One Neutron Knockout on ^{50}Ca ♢

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The evolution of shell-structure for neutron-rich nuclei is one of the main topics of recent research in nuclear structure physics. Shell-model calculations for neutron-rich calcium and titanium isotopes predict (sub-) shell closures for 32 and 34 [1] or 32 neutrons only [2]. The central nucleus of that region, ^{54}Ca, has not been reached yet with current facilities, therefore we have to rely on information from neighbouring nuclei.

Knockout reactions at relativistic energies allow to measure inclusive cross sections and momentum distributions and are therefore a perfect tool to study single particle structure far away from stability. Individual excited states can be investigated by detecting coincident gamma transitions [3]. This reaction mechanism was used for the first time for medium-mass nuclei at high beam energies to probe the structure of ^{55,56}Ti [4]. In this experiment, also the one neutron knockout on ^{50}Ca was investigated.

The exotic nuclei were produced in a fragmentation reaction of a 500 AMeV ^{86}Kr primary beam. In 8.5 days of beam time $2.73(2) \cdot 10^4$ ^{9}Be(^{50}Ca,^{49}Ca)X knockout-reactions were measured within the FRS acceptance leading to an inclusive cross-section of 97(18) mb. Figure 1 shows at the top the doppler corrected gamma spectrum of the ^{9}Be(^{50}Ca,^{49}Ca)X reaction (solid line). With the comparison to a GEANT4 simulation (dashed line), a gamma transition at 3350(150) keV could be identified. The lower left figure shows the momentum distribution, measured in coincidence with this transition. It can be reproduced by a calculated distribution with L=3, identifying the populated state with a so far unobserved $7/2^-$ state in ^{49}Ca. The lower right figure shows the quasi-exclusive momentum distribution, representing the population of the ground state in ^{49}Ca. Of the superimposed calculations, only the L=1 distribution can reproduce the expeimental values, in agreement to the theoretical and experimental expectation of a $3/2^-$ ground state in ^{49}Ca.

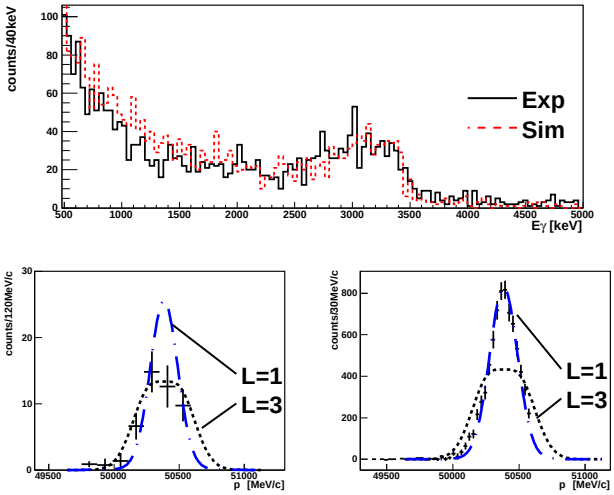

Fig. 1: **Top:** Gamma spectrum of the ^{9}Be(^{50}Ca,^{49}Ca)X reaction (solid), superposed by a MC simulation including a single transition at 3350 keV (dashed). **Bottom:** Longitudinal momentum distributions in coincidence with the gamma transition at 3350 keV (left) and quasi-exclusive representing the ground state in ^{49}Ca (right). Calculated distributions for L=3 and L=1 knockout reactions are shown.

The analysis of this experiment is ongoing and further results will be published soon.

References

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