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Study of Coincidence Reactions in the Dip and Delta Regions

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Inclusive inelastic electron scattering from nuclei at intermediate energies, generally shows two broad peaks corresponding to quasifree elastic scattering from the nucleon (QE) and quasifree delta resonance production with a "dip" region between them. The goal of this experiment is to identify the various reaction mechanisms that contribute to the electron-nucleus scattering process in the dip and delta-resonance regions.

The proposal was submitted in 1989. It was motivated by the existing inclusive (e,e') and exclusive (e,e'p) data that were indicating that non-one-body processes play an important role in the delta region, the dip region, and even the QE region. Since then, more experimental data and theoretical calculations have become available. These new results not only confirm the previous findings, but further demonstrate the need for performing exclusive experiments with multihadrons in the final state. Here, we summarize some of the results:

1) In the QE region, the one-body picture which describes the (e,e) cross sections reasonably well, fails to explain the separated response functions. Despite the extensive amount of theoretical work that has been devoted to the understanding of (e,e') data, especially in the last few years, a full explanation of both response functions in a consistent model has not yet been accomplished. [1] The ^{12}C(e,e'p) data show that multinucleon knockout processes can account for 25\%-40\% of the total cross section. [2] Separated (e,e'p) coincidence data show a substantial enhancement of the transverse response function relative to the longitudinal above the two-body emission threshold.

2) In the dip region, the underestimation of the inclusive cross section by the theoretical calculations has not been solved. The first exclusive ^{12}C(e,e'p) data indicated a strong contribution of multinucleon processes that could not be explained by rescattering effects. [3] Similar observations are made in ^{3}He(e,e'p) data in the dip region and also in more recent ^{12}C(e,e'p) experiments at non-parallel kinematics.[4]

3) In the delta region, the theoretical calculations that include medium effects in the delta-excitation, in the framework of the delta-hole model, generally reproduce the broad shape of the (e,e'p) peak relatively well, but underestimate the data. These results suggest the presence of more complex multinucleon processes, and perhaps the need for a better treatment of the modification of the delta in the nuclear medium. The exclusive ^{12}C(e,e'p) data in this region clearly show a strength beyond the region populated by the one-body process and below the pion threshold. [5] Theoretical calculations, that only recently have become available, show that this region is dominated by two-body knockout processes and their contribution may well extend to the pion production region. [6] Three-body absorption, which is not yet included in the existing calculations, is expected to contribute mainly to the region above pion threshold. The more recent ^{12}C(e,e'p) data that have been taken at non-parallel kinematics also show similar features. [4,6]

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