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One-loop structure of parton distribution for the gluon condensate and "zero modes"

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We present the results for the one-loop corrections to the "gluon condensate" twist-4 PDF F(x), in particular, we give expression for the gg-part of its evolution kernel. To enforce strict compliance with the gauge invariance requirements, we have used on-shell states for external gluons and have obtained identical results both in Feynman and light-cone gauges. No "zero mode" terms were found for $F(x)$. However, a $q^2\delta(x)$ term was found for the $\xi = 0$ GPD $F(x, q^2)$ at nonzero momentum transfer q. These results do not agree with the original attempt of one-loop calculations of $F(x)$ for gluon states, which sets alarm warning for calculations and the lattice renormalization procedures that use matrix elements with virtual external gluons.

Authors: RADYUSHKIN, Anatoly; ZHAO, Shuai (Old Dominion University/Jefferson Lab)

Presenter: ZHAO, Shuai (Old Dominion University/Jefferson Lab)

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