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## The Fractal TMDs and the proton structure functions at low x

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In this paper, we study the Parton Distribution Functions (PDFs) at low x and at NLO approximation in perturbative QCD.

To this end, a simple parametrization for the unintegrated Parton Distribution Functions based on the "Fractal" approach is considered. These functions have self-similar behavior at low x and  $k_t^2$  for sea quarks and have self-similar behavior at low x for gluon distribution. By integration from these TMDs, the initial input densities are obtained and the free parameters of this model are calculated by global analysis of experimental data released by HERA experiment on electron-proton  $(e^-p)$  and positron-proton  $(e^+p)$  for natural current (NC) interactions in DIS processes for the range of  $1.5 < Q^2 < 650$  (GeV<sup>2</sup>) and x < 0.01.

The uncertainty estimations in the present analysis are carried out using the standard "Hessian" method. Considering the overall value of  $\chi^2$ /dof and theory-to-data comparisons, the results indicate nice agreements between the experimental datasets and other phenomenological predictions at low *x*.

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