High-spin states above the $T_{1/2}$=2.1 ms isomer in ^{213}Ra

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The region of nuclei around doubly-magic ^{208}Pb is well known as a testing ground for the nuclear shell model, with the presence of long-lived isomers often associated with states where simple particle configurations have their component nucleon angular momenta fully-aligned to the maximum possible spin value. While many nuclei are well-studied, there are a number of neutron-deficient cases where fission competition becomes a major limitation, or where a very long-lived isomer has precluded simple correlation of the high-spin level-scheme with the known low-lying states.

One such case is ^{213}Ra, where the only excited states known are those populated in the decay of an isomer with $T_{1/2}$=2.15 ms and a suggested spin and parity of $17/2^-$ [1,2]. The configuration of this state is $(\pi h_{9/2})^6(\nu p_{1/2})^{-1}$, confirmed by g-factor measurements [3], and corresponds to two of the $h_{9/2}$ protons coupling to their maximum spin of I=8 and further coupling to the $p_{1/2}$ neutron hole. Higher-spin states are certainly expected within this configuration and would be related to the known high-spin states in the N=126 nucleus ^{214}Ra [4] by the coupling of a single neutron hole.

We have populated high-spin states in ^{213}Ra via the ^{204}Pb(^{13}C,4n) reaction at 75 and 80 MeV with pulsed beams from the ANU 14UD accelerator of 1 ns width separated by 1712 ns. Time-correlated gamma-gamma coincidence spectroscopy performed with the CAESAR detector array has revealed two new isomers above the $T_{1/2}$=2.15 ms isomer. Evidence for these new states, as well as their interpretation within the semi-empirical shell model, will be presented.

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