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# Study of Nuclear Medium Effects by Recoil Polarization up to High Momentum Transfers

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The effect of the nuclear medium on the propagation of nucleons is of fundamental importance in the study of the nuclear many body problem. At present there is no consistent set of theories to describe this phenomena. Spectroscopic factors derived from *(e,e'p)* reactions at low outgoing proton energies have always shown a quenching of the order of 20% to 40% from the shell model values after all distortions of the proton have been taken into account, contrary to results obtained from hadron scattering reaction studies. It is possible that various effects such as relativistic dynamics, off shell effects and final state interactions are important and should be incorporated in the analysis. It would also be of great help to isolate these effects and study their importance. In this respect, new observables which are sensitive to specific aspects of the reaction mechanism; e.g., spin response functions, would be very useful to study.

At high $Q^2$ Brodsky[1] and Muller[2] have predicted the possible occurrence of "color transparency" in nuclei. Explicit models to describe the evolution of the hadronic cross section associated with the occurrence of color transparency, in the context of the parton model and PQCD have been proposed. Experimental evidence of color transparency can also be inferred from *(e,e'p)* reactions at high momentum transfers by studying the A and $Q^2$dependence of the nuclear absorption of the knocked out proton. Color transparency is expected to lead to a modification of the final state interaction (FSI) of the struck nucleon with respect to the prediction of the conventional picture in which the nucleons are assumed to be structureless. Frankfurt, Strikman and Zhalov[3] have examined the possibility to observe color transparency by studying the $Q^2$ behavior of the *(e,e'p)* reaction cross sections to specific final hole states in the residual (A-1) nucleus.

This proposal also plans to measure the normal component of the recoil polarization of the ejected proton, $P_n$. In the absence of any nuclear medium effects, $P_n$ is independent of the polarization of the beam and should be zero to first order in PWIA due to time reversal symmetry. Hence this effect can be used to great advantage as an effective filter in the study of FSI in nuclei and also to observe the onset of color transparency in nuclei at high momentum transfers.

We therefore plan to study nuclear medium effects by measuring the $Q^2$ variation of the cross sections and the normal component of the recoil polarization, $P_n$ in the $(e,e'\vec{p})$ reaction on deuterium ($^2$H) and other nuclei ($^4$He, $^{12}$C, and $^{16}$O) at essentially the same kinematics for each nucleus in the $Q^2$ range of 1 to 6 (GeV/c)$^2$ with the pair of high resolution spectrometers in Hall A. The reaction would also be performed on the proton, where $P_n = 0$ at all momentum transfers due to absence of FSI.

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1 S. J. Brodsky, in *Proceedings of the Thirteenth International Symposium on Multiparticle Dynamics.* Eds. E. W. Kittel, W. Metzger and A. Stergion (World Scientific, Singapore), 963 (1982).

2 A. Muller, in *Proceedings of the Seventh Recontre de Moriond.* Ed. J. Thran Thanh Van (Editions Frontieres, Gif-sur-Yvette), 13 (1982).

3 L.L. Frankfurt, M.I. Strikman, and M.B. Zhalov, Nucl. Phy. **A515**, 599 (1990) and M. B. Zhalov, priv. comm. (1990).