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The Compton amplitude and nucleon structure functions

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The structure of hadrons relevant for deep-inelastic scattering are completely characterised by the Compton amplitude. The standard approach in structure function calculations is to utilise the operator product expansion where one computes the local matrix elements. However, it is well established that tackling anything beyond leading-twist presents additional challenges that are not easily overcome; complicating the investigations of hadron structure at a deeper level. Alternatively, it is possible to directly calculate the Compton amplitude by taking advantage of the Feynman-Hellmann approach. By working with the physical amplitude, the intricacies of operator mixing and renormalisation are circumvented. Additionally, higher-twist contributions become more accessible given precise enough data.

In this talk, we focus on the QCDSF/UKQCD Collaboration's advances in calculating the forward Compton amplitude via an implementation of the second-order Feynman-Hellmann theorem. We highlight our progress on investigating the low moments of unpolarised structure functions of the nucleon. We also have a glance at our progress on the polarised and off-forward cases.

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