

Recoil- α -fission and recoil- α - α -fission chains stemming from element 115

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Products of the $^{48}\text{Ca}+^{243}\text{Am}$ fusion-evaporation reaction were studied with the TASISpec set-up [1, 2] behind TASCA [3-5]. Thirty correlated α -decay chains originating from different isotopes of E115 were observed [6, 7], produced with an overall production cross section of ≈ 10 pb. There are $1+22=23$ five- α -long chains linked to the production of $^{287,288}\text{115}$ [6], in agreement with $2+31=33$ chains reported earlier [8]. The combined $22+31=53$ chains associated with $^{288}\text{115}$ yield a statistically solid reference.

Besides these 'long chains', two recoil- α -fission and five recoil- α - α -fission chains are present in the TASISpec data [7]. Interestingly, the interpretation and thus the assignment of these 'short chains' to a certain isotope of E115 turns out to be non-trivial. The issue is discussed with the help of Fig. 1: Panel (a) shows the relevant beginning of the long $^{288}\text{115}$ reference chain. The average values of the $2+5=7$ new short chains in panel (b) are consistent with the numbers in panel (a). This indicates at first sight ~ 5 -15% fission or electron-capture branches of $^{284}\text{113}$ and ^{280}Rg . However, this view is at variance with the interpretation of $3+1=4$ short chains previously observed at Dubna [8] [panel (c)]. There, one chain, denoted 'D3', is significantly different from all the other E115 chains. However, only including this particular chain in the $3+1=4$ averaging procedure generated a seemingly consistent link between E115 and E117 [8, 9] [panel (d)]. Panel (e) provides a refined interpretation of all published E117 data [9, 10]. The rightmost sequence averaged

over twelve E117 chains opens for a connection to E115 via 'D3', while the other ten E117 chains would be consistent with (a subset of) other E115 chains [11].

More high-quality spectroscopic data is obviously required. This is necessary to provide the foundation for a relevant nuclear-structure based interpretation of links between decay chains of these two odd- Z elements [7, 11].

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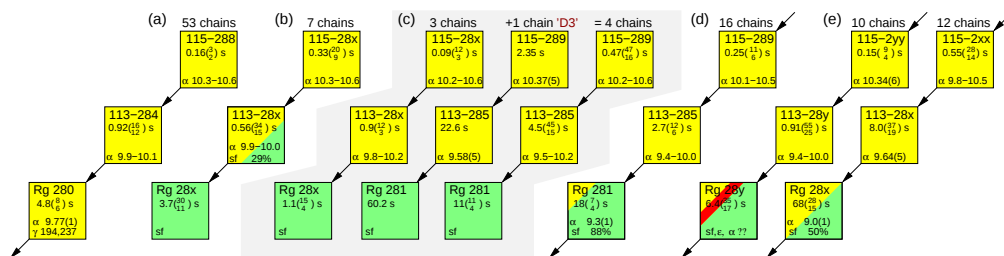


Figure 1: Average values from selections of decay chains of isotopes of E115 to E113 into Rg ($Z = 111$). (a) 53 $^{288}\text{115}$ reference chains [6, 8]. (b) Seven recoil- α - (α) -fission chains observed with TASISpec [7]. (c) Data from all four recoil- α -fission 'Dubna chains' listed in Table III of Ref. [8]. (d) Sixteen chains associated with the decay of $^{293}\text{117}$, i.e. interpreted to populate the isotope $^{289}\text{115}$ [9]. (e) Possible re-interpretation [11] of all existing E117 decay data [9, 10].