RJPHY Research Journal of Physics

OPEN ACCESS

Executive Summary

Colour Transparency in Holographic Light

Rasha Kamal

Quantum chromodynamics (QCD), the theory of the fundamental components of hadrons, quarks, and gluons, makes a unique prediction in the form of colour transparency (CT). A hadron's capacity to transit a nucleus with less absorption is referred to as CT when it is created at a high momentum transfer, Q, in a hard exclusive process. This characteristic represents the fact that a hadron's valence Fock state, in which its quark elements have a small transverse separation, a1/Q, and propagate as a small-size colour-singlet, dominates the dynamics of a hard scattering interaction. The dependence on the twist is since the twist increases, more momentum must be transferred to form a tiny size colour-singlet by bringing all of the hadron's valence Fock state's constituents to a small transverse separation.

One of the most prominent features of quantum chromodynamics (QCD) phenomenology is colour transparency (CT): When a hadron is created at a high transverse momentum in a hard exclusive process, its absorption is diminished as it travels through nuclear materials. The magnitude of the propagating hadron's colour dipole moment, or the distance between its coloured components, is reflected in the nuclear absorption.

The nonperturbative analytic structure of the hadron generalized Parton distributions (GPDs), produced within the framework of holographic light-front (LF) QCD, and valid in the entire domain of the kinematic variables, is the foundation for the beginning of CT predicted in this research.

It was already suggested that CT effects for a meson beam should be stronger when compared to nucleon-nucleon scattering. The findings at Jefferson Laboratory (JLab), which have shown CT presence for the mesons and the absence of CT for protons, are consistent with the predictions made here for the commencement of CT. These current observations, however, are restricted to readings below the range of Q2, which is thought to be the point at which proton CT will begin.

Journal Reference

Brodsky, S.J.; de Téramond, G.F., 2022. Onset of Color Transparency in Holographic Light-Front QCD. Physics 2022, 4, 633–646

KEYWORDS

QCD color transparency,high-transverse-momentum reaction in nuclei, hadron electroproduction in nuclei, nuclear absorption