(e,e'p) reaction at true quasielastic kinematics in ^{16}O, ^{12}C and ^{208}Pb at JLab

J.L. Herraiz[1], J.M. Udías[1], L. Weinstein[2], K. Fissum[3], A. Camsonne[4], A.Saha[4], J.C. Cornejo[5], K. Aniol[5], G. M. Urciuoli[6] , and Hall A collaboration

[1] Universidad Complutense, Madrid, Spain
[2]Old Dominion University, Norfolk, VA, USA
[3]Lund University, Lund, Sweden
[4] Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
[5]California State University, Los Angeles, Califonia, USA
[6]INFN, Sezione di Roma, Rome, Italy

Abstract: The reactions $^{16}O(e,e'p)^{15}N$, $^{208}Pb(e,e'p)^{207}Tl$ and $^{12}C(e,e'p)^{11}B$ were measured in experiments E00-102 and E06-007 performed at JLab (VA, USA) at true quasielastic kinematics ($x_B = 1$) with constant energy (ω) and momentum (q) transferred over a wide p_{miss} range. These experiments address several open issues in nuclear structure such as the role of relativity and of long-range correlations in the description of nuclei as well as a possible dependence of the spectroscopic factors on Q^2. Preliminary experimental results and theoretical predictions from a fully relativistic DWIA model carefully averaged over the experimental acceptances are shown.

Keywords: Quasielastic electron scattering, Nuclear Structure, Impulse Approximation
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INTRODUCTION AND EXPERIMENTAL SETUP

The A(e,e'p)B reaction is one of the main tools for studying nuclear structure [1]. The experiments described in this work [2-3] were performed with a continuous electron beam in Hall A at JLab. The scattered electron **e'** and the ejected proton **p** were measured in coincidence with two High-Resolution Spectrometers (HRS) [4].

By measuring the 3-momentum of the incident and detected particles and applying the conservation of energy and momentum, the energy and momentum of the residual nucleus can be determined. From this, useful nuclear-structure information is obtained.

TABLE 1. Kinematics of the E00-102 and E06-007 experiments.

Target	Incident Energy	q (GeV/c)	ω (GeV)	p_{miss} range (GeV/c)
^{16}O	4.620 GeV	1.073	0.499	(-0.55,+0.75)
^{12}C, ^{208}Pb	2.649 GeV	1.000	0.439	(-0.5,+0.5)

THEORY AND SIMULATIONS

Within the Plane-Wave Impulse Approximation (PWIA), the measured differential cross section factorize into the elementary electron-proton cross-section and a spectral function representing the probability of finding a proton with binding energy E_{miss} and momentum $\mathbf{p}_{miss}$ inside the target nucleus. Nevertheless, realistic predictions require more sophisticated approaches, such as the Distorted-Wave Impulse Approximation (DWIA) [3]. In this work, a fully-relativistic, unfactorized DWIA model [5] was carefully averaged over experimental acceptances via the Monte-Carlo simulation code MCEEP [6, 7]. These simulated data were analyzed using the exact same cuts and criteria applied to the experimental data.

PRELIMINARY RESULTS

As shown in Fig. 1, the experimental reduced cross-section (with statistical errors only) and the results obtained from the simulations are in reasonable good agreement. Spectroscopic factors of about 0.6 are required in all cases. There is no significant excess strength in the data as compared to the simulations at large $\mathbf{p}_{miss}$. This would be expected if long-range correlations played a significant role [3] as the simulations do not include them. Comparison with other theoretical models is currently under way.

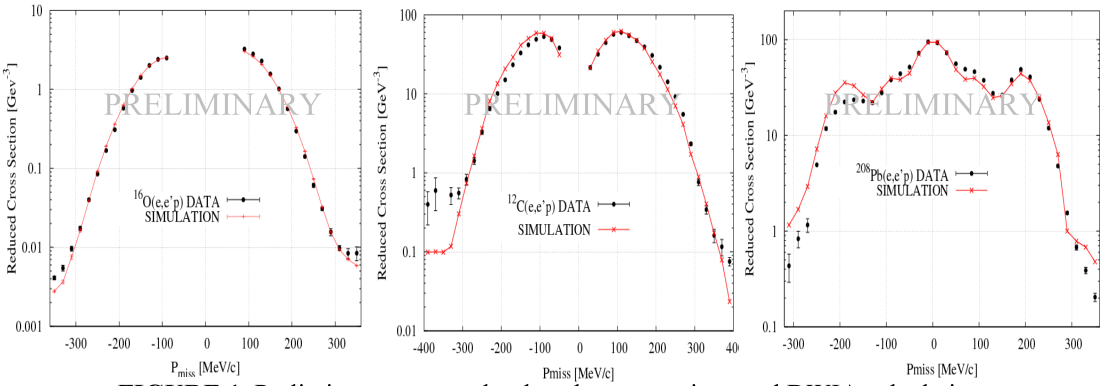

FIGURE 1. Preliminary measured reduced cross sections and DWIA calculations for the extraction of a proton from the valence states of ^{16}O, ^{12}C, and ^{208}Pb.

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