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From deep-inelastic structure functions to two-photon dilepton production in proton-proton collisions

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We investigate different methods to incorporate the effect of
photons in hard processes.
We compare two different approaches used for calculating
cross sections for two-photon $pp \to l^+l^-X$ process.
In one of the approaches photon is treated as a collinear parton in
the proton. In the second approach recently proposed a k_t-factorization
method is used. We discuss how results of the collinear parton model
depend on the initial condition for the QCD evolution
and discuss an approximate treatment where photon is excluded
from the combined QCD-QED evolution.
We demonstrate that it is not necessary to put photon into the
evolution equation as often done recently but it is sufficient
to use a simplified approach in which photon couples to quarks
and antiquarks which by themselves undergo DGLAP evolution equations.
Our k_t-factorization results (inelastic photon fluxes in the nucleon)
depend on deep-inelastic structure function.
We discuss sensitivity of the results to the choice
of structure function parametrization and experimental cuts
in the k_t-factorization approach. We find that results are sensitive
to the region of x and Q^2 where pQCD DGLAP evolution does not apply.
We compare results of our calculations with recent experimental data
for dilepton production and find that in most cases
the contribution of the photon-photon mechanism is rather small.
We discuss how to enhance the photon-photon contribution.
We also compare our results to those of recent measurements of
exclusive and semi-exclusive e^+e^- pair production with new
experimental data obtained by the CMS collaboration.
The presentation will be based on our recent papers
[1], [2].

[1] G.~G.~da Silveira, L.~Forthomme, K.~Piotrzkowski, W.~Sch\"afer and A.~Szczurek,
"Central $\mu^+ \mu^-$ production via photon-photon fusion in proton-proton collisions with proton dissociation,"
JHEP {\bf 1502}, 159 (2015)
[arXiv:1409.1541 [hep-ph]].

[2] M. {\L}uszczak, W. Sch\"afer and A. Szczurek,
"Two-photon dilepton production in proton-proton collisions: two alternative approaches,"
[arXiv:1510.00294 [hep-ph]].

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