Transverse asymmetry in polarized electron scattering off polarized ^3He, final state interaction and relativistic effects

E. Pace[a], G. Salmè[b] and A. Kievsky[c]

[a] *Dipartimento di Fisica, Università di Roma "Tor Vergata" and Istituto Nazionale di Fisica Nucleare, Sezione Tor Vergata, Via della Ricerca Scientifica 1, I-00133 Roma, Italy*
[b] *Istituto Nazionale di Fisica Nucleare, Sezione Roma I, P.le A. Moro 2, I-00185 Roma, Italy*
[c] *Istituto Nazionale di Fisica Nucleare, Sezione di Pisa, Via Buonarroti 2, I-56100 Pisa, Italy*

In the last decade the precise determination of both the electric, G_E^n, and magnetic, G_M^n, neutron form factors has become a focus of an intense experimental activity. Because of the lack of free neutron targets, effective neutron targets are needed. Polarized ^3He is especially useful, since its ground state is dominated by a spatially symmetric S wave, where the proton spins cancel out and the ^3He spin is carried by the unpaired neutron.
The transverse asymmetry, $A_{T'}$, in the inclusive polarized electron scattering from polarized ^3He at the quasielastic peak was shown to be most sensitive to the neutron magnetic form factor. PWIA calculations [1], which make use of relativistic kinematics and of a relativistic expression for the electron-nucleon cross section, were shown able to describe $A_{T'}$ in the region around the quasielastic peak, for high momentum transfer values, while nonrelativistic Faddeev calculations [2], which include a full evaluation of the final state interaction (FSI) and the contribution of meson-exchange currents, give a good description of the data, both around the quasielastic peak and in the threshold region, at low Q^2 values (≤ 0.2 $(GeV/c)^2$) [3]. An analysis of $A_{T'}$ with the full Faddeev nonrelativistic calculations allowed to extract G_M^n from the experimental data at $Q^2 = 0.1$ and $Q^2 = 0.2$ $(GeV/c)^2$ [3(a)]. The extension of this analysis to higher values of the momentum transfer requires both the inclusion of FSI and a proper treatment of relativistic effects.
In this contribution preliminary results for $A_{T'}$ in the framework of relativistic hamiltonian dynamics in the instant form will be presented. The wave functions for bound and scattering states are solutions of the mass equation in intrinsic variables. The mass equation is solved using the Kohn variational principle and the correlated hyperspherical harmonic expansion for the wave functions [4]. The Argonne AV18 interaction and the URIX three-nucleon potential are used, and the effects of the Coulomb interaction are taken into account. As a first step, the interaction in the final states is retained only in the scattering states with an incoming $p-d$ state. The full relativistic expression for the electron scattering cross section is used, while the electromagnetic current is considered in impulse approximation. The obtained transverse asymmetry is compared with the results of the PWIA, where only the interaction of the spectator pair is retained, and the effects of FSI are shown to vanish as the momentum transfer increases.

References

[1] A. Kievsky, E. Pace, G. Salmè and M. Viviani, Phys. Rev. **C 56** (1997) 64.
[2] J. Golak et al., Phys. Rev. **C 62** (2000) 054005; Phys. Rev. **C 63** (2001) 034006.
[3] (a) W. Xu et al., Phys. Rev. Lett. **85** (2000) 2900; (b) F. Xiong et al., Phys. Rev. Lett. **87** (2001) 242501.
[4] A. Kievsky, M. Viviani and S. Rosati, Phys. Rev. **C 64** (2001) 024002.