(e, e' p) study of momentum distributions in *A*=3 nuclei

U.S. DEPARTMENT OF ENERGY | Office of Science

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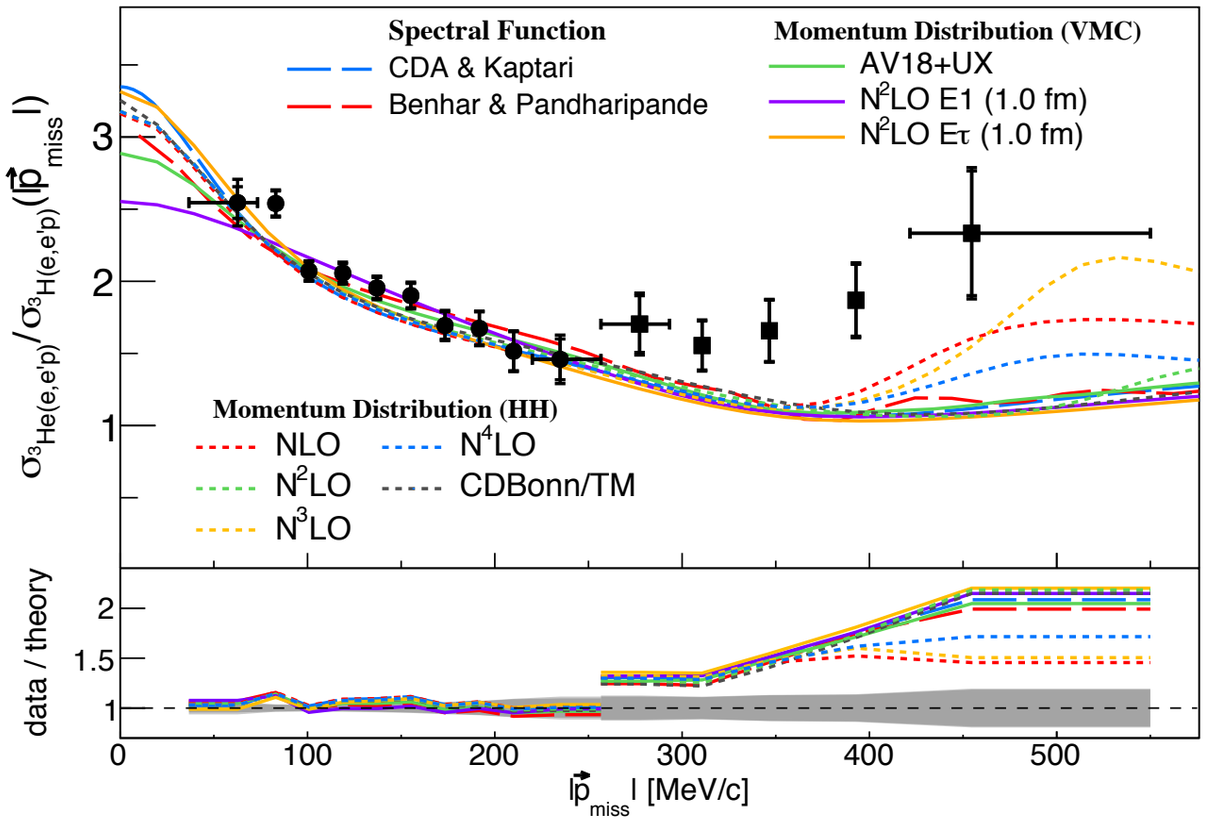
Objectives

- We report the first measurement of the (*e,e'p*) reaction cross-section ratio for ^{3}He relative to ^{3}H, with missing momentum range of $40 \le p_{miss} \le 550$ MeV/c, at large momentum transfer $\langle Q^2 \rangle \approx 1.9$ (GeV/c)^2 and $x_B > 1$.
- The data is compared with calculations performed within the plane-wave impulse approximation (PWIA) using realistic spectral functions and momentum distributions.



Extracted ^{3}He to ^{3}H(*e,e'p*) cross section ratio plotted vs. p_{miss} compared with different models of the corresponding momentum distribution ratio.

Impact

- The measurement of the ^{3}He(*e,e'p*) and ^{3}H(*e,e'p*) reactions is performed in kinematics where the cross-sections are expected to be sensitive to the proton momentum distribution, and two-body currents and the effects of final state interaction (FSI) are minimal.
- The measured and PWIA cross-section ratios agree within the measurement accuracy of about 3% up to the nuclear Fermi-momentum (≈ 250 MeV/c), and differ by 20%–50% at higher momenta despite a four order of magnitude decrease of the momentum distribution in this range. FSI calculations using the generalized Eikonal Approximation indicate that FSI should change the ^{3}He/^{3}H cross-section ratio for this measurement by less than 5%.
- The data overall supports the transition from single-nucleon dominance at low p_{miss}, towards an *np*-short-range-correlated pair dominant region at high p_{miss}.
- The observed difference between the ^{3}He/^{3}H experimental ratio and momentum distribution ratios at large p_{miss} might arise from the loosely-constrained short-distance parts of the *NN* interaction.

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Accomplishments

- Publication: R. Cruz-Torres *et al.* (Jefferson Lab Hall A Tritium Collaboration), Phys. Lett. B 797, 134890 (2019)