DOES A NUCLEON APPEARS DIFFERENT WHEN INSIDE A NUCLEUS

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INTRODUCTION

The famous EMC effect[1] was discovered inadvertently 25 years ago when physicists, in the goal of increasing the counting rates, used heavy nuclei as targets to study the properties of the nucleon. It was observed that the nucleon structure changed as one looked at heavier and heavier nuclei. This modification can be interpreted as a suppression of high momentum quarks in heavier nuclei. Many theoretical models were developed trying to map out this effect but most of them failed to reproduce all its aspects. A new measurement was performed at Jefferson Lab in 2004 with, for the first time, a look at the EMC effect in ^{3}He and better precision data for five other nuclei between ^{4}He and ^{197}Au. The study of the EMC effect on light nuclei benefits from the availability of few-body calculations. A theoretical overview in addition to the nearly final data from Jefferson Lab will be presented in this talk.

EXPERIMENTAL

The experiment ran during the fall of 2004 in the experimental hall C at Jefferson Lab. It was an inclusive experiment scattering unpolarized electron beam on eight different fix target: ^{1}H, ^{2}H, ^{3}He, ^{4}He, ^{9}Be, ^{12}C, ^{63}Cu, ^{197}Au. Data were taken at two incident beam energies (5.011 and 5.767 GeV) and ten scattering angles (18, 22, 24, 26, 29, 32, 36, 40, 46 and 50^{o}) covering the quasi-elastic scattering region, the resonance region and part of the deep inelastic scattering region for values of Q^2 between 2 and 7 $(GeV/c)^2$. Absolute cross sections were extracted for each target at each kinematic and then ratios of nuclear cross sections (s_A) per nucleon to the deuterium cross sections (s_D) per nucleon were formed.

RESULTS

Because our data are at lower energy than previous measurements, a careful study of the Q^2-dependence on the carbon to deuterium ratio was performed. Only the two highest Q^2 data sets, which are positioned well above the onset of the Q^2-independence, were used in the final results. Fig. 1 shows our preliminary results on the EMC effect in ^{3}He compared to data from the HERMES collaboration[2] at DESY, three theoretical calculations (cyan[3], navy blue[4] and magenta[5]) and the SLAC fit[6]. The experimental EMC ratio has been corrected for the proton excess which reduced the EMC ratio by as much as 10% at x=0.6. We can observe a striking underestimate of the EMC effect at large x from the calculations and the SLAC fit. However the models assume a dependence of the magnitude of the EMC effect as a function of the nuclear mass but results on ^{4}He and ^{12}C indicate the possibility of nuclear density dependence.
More results will be presented in the talk, including the EMC effect on heavier nuclei.

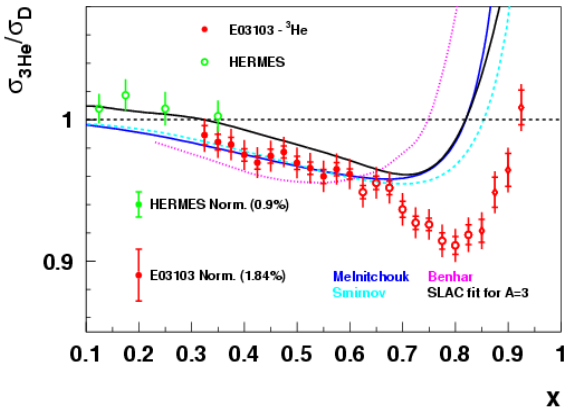

Figure 1: Preliminary results on the EMC effect in ^{3}He (for more details, see text)

Finally the results on the reanalysis of the world data on the EMC effect will be shown as well as the new extrapolation to the EMC effect on an infinitely heavy nucleus (or nuclear matter). The advantages of EMC effect measurements on light nuclei or the extraction of the nuclear matter is that advanced calculations are available.

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