

# XXVIII International Workshop on Deep-Inelastic Scattering and Related Subjects



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## The role of the axial anomaly in polarized DIS: Emergent axion-like dynamics and the small $x$ effective action

*Wednesday, 14 April 2021 14:03 (18 minutes)*

We discuss the role of the chiral “triangle” anomaly in deeply inelastic scattering (DIS) of electrons off polarized protons employing a powerful worldline formalism which allows for the efficient computation of perturbative multi-leg Feynman amplitudes. We 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  $x_B$ . We show for the first time that the off-forward infrared pole of the anomaly appears in both limits. We motivate a small  $x$  effective action, consistent with anomalous chiral Ward identities, that shows how non-perturbative effects cancel the infrared pole, leading to an effective axion-like dynamics at small  $x$ . There are two non-perturbative scales that control this dynamics: one is the saturation scale and the other is the pure Yang-Mills topological susceptibility; we discuss how their dynamical interplay can be uncovered in polarized DIS at the Electron-Ion Collider.

References:

A. Tarasov and R. Venugopalan “Role of the chiral anomaly in polarized deeply inelastic scattering: Finding the triangle graph inside the box diagram in Bjorken and Regge asymptotics”, *Phys. Rev. D* 102, 114022;

A. Tarasov and R. Venugopalan “The role of the chiral anomaly in polarized deeply inelastic scattering: Emergent axion-like dynamics and the small  $x$  effective action”, in preparation.

**Primary authors:** Dr TARASOV, Andrey (The Ohio State University); VENUGOPALAN, Raju (BNL)

**Presenter:** Dr TARASOV, Andrey (The Ohio State University)

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