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Short Communication

Main decay modes of super heavy nuclei

D N Poenaru

Horia Hulubei National Institute of Physics and Nuclear Engineering, Romania

Abstract

Several laboratories in the world, like GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany; JINR Dubna, Russia Nat. Livermore Lab., USA and RIKEN Japan are trying to produce super heavy (SH) nuclei with atomic numbers $Z > 118$ using cold fusion reactions (with just one neutron-evaporation or hot fusion (with 3-4 evaporation neutrons) and ^{48}Ca projectile beam. Until now the main decay modes of SHs, allowing identifying the new element were alpha decay (AD) and spontaneous fission (SF), with a clear advantage of using AD chains, leading to a well-known final nucleus. We would like to point out that in some cases with large atomic number Z (usually $Z > 120$) cluster radioactivity (CR) may compete as well, opening a new opportunity in this

field. In order to illustrate this new finding, we shall present the results of our calculations for the following nuclides: 297,299,300119 and 299,300,301,302120. We are using mainly the following models: ASAF (analytical super-asymmetric fission); UNIV (Universal formula), and SEMFIS (semi-empirical formula based on fission theory) to study AD. ASAF and UNIV are useful for CR. A dynamical model based on cranking inertia tensor allows us to calculate SH half-lives. Strutinsky's macroscopic-microscopic method with Yukawa-plus-exponential (Y+EM) liquid drop and the best two-center shell model are necessary to calculate the total deformation energy. For pairing we have to solve the BCS system of two equations. For ^{38}Sr CR of 300,302120 we predict a branching ratio

relative to AD of -0.10 and 0.49, respectively, meaning that it is worth trying to detect such kind of decay modes in competition with AD. Whenever possible we calculate the Q-values by using the latest experimental evaluation of the masses. Otherwise the W4 atomic mass model is our choice.

Biography:

D N Poenaru Presently Honorary Member of the Romanian Academy. Retired in 2009 from Horia Hulubei National Institute for Physics and Nuclear Engineering (IFINHH), Magurele near Bucharest. Two PhD: in Nuclear Electronics (1968) and in Theoretical Physics (1981), from Polytechnical Institute of Bucharest, and Central Institute of Physics, Magurele, respectively. From 1996 until 2000 Scientific Director of IFIN-HH. Former Project Coordinator (2000-2003) of the European Commission, Centre of Excellence IDRANAP (InterDisciplinary Research and Application based on Nuclear and Atomic Physics), selected in 2000 among the 34 successful proposals out of 185 applications from 11 countries. Co-author of the paper in which heavy-ion radioactivities were predicted. Mentioned in THE NEW ENCYCLOPAEDIA BRITANNICA.

<http://www.britannica.com/EBchecked/topic/465998/D-N-Poenaru>. Total Number of Various Publications: 208 articles in refereed Journals; 209 publications abroad; 63 pub. In foreign languages printed in Romania; 57 publications in Romanian; 23 articles of popularization; 29 preprints and e-prints; 65 invited talks at International Conferences; 11 chapters in books edited by others; 17 chapters in books edited by himself.