I. Physics Motivation

The study of few body systems, especially the ^{3}He nucleus, has been of great interest in the last years, since one can now solve the three body system exactly by means of solving the corresponding Faddeev equations. However, due to the different treatment of the nucleon-nucleon isospin dependence and tensor forces most existing calculations show some scatter in their predictions for the triton binding energy. Nearly all calculations underestimate the triton binding energy by about 0.9 MeV (the experimental value is 8.48 MeV). The effect of three-nucleon forces is hardly addressed at all. Since the ^{3}He nucleus consists of two protons and one neutron, where the probability of finding the neutron in a spatial S-part of the wave-function is about 0.87, the nuclear spin of ^{3}He is more or less comletely carried by the neutron (both proton spins add up to zero). This means a polarized ^{3}He nucleus can be envisaged to a good approximation as a polarized neutron. Due to the isospin dependence and tensor force in the nucleon-nucleon interaction, the neutron can also be found in part in the spatially mixed S′-state, at low missing momenta, and in the D-state, at higher missing momenta. The S′ state has both proton spins paired parallel to the spin of the nucleus whereas in the D-state the spins of the nucleons are antiparallel to the orbital momentum L=2 and therefore antiparallel to the ^{3}He spin. Friar*et al.*[1] give an estimate for the S′-state probability of 2.8%. The D-wave contribution is of the order 10%. This shows that ^{3}He is a suitable target to study the electromagnetic form factors of the neutron. On the other hand, in order to extract precise numbers on the neutron, the ^{3}He wave-function has to be knwon to good precision as well, due to the uncertainties described above. Therefore, we propose to perform a measurement which will allow us to study the effects of the S′- and D-states at a Q^2 of 1.0 GeV/c^2. We plan to study the reactions $^3\vec{\mathrm{He}}(\vec{e},e'p)d$ and $^3\vec{\mathrm{He}}(\vec{e},e'p)pn$ in Hall A using both high resolution spectrometers (HRS).