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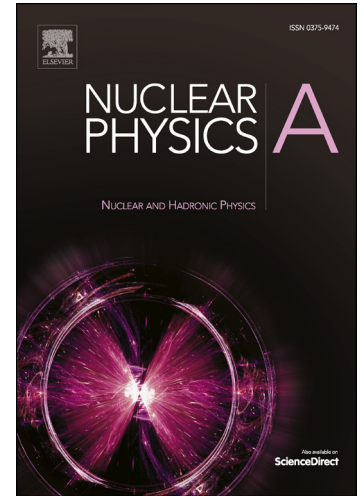
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Systematic investigation of cluster radioactivity for uranium isotopes

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ABSTRACT

The most probable cluster decays that can be observed for ²¹⁷⁻²³⁸U isotopes are investigated. We identified the more-probable decays that commonly manifest themselves via cold valleys in the driving potentials with respect to the mass number and the atomic number, individually. The calculations are performed using the Skyrme-SLy4 nucleon-nucleon interaction, within the frame work of the performed cluster model. Among the indicated favored decays that involve emitted light clusters heavier than α -particle, twenty six decay modes display calculated half-life less than 10^{22} years, with branching ratio larger than $10^{-14}\%$. The estimated branching ratio for the α -decay of ²³⁷U, that did not observed yet, is $B=2.1\times 10^{-10}\%$ ($T_{\alpha}=8.7\times 10^9$ years). The indicated most probable decays that did not observed yet include the ²²Ne decay of ²³²U, ²⁵Ne and ³²Si decays of ²³³U, ²⁴Ne and ²⁹Mg decays of ²³⁵U, and the ³⁴Si and ³⁰Mg decay modes of ²³⁸U, with $10^{-14}<B(\%)<10^{-7}$.

I. INTRODUCTION

The recent increased sophistication in the element production and observation facilities demands a wider range of theoretical investigations on the different decay modes of heavy, superheavy and exotic nuclei. Cluster decays are rare decay modes lie between α decay and spontaneous fission. They were first theoretically predicted by Săndulescu, Poenaru and Greiner in 1980 [1] and subsequently observed by Rose and Jones four years later [2]. About 35 decays involve the light emitted clusters ¹⁴C, ¹⁵N, ^{18,20}O, ²²⁻²⁶Ne, ²³F, ^{28,30}Mg, and ^{32,34}Si have been detected from parent nuclei between ²²¹Fr and ²⁴²Cm [2-9]. The observed daughter nucleus in these decays was the doubly magic nucleus ²⁰⁸Pb, or one of its neighbors. The detected cluster decays exhibit very long half-lives, up to 10^{28} s, and very small branching ratios, down to 10^{-16} % [10]. Cluster decays involving different C, O, Ne and Mg isotopes, as emitted light clusters, have been

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