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Analysis of cluster radioactivity using Q-value dependent relative separation

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The spontaneous disintegration of an unstable nucleus to attain a relatively stable configuration is known as radioactivity. Generally, it is considered that the radioactive decay happens via emission of the alpha particle, beta particle and gamma radiation. Apart from this, cluster radioactivity (CR), heavy particle radioactivity (HPR) and spontaneous fission (SF) are also probable ground state emission modes. The spontaneous splitting of a unstable parent nucleus into fragment heavier than the α-particle but lighter than the fission fragments is known as cluster radioactivity (CR). It was theoretically predicted in [1], and then experimental verification was done by Rose and Jones [2], where 14C was detected from 223Ra radioactive parent nucleus. In past few decades, different experimental and theoretical attempts [3,4] were made to explore the cluster radioactive emission modes. Numerous theoretical models are introduced to explore such complex decay mode on the basis of different nuclear properties (size, shape, magicity etc.).The preformed cluster model (PCM) is one such model [5] which is successfully employed to address the cluster radioactivity and other competing ground state decay modes. PCM works out in terms of the mass asymmetry coordinate η and relative separation distance R. The preformation probability (η-motion) and the penetration probability (R-motion) are calculated at a fixed turning point Ra, which is the sum of the relative separation at touching configuration and the neck length parameter "ΔR". In the present work, we have estimated Q-value dependence of Ra ,which can be further utilize to calculate the decay half-lives and other decay properties of the radioactive nuclei. The work includes the study of CR by taking spherical choice of the decaying fragments. It will be of further interest to extend this work to study the comparative analysis of cluster dynamics with other ground state channels such as alpha-decay, hpr,and sf etc.

The speaker is a student or young scientist

Yes

Section

1. Experimental and theoretical studies of nuclear reactions

Primary authors: Ms JINDAL, Chahat (Thapar Institute of Engineering and technology,Patiala,India); Mr SHARMA, Nitin (School of Physics & Materials Science, Thapar Institute of Engineering and Technology, India, Patiala 147004, India); Mr SHARMA, Manoj Kumar (School of Physics & Materials Science, Thapar Institute of Engineering and Technology, India, Patiala 147004, India)

Presenters: Ms JINDAL, Chahat (Thapar Institute of Engineering and technology,Patiala,India); Mr SHARMA, Nitin (School of Physics & Materials Science, Thapar Institute of Engineering and Technology, India, Patiala 147004, India); Mr SHARMA, Manoj Kumar (School of Physics & Materials Science, Thapar Institute of Engineering and Technology, India, Patiala 147004, India)

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