we obtain $n(206) = 1.37(22)$ and $n(205) = 0.67(22)$. With the ratio $\sum S_f(206)/\sum S_f(208) = 0.83(7)$ for the lead isotopes ^{206}Pb and ^{208}Pb determined previously,[5] one gets $n(208) = 1.65(30)$ for $3s_{1/2}$ proton occupancy of ^{208}Pb.

The $3s_{1/2}$ occupation probabilities deduced from the present sum-rule analysis scale linearly with the value of z. Future changes of z will directly affect the above results. It should be mentioned that there is some ongoing criticism[6,7] of its value.

The results of this investigation have been submitted to Physical Review Letters for publication.

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PROTON KNOCKOUT FROM THE $1f_{7/2}$ ORBITAL IN ^{40}Ca AND ^{48}Ca

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The extent to which proton core excitations exist in the ground states of the doubly-magic nuclei ^{40}Ca and ^{48}Ca has come under recent scrutiny in connection with attempts to detect signatures of non-nucleonic (Δ-hole) degrees of freedom in the magnetic dipole[1] and spin-isospin[2] response function of complex nuclei. The most direct experimental evidence for core excitations in the ground states of ^{40}Ca and ^{48}Ca, in which $1d_{3/2}$ and $2s_{1/2}$ protons are promoted into the $1f_{7/2} - 2p_{3/2}$ orbitals, involves an accurate determination of spectroscopic factors for picking up $1f_{7/2} - 2p_{3/2}$ protons or stripping protons into $1d_{3/2} - 2s_{1/2}$ holes.

In both cases, however, the transfer reactions involve "small" components of the ground-state wave functions, thus rendering the standard form factor (bound state wave function of the transferred nucleon) description in distorted-wave Born approximation (DWBA) analyses inadequate.[3] The use of more realistic form factors for the pickup from a nearly empty orbit reduces the extracted spectroscopic factor, whereas for stripping into nearly full orbits the opposite is true. This leads to large disagreements between the deduced number of particles and holes of the core excitation, with the hole admixtures becoming uncomfortably large.[4] For

this reason it has been speculated that these transitions receive signifiant contributions from multistep processes.

Therefore we have employed the (e,e'p) knockout reaction on ^{40}Ca and ^{48}Ca to address the question of the occupancy of the proton $1f_{7/2}$ orbital in the Ca-region. It has recently been shown that multistep processes in the (e,e'p) reaction are sufficiently small[5] to enable the study of these "small" wave function components in ^{40}Ca and ^{48}Ca. Furthermore the reaction zone is not concentrated on the surface and outside of the nucleus only, as it is the case for the transfer reactions. In fact, the wave function of the knocked out proton is mapped out in momentum space. Consequently the extraction of spectroscopic factors depends only weakly on the assumed bound state wave function.

The ^{40}Ca(e,e'p)^{39}K reaction has been performed at the NIKHEF-K electron accelerator in the missing momentum range from 40 to 280 MeV/c. The coincident scattered electrons and knocked out protons were detected by two high-resolution magnetic spectrometers. By operating the beam handling system in a dispersion matching mode, a typical missing-energy resolution of about 100 keV was achieved. Data were taken on a enriched ^{40}Ca target in parallel kinematics with a fixed momentum of the detected proton (T_p = 100 MeV). In parallel kinematics the proton is detected in the direction of the momentum transfer. The missing momentum was varied by simultaneously changing the electron scattering angle and the proton detection angle while keeping the kinematics parallel. The measured coincidence cross sections were converted to a spectral function $S(E_x, p_m)$ respresentation. In Fig. 1 the experimental spectral function for p_m = 220 MeV/c is shown versus excitation energy. As can be seen, the
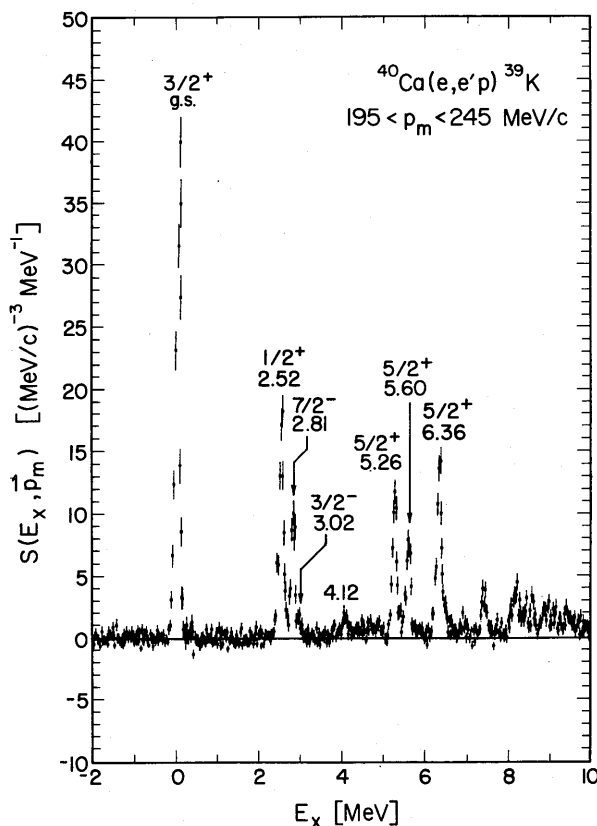

Figure 1. Excitation energy spectrum of the ^{40}Ca(e,e'p)^{39}K reaction for 195 ⩽ p_m ⩽ 245 MeV/c. Excitation energies (in MeV) and spin-parity J^{π} of some known levels in ^{39}K are indicated.

2.81 MeV, J^{π} = 7/2⁻ and 3.02 MeV, J^{π} = 3/2⁻ states in ^{39}K are quite strongly excited, resulting from a proton knockout from the $1f_{7/2}$ and $2p_{3/2}$ orbits.

The analysis of the data and the extraction of spectroscopic factor is under way.

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