PREFACE

The study of alpha radioactivity started almost from the beginning of this century. Many theories of varying sophistications have been propounded, still the problem has not been solved completely. The absolute decay-rates of the different types of nuclei even-even, odd-A and odd-odd particularly the intensities of the different alpha-spectra could not be explained satisfactorily as yet. In the present work, an attempt has been made to obtain the intensity pattern of the alpha spectra of different types of nuclei making use of a statistical model called the exciton model which is used to explain the intermediate processes in nuclear reactions. The model makes use of the density of single particle states characterised by a number called the exciton number. In order that the concept of the exciton model may be applied to the problem of decay probability or decay intensity, phenomenological investigations have been made to see whether the alpha-decay probability has any connection with the single pariticle effects. Nuclear masses are very important parameters to show whether a nucleus is alpha-stable or not. Shell corrections are also important components of the nuclear masses though small in magnitude in comparison with the actual masses. If the alpha-decay probability has to have any dependence on the single-particle effect, they have to depend on this shell-

correction because the shell correction in its turn is a function of the density of single particle states. These studies have been done in Chapter II and Chapter III. Chapter IV indicates briefly some of the shell model theories of alpha-decay problem. Chapter V deals with the intensity problem from the view point of exciton model bringing out the intensity pattern of different types of nuclei both in the harmonic as well as in the rotational region together with the selection rule for the orbital angular momentum of the emitted alpha-particle. The new but very simple approach to the alpha-decay problem through the nuclear masses and statistical formalism of nuclear reactions put all types of nuclei on similar footing.

It may be mentioned at the end that the eqn. (2.12) of Chapter II and eqn. (3.4) of Chapter III have already been published and the entire matter of Chapter V has been accepted for publication in the November 1986 issue of Journal de Physique.