Theoretical description of deeply virtual Compton scattering off ^{3}He

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The measurement of Generalized Parton Distributions (GPDs) plays a very relevant role in nowadays Hadronic Physics. In particular, it will be an important part of the initial Science Program of the 12 GeV upgrade of JLab [1]. Many crucial nonperturbative hadron properties will be accessed for the first time, as, e.g., the parton orbital angular momentum (OAM), a crucial step towards the understanding of the cumbersome nucleon spin structure [2]. The issue of measuring GPDs for nuclei has been addressed in several papers, starting from Ref. [3], with the aim at unveiling the parton structure of bound nucleons. Great attention has anyway to be paid to avoid to mistake novel effects with conventional ones. To this respect, a special role is played by few-body nuclear targets, for which realistic studies are possible and exotic effects can be therefore distinguished. In Ref. [4], an Impulse Approximation (IA) calculation of the GPD H of ^{3}He has been presented, valid at low values of the momentum transfer, Δ^2. The approach permits to investigate the coherent, no break-up channel of deeply virtual Compton Scattering (DVCS) off ^{3}He, which can be hardly studied at large Δ^2, due to the vanishing cross section. In this talk, a very recent extension of Ref. [4], reported in Refs. [5,6,7], will be presented. With respect to that of Ref. [4], the aim here is a different one: it is proposed to use ^{3}He to collect effective neutron data, to allow a clear flavor separation of the nucleon GPDs, an impossible task using proton data only. An IA calculation, within the Av18 interaction [8], of the GPDs $H(x, \Delta^2, \xi)$ and $E(x, \Delta^2, \xi)$ (ξ being the so called "skewedness", representing the longitudinal momentum asymmetry) of the ^{3}He nucleus, whose sum, $\tilde{G}^3_M(x, \Delta^2, \xi)$, is related in a proper limit to the magnetic form factor of ^{3}He, is described. The IA contribution to the magnetic form factor of ^{3}He is correctly recovered and, more importantly, it is found that $\tilde{G}^3_M(x, \Delta^2, \xi)$, at low momentum transfer, is dominated to a large extent by the neutron contribution [5]: the peculiar spin structure of ^{3}He, very well known and widely used for similar purposes [9], makes this target unique for the extraction of the neutron information. It is shown moreover that a simple approximation to $\tilde{G}^3_M(x, \Delta^2, \xi)$, using nuclear structure ingredients which are independent on the nuclear potential and under good theoretical control, accounts for the full calculation. As a consequence, a safe extraction procedure, able to take into account the nuclear effects described in the IA framework, largely independent also on the nucleonic model used in the calculation, is proposed [6,7]. Thanks to this new relation it is possible to extract the neutron information directly from ^{3}He data. This observation could allow to access, for the first time, the OAM of the partons in the neutron. The evaluation of the DVCS cross section, in terms of the calculated GPDs, is under way.

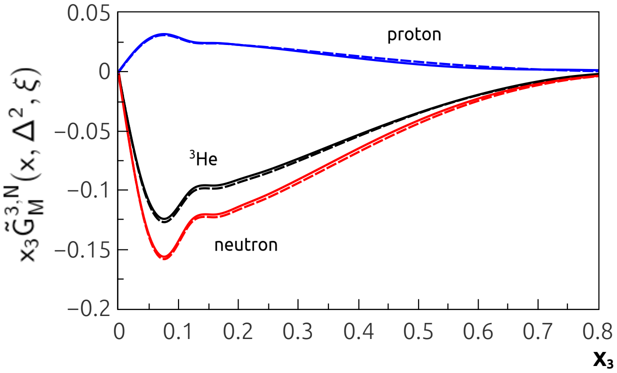

Figure 1: $\tilde{G}^3_M(x, \Delta^2, \xi)$, multiplied by $x_3 = 3x$, at $\Delta^2 = -0.1$ GeV^2 and $\xi_3 = 3\xi = 0.1$, together with the proton and neutron contributions (full lines), compared to a simple approximation to these quantities (see text and Refs. [6,7]) (dashed lines). It is seen that the approximation works very well. This allows a safe extraction of the neutron information [6,7].

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