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Consistency Constraints on Pion Momentum Distributions in the Nucleon KHALIDA HENDRICKS, North Carolina State University, Raleigh, NC 27695, WALLY MELNITCHOUK, Thomas Jefferson National Accelerator Facility, Newport News, VA 23606 — The effects of the pion cloud of the nucleon can be parametrized in the form of pion momentum distributions (PMDs) in the nucleon. Previous efforts have used the naive pseudoscalar formulation to calculate PMDs; however, the pseudovector formulation arises more naturally from chiral field theory and explicitly respects chiral symmetry. We used pseudovector theory to calculate PMDs using several different form factors commonly used in the literature. It was found that the pseudovector formulation introduces terms that have a profound effect on the resulting PMDs. Terms that had values only at zero pion momentum had important consequences for the physical interpretations of the results. Form factors that explicitly suppress these terms may introduce significant error into calculations. In addition, suppressing terms at zero pion momentum requires that contributions previously treated separately be considered together in order to maintain a physical, probabilistic interpretation. One form factor is shown to violate gauge invariance not just in the pseudovector but also in the pseudoscalar formulation, calling into question the validity of using this form factor at all. These results will provide guidance for more accurate effective theories to describe the long-range structure of the nucleon.

Khalida Hendricks
North Carolina State University, Raleigh, NC 27695

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