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Single-particle states in the N=82 nucleus 129Ag

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129Ag is a single magic N=82 nucleus. With three protons holes below 132Sn is neutron-rich, and any experimental information to be obtained on its structure is directly applicable for the understanding of lighter N=82 nuclei on the r-process waiting path. Proton knockout from 130Cd on the MINOS liquid hydrogen target will be used to populate 129Ag.

130Cd in it is ground-state has two proton holes in g9/2. Therefore, in (p,2p) reaction one would populate predominantly single-particle states in 129Ag: the 9/2+ g9/2 ground-state and the low lying excited states with p1/2, p3/2, f5/2 proton-hole characters (all coupled to (g9/2^2)0+). Several shell model calculations were performed: with NA14 [1], CSnhp [2] and SM28 [3] in full proton hole model space□□(g9/2, p, f5/2) and reduced space □□(g9/2, p1/2) (SM28). Effective operators e□ = 1.5 e, gs□ = 0.7 gsfree were adopted. A 132Sn core is assumed. The results are shown in figure 1. The calculated transition strengths using NA14 were used to predict the decay properties of the single-particle dominated states. Both the 5/2- f5/2 (predicted half-life T1/2<1ps) and the 3/2- p3/2 (~4ps) will decay into the yrast ½-. Some of the positive parity-states, with predominantly g9/2^3 character are expected to have longer half-lives. The population of these might be enhanced in reactions involving the removal of more particles. Line shape analysis [8] of the measured gamma using MINIBALL++ will be used to determine some of these half-lives and therefore transition strengths.

129Ag was populated before, and its beta-decay half-life measured at RIKEN [4]. No excited state were ever directly observed, however from systematics the ½- state is expected at 20+-20 keV [5]. For comparison, in the heavier N=82 isotone 131In, the 1/2- p1/2 state is 365 keV above the 9/2+ g9/2 ground-state, while the 3/2- p3/2 was recently measured at 1353 keV [1].

Fig. 1: Low-lying levels calculated for 129Ag with three different interactions. Note that SM28 has a reduced model space, i.e. no p3/2 (and f5/2) single hole states.

Predicted beam intensity of 130Cd is 15 particle/s. This assumes 40pnA 238U beam at 345 MeV/u. 5mm Be target, sigma=1.12e-4 mb, transmission 0.85%. This should be optimized. This value fits well with yields observed in previous measurements in this mass region [6,7].

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