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Benchmarking reaction theories for nucleon knockout reactions

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Recently, proton-induced nucleon knockout reactions, (p,pN), have been utilized for the nucleon spectroscopy of nuclei, for unstable nuclei in the inverse kinematics in particular. In this study the benchmarking of the three reaction theories for describing the (p,pN) reaction has been done. The momentum distributions calculated with the distorted wave impulse approximation (DWIA) and the transfer-to-the-continuum model (TC) for the 15C(p,pn)14C reaction at 420 MeV/u have been compared with the already published results of the Faddeev/AGS (FAGS) method. The same inputs are adopted to three reaction calculations as much as possible. As a result, a very good agreement has been found between DWIA, TC and FAGS. Within the DWIA framework, the energy dependence of the distorting potentials, which is difficult to be taken into account in the TC and FAGS frameworks, is found to affect in a modest way on the shape and magnitude of the momentum distributions. However, it is found that the inclusion of relativistic corrections increases the knockout cross section by about 30%, which shows the importance of that treatment for deducing the spectroscopic information from the (p, pN) cross sections.

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