The Compton amplitude and structure functions of the nucleon

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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 (OPE) where one computes the local matrix elements. However, it is well established in the lattice community that computing higher-twist contributions 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 familiar Feynman-Hellmann approach applied in the context of lattice QCD. By working with the physical amplitude, the intricacies of operator mixing and renormalisation that plauge the OPE approach are circumvented. Additionally, higher-twist contributions become more accessible given precise enough data.

In this talk, we focus on the QCDSF/UKQCD/CSSM lattice collaboration's advances in calculating the forward Compton amplitude of nucleon via an implementation of the second-order Feynman-Hellmann theorem [1]. We highlight our progress on investigating the low moments of unpolarised and polarised structure functions of the nucleon.

[1] K. U. Can, A. Hannaford-Gunn, R. Horsley, Y. Nakamura, H. Perlt, P. E. L. Rakow, G. Schierholz, K. Y. Somfleth, H. Stüben, R. D. Young, and J. M. Zanotti, *"Lattice QCD evaluation of the Compton amplitude employing the Feynman-Hellmann theorem,"* Phys. Rev. D **102** (2020), 114505 doi:10.1103/PhysRevD.102.114505 [arXiv:2007.01523 [hep-lat]].