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First Computation of 4He Compton Scattering and Nucleon Polarisabilies: the Transition Density Formalism

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In few-nucleon systems, the transition-density formalism is highly efficient to compute interactions with perturbative probes. One- and two-body transition densities that encode the nuclear structure of the target are evaluated once and stored for one nucleus. They are then convoluted with an interaction kernel to produce observables. The same densities can be used with different kernels. This method exploits factorisation between nuclear structure and interaction kernel in Chiral EFT. It takes full advantage of the numerical power of modern few-nucleon methods, is markedly more computationally efficient and applicable to a wide array of nuclei and reactions. In this contribution, the formalism is first introduced and then applied to present the first theory description of 4He Compton scattering. It uses the same Compton kernels familiar from proton, deuteron and 3He Compton scattering in Chiral Effective Field Theory with explicit Delta degrees of freedom, applicable between about 50 and 130MeV. The result compares well to data from HIγS, MAXlab and Illinois. We also address the sensitivity of cross section and beam asymmetry on the (static) scalar-isoscalar polarisabilities of the nucleon which parametrise the stiffness of charge distributions against deformations. The project is part of the synergetic international effort of experimentalists and theorists in Compton scattering on one- and few-nucleon systems.

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Parallel Session

Few-Body Systems

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