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QCD and Deep Inelastic Scattering

In this chapter QCD and its properties are reviewed. QCD is a gauge theory based on the non-Abelian color symmetry group $SU(3)$. In QCD the gluon is a mediator particle of color interactions carrying color charge, in contrast with the photon in Quantum Electrodynamics (QED). In this review, starting from the Lagrangian of QCD, both perturbative QCD and nonperturbative QCD are presented. In the high energy region, the perturbative QCD approach is a very powerful method to link elementary quantities and physical quantities through a factorization theorem in order to be able to interpret the theoretical results and experimental data. In the factorization theorem, the differential cross section is factorized based upon all orders of the running coupling constants, $\alpha_S(Q^2)$. A summary review of QCD and its properties, the quark parton model (QPM), DIS, factorization theorem, and QCD evolution is presented in the next sections.

2.1 Quantum Chromodynamics

QCD poses a fundamental theory of the strong interaction, where quarks and gluons are its degrees of freedom and it is a part of the $SU(3) \times SU(2) \times U(1)$ standard model of particle physics. The dynamical interaction of the quarks and gluons renders the color interactions. QCD is constructed based upon the gauge group $SU(3)_C$ in color space which is non-Abelian gauge group. In group theory, $SU(3)$ means the special unitary group in 3 dimensions which involves the unitary set of 3×3 matrices with determinant one. The set has nine linearly independent unitary complex matrices¹. One has determinant -1 and there are a total of eight independent component matrices in the matrix space. This corresponds to eight different generators of $SU(3)$ ². In QCD, the quark-quark interaction and gluons interaction as potential part and kinetic (free)

¹A complex matrix has $2N^2$ degrees of freedom. Unitary has N^2 constraints

²The number of generators of the $SU(N)$ is $N^2 - 1$. Hence the number generators is 8 for $SU(3)$.

Deep Inelastic Scattering And Qcd

DIS, Johannes Blümlein



Deep Inelastic Scattering And Qcd:

Deep Inelastic Scattering and QCD, 1997 **QCD at HERA** Michael Kuhlen, 2013-10-03 The book provides a review of the hadronic final state measurements at HERA in deep inelastic scattering It covers general event properties particle spectra heavy flavours jets event shape measurements QCD instantons and small x physics The emphasis is on experimental results providing quick access to the data complete up to fall 1997 for reference The results are discussed in the context of QCD

Deep Inelastic Scattering and QCD J. Blumlein, T. Riemann, 1999 **Deep Inelastic Scattering** Robin Devenish, Amanda Cooper-Sarkar, 2004 This is a self contained account of deep inelastic scattering in high energy physics It covers the classic results which led to the quark parton model of hadrons and the establishment of quantum chromodynamics as the theory of the strong nuclear force in addition to new vistas in the subject *Higher Order QCD Corrections to Double Moment Ratios in Deep Inelastic Scattering*, 1981 In this paper order α^2 contributions to double moment ratios in semi inclusive deep inelastic scattering are computed They are substantial [QCD analysis of polarized deep inelastic scattering data](#) Johannes Blümlein, Helmut Böttcher, 2010 [QCD Instanton Induced Final States in Deep Inelastic Scattering](#), 1998

DIS '99 Johannes Blümlein, Tord Riemann, 1999 **Proceedings of the 7th International Workshop on Deep Inelastic Scattering and QCD DIS**, Johannes Blümlein, 1999 **Deep Inelastic Scattering: Dis 2006 - Proceedings Of The 14th International Workshop** Masahiro Kuze, Kunihiro Nagano, Katsuo Tokushuku, 2007-01-23 These proceedings present the most up to date status of deep inelastic scattering DIS physics Topics such as structure function measurements and phenomenology quantum chromodynamics QCD studies in DIS and photoproduction spin physics and diffractive interactions are reviewed in detail with emphasis on those studies that push the test of QCD and the Standard Model to the limits of their present range of validity towards both the very high and the very low four momentum transfers in lepton proton scattering **Small-X Behavior of Deep Inelastic Structure Functions in QCD** A. Ali, J. Bartels, 2016-06-03 Small x Behavior of Deep Inelastic Structure Functions in QCD covers the proceedings of the DESY topical meeting entitled Small x Behavior of Deep Inelastic Structure Functions in QCD held in DESY Hamburg Germany on May 14 16 1990 The book focuses on Quantum Chromo Dynamics QCD structure function technology including structure function measurements photon structure multi parton interactions and hadronic collisions The selection first offers information on structure function measurements at Hera and pomeron and odderon in QCD and a two dimensional conformal field theory Topics include nucleon structure function measurements handles on the gluon distribution and photon structure The book also examines Regge poles in asymptotic free theories QCD phenomenology of parton distribution functions at small x and possible parametrization of parton distributions The text elaborates on low x structure function and saturation of the parton density and photon diffractive dissociation in deep inelastic scattering The publication also considers multi parton interactions in high energy hadronic collisions and bound state quark and gluon contributions to structure functions in QCD Discussions

focus on bound valence quark distributions intrinsic gluon distribution of protons and intrinsic charm quark distributions The selection is a dependable reference for readers interested in small x behavior of deep inelastic structure functions in QCD

Tests of QCD with Hadronic Final States in Deep Inelastic Scattering ,1998 **QCD FACTORIZATION FOR SEMI-INCLUSIVE DEEP INELASTIC SCATTERING.** ,2005 In this talk we will present a QCD factorization theorem for the semi inclusive deep inelastic scattering with hadrons in the current fragmentation region detected at low transverse momentum QCD-instanton induced final states in deep inelastic scattering Mark Gibbs,Andreas Ringwald,Fridger Schrempp,1995 *QCD-Instantons in deep-inelastic scattering* Sven-Olaf Moch,1997 Dt Zusammenfass **Tracing QCD - Instantons in Deep Inelastic Scattering** Andreas Ringwald,Fridger Schrempp,1996 **QCD Predictions for Deep Inelastic Scattering on an Electron** K. Kajantie,1979 *6th International Workshop on Deep Inelastic Scattering and QCD* Gh Coremans,R. Roosen,1998-01-01 QCD Analysis of Polarized Deep Inelastic Scattering Data and Parton Distributions Johannes Blümlein,Helmut Böttcher,2002 *Nonperturbative QCD Effects in Deep Inelastic Scattering* Michael Lublinsky,Ṭekhniyon, Makhon ṭekhnologi le-Yiśra'el. Faḳulṭah le-fisikaḥ,2001

Unveiling the Magic of Words: A Overview of "**Deep Inelastic Scattering And Qcd**"

In a global defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their power to kindle emotions, provoke contemplation, and ignite transformative change is really awe-inspiring. Enter the realm of "**Deep Inelastic Scattering And Qcd**," a mesmerizing literary masterpiece penned by way of a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve into the book is central themes, examine its distinctive writing style, and assess its profound effect on the souls of its readers.

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