Structure functions: a challenge for the lattice

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Abstract

The lattice provides a method to compute physical quantities from first principles in a fully non-perturbative fashion. The particular interesting example of structurefunctions on the lattice is discussed in this talk. The status of theses computations is demonstrated with the example of a lattice computation of the second moment $\langle x \rangle$ of the pion matrix element of the twist-2, non-singlet operator.

It is shown that a full non-perturbative evaluation of the running renormalization constant as well as a careful extrapolation of the results to the continuum limit can be performed using modern finite size scaling techniques. Hence, the only limitation of the final result is the quenched approximation. Within this approximation it is found that $\langle x \rangle = 0.30(3)$ from lattice calculations whereas experiments give $\langle x \rangle = 0.23(2)$. Whether the difference is to be attributed to the quenched approximation is an interesting question to be resolved in the future.

Many further results are already obtained from lattice calculations but they are still lacking a non-perturbative renormalization and/or a continuum limit value. People are working hard to overcome these shortcomings.

The big challenge is, however, to leave the quenched approximation behind and perform full dynamical quark simulations. Here the work has just begun and it needs a little patience to let the people working with lattice methods obtain values of many moments with fully controlled systematic errors.