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Three-nucleon force effects in 3N hadronic reactions[1]

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Results on three-nucleon scattering below the pion production threshold will be presented with emphasis on the need of a three-nucleon force (3NF). The large discrepancies between a theory based on numerical solutions of 3N Faddeev equations with modern NN interactions and data clearly point to the action of 3NF's. Successes and failures in the description of high precision 3N data using in addition to the pairwise interactions present day 3N forces will be discussed. The large theoretically predicted 3NF effects for different 3N polarization observables nourish the hope to pin down the proper spin structure of 3NF's. Especially interesting in this respect are higher energy data which, however, require to study magnitude of relativistic effects. Importance of relativity in 3N continuum, in particular of boost and Wigner spin rotation, on observables in elastic scattering and breakup will be discussed. The boost effects turn out to be significant for the elastic scattering cross section mostly at higher energies. They diminish the transition matrix elements at higher energies and lead, in spite of the increased relativistic phase-space factor as compared to the nonrelativistic one, to rather small effects in the cross section, mostly restricted to the backward angles. At energies below $\sim$20 MeV boost and Wigner spin rotation lower the maximum of vector analyzing power increasing the discrepancy between theory and data. This calls for even larger 3NF effects to explain low energy analyzing power puzzle. Higher energy elastic scattering spin observables are only slightly modified by relativity. The selectivity of the breakup singles out this reaction as a tool to look for localized effects which when averaged are difficult to see in elastic scattering. At higher energies this selectivity of breakup allows to find the configurations with large relativistic and/or 3NF effects.

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