A Search for ^{264}Sg

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A search was undertaken at the 88-Inch Cyclotron at the Lawrence Berkeley National Laboratory for the new isotope ^{264}Sg. This nucleus is predicted to decay with nearly equal probability by spontaneous fission (SF) and by alpha emission with $E_\alpha \approx 9$ MeV and with a half life between 0.5 and 2 seconds[1-2]. The ^{260}Rf daughter of this alpha decay undergoes SF with a reported half life of 20 ms. We tried to produce ^{264}Sg via the ^{250}Cf(^{18}O,4n)^{264}Sg reaction at 111 MeV and to correlate parent and daughter decays using our MG rotating wheel system.

Due to high background activities produced from binary transfer reactions, fairly stringent requirements were needed for an event. An acceptable event was defined as a parent alpha decay of between 8.5 and 9.2 MeV detected in the bottom detector (which would cause the daughter to recoil from the source into the top detector) followed within 40 ms by detection of a SF single event in the top detector (indicating fission from an atom on the top detector surface). Unfortunately, only 4 of these α-SF correlations were detected, while our calculations predict 2 or 3 random correlations of unrelated background activity. This result permits us to set an upper limit on the cross section for this reaction. If the α-decay branch is ≥25% and the half life is between 0.5 and 2 seconds, the cross section is ≤200 pb at 111 MeV. Figure 1 shows a plot of cross section versus half life, when a 25% α-decay branch is assumed. The expected cross section for this reaction is 200 pb.

In addition to looking for α–SF correlations, we also searched for α–α and α–α–α correlations. These would result from an alpha decay branch in a possible longer-lived isomer of ^{260}Rf. However, we saw no evidence for these correlations .

These negative results have forced us to consider other production methods.

References

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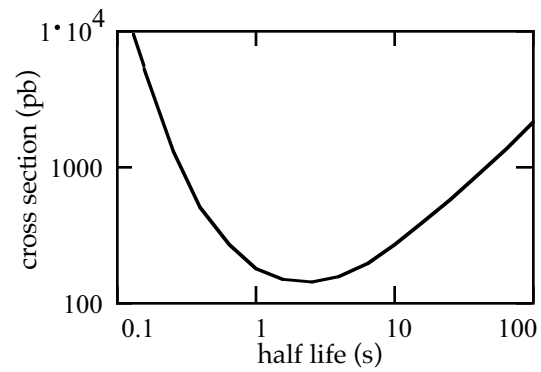

Fig. 1. Cross section upper limit plotted versus assumed ^{264}Sg half life for the ^{250}Cf(^{18}O,4n)^{264}Sg reaction at 111 MeV. An α-decay branch of 25% was assumed.