with  $Z = 52$  to 122. Our values are compared with those of Analytical Super Asymmetric Fission Model (ASAFM) for all the nuclei considered. These results will be presented with all the required details in this work.

A sample result is given for reference in the following table:

Parent nucleus		Daughter nucleus		Emitted fragment		Q value (MeV)	Log <sub>10</sub> T (s)		
							A	Z	A <sub>2</sub>
With C.E*	Without C.E*								
316	122	312	120	4	2	11.9	-3.2	-2.48	-2.11
316	122	308	118	8	4	22.85	15.1	17.27	18.15
316	122	302	116	14	6	44.36	15.5	16.92	18.01
316	122	244	94	72	28	250.54	16.0	17.45	20.77

\* Charge Equilibration

## References:

- [1] G.Shanmugam and B.Kamalaharan, Phys. Rev. **C38**, 1377 (1988).
- [2] G.Shanmugam and B.Kamalaharan, Phys. Rev. **C41**, 1742 (1990).
- [3] D.N.Poenaru, D.Schnabel, W.Greiner, D.Mazilu and I.Cata, Report No. GSI-90-28, 1990.
- [4] G.Shanmugam *et al.*, Proc. of DAE-BRNS Symposium on Nucl. Phys. **45B**, 60(2002).