

Probing TeV physics with precision calculations of nucleon Structure using lattice QCD

This talk will present a number of high precision results on matrix elements of quark bilinear operators between nucleon states using lattice QCD. From these, we extract a number of exciting quantities, at the intersection of nuclear and particle physics. We show that the axial charge g_A , a fundamental parameter encapsulating the weak interaction of nucleons, is calculated with a few percent accuracy. Results for the scalar and tensor charges, g_S and g_T , which combined with precision neutron decay distribution probe novel scalar and tensor interactions at the TeV scale. Vector form factors are probed in electron scattering, while axial vector form factors are used in the calculation of the cross-section of neutrinos on nuclear targets. These energy dependent cross-sections are needed to determine the neutrino flux, an important systematic in neutrino oscillation experiments. Finally we will present results for flavor diagonal charges that provide the contribution of the quark spin to the nucleon spin, the quark EDM to the neutron EDM, and needed to determine the cross-section of dark matter with nuclear targets.

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