Contribution ID: **429**   Type: **Talk**

The chiral anomaly and axion-like dynamic in polarized DIS

Wednesday 8 September 2021 17:26 (15 minutes)

I'll discuss the role of the chiral anomaly in deep inelastic scattering (DIS) of electrons off polarized protons employing a worldline formalism, which is a powerful framework for the computation of perturbative multi-leg Feynman amplitudes. I'll demonstrate how the triangle anomaly appears at high energies in the DIS box diagram for the polarized structure function $g_1(x_B, Q^2)$ in both the Bjorken limit of large Q^2 and in the Regge limit of small x_B. I show that the infrared pole of the anomaly appears in both limits. I will introduce an effective action for spin dependent observables at small x that follows from the cancellation of the infrared pole in the matrix element of the anomaly. This effective action, consistent with anomalous chiral Ward identities, is controlled by two dimensionful scales in Regge asymptotics. The first is the color charge squared per unit area, while the second is the pure Yang-Mills topological susceptibility.

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Session Classification: QCD, spin physics and chiral dynamics

Track Classification: QCD, spin physics and chiral dynamics