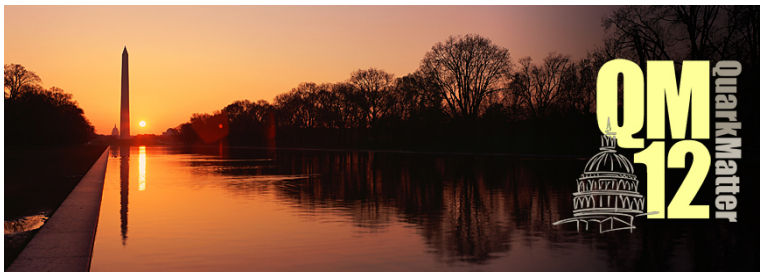

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Non-linear QCD dynamics in photon-photon interactions at high energies

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At high energies the amount of gluons in a hadron is much larger than the amount of any other constituent, for example it is much larger than the amount of sea quarks. Therefore, at high energies the hadronic cross sections are basically a function only of the gluons distribution. The color dipole formalism applied to photon-photon collisions implies that, before interacting, each of the photons fluctuates in a pair quark-antiquark with a certain probability. The pair is colorless and it is also called Color Dipole. In a first approximation we can treat one of the pairs quark-antiquark as if it was a hadron and we can apply the evolution equations of QCD to determine its gluons distribution. Then the photon-photon cross section can be factorized as a product of two terms. The first one is the probabilities for each photon fluctuate in a color dipole and the second term is the dipole-hadron cross section. In order to determine the dipole-hadron scattering amplitude we used non-linear QCD dynamics. The non-linearity of the evolution equations implies that the gluons distribution inside the hadron saturates when a given kinematic regime is reached. The scale separating the saturation regime of the linear one is called Saturation Scale. When the saturation regime is reached it is expected that the gluons distribution form a new state of matter, the called Color Glass Condensate (CGC). The search for the CGC is still going on and it is expected that LHC, as well as the future eRHIC, will give us a definitive answer of its existence. In this work we applied the CGC approach to photon-photon collisions through the color dipole formalism. We calculated cross sections to photon-photon scattering and calculated structure functions of virtual and real photons. We proposed a new model to the dipole-dipole cross section and compared our results with a model available in the literature. Our calculations can be considered as predictions to observables that will be measured in a future linear collider.

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