

Quantum Chromodynamics ████████

QCD TESTS-OVERVIEW

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A large group of individuals met initially to discuss possible experimental tests of various aspects of quantum chromodynamics. A long list of topics was made, and subgroups were formed to study certain of these in some depth. Listed below are the topics which were considered initially, along with a brief summary of the results of our investigations. Owing to the specific interests of participants and time limitations, some topics regrettably received no significant study.

The initial division of subject matter was made into the non-perturbative and perturbative aspects of the theory. Under the non-perturbative heading, one may list glueballs, instantons, merons, and so on. Experimental issues related to glueballs were delegated to J. Donoghue; instantons and the like were ignored altogether.

Ten topics were listed under the heading of perturbative QCD. These are:

1. Inclusive Deep-Inelastic Scattering
 $\nu N \rightarrow \mu X, \nu N \rightarrow \nu' X, \mu N \rightarrow \mu' X$
 - Structure functions; F_1, F_2, F_3
 - Singlet moments; non-singlet moments
 - $R = \sigma_L/\sigma_T$
 - Q^2 dependence
 - A dependence
 2. Deep-Inelastic Scattering. The Hadron Vertex
 - Fragmentation functions, $D(z, Q^2)$
 - Universality of $D(z, Q^2)$?
 - Q^2 dependence
 - Quark-gluon jets
 - Higher-twist phenomena; correlations
 - Jet broadening
 - A dependence
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3. High Transverse Momentum Phenomena
 - Single photons
 - Single hadrons vs. jets
 - Multi-jet rates
 - Charge ratios
 - Beam dependence
 - Quantum number correlations
 - Higher-twist
 - A dependence
4. Jets
 - High p_T and elsewhere
 - Universality
5. Exclusive Processes
 - Elastic scattering at large t , especially with meson beams and γ beams
 - $\gamma N \rightarrow (J/\psi)N$
 - $eN \rightarrow e'(J/\psi)N$
 - Helicity rules
 - Spin/alignment effects
 - Form factors at large Q^2
6. Heavy Flavor Production
 - Gluon fusion, intrinsic charm content, and/or other production mechanisms
 - Forward production/central production
 - Energy dependence of different production mechanisms
 - Photon and Meson beams
7. Drell-Yan Process, $hN \rightarrow (e^+e^-)X$
 - The ugly K factor

- A dependence
- Higher-twist effects
- Angular distributions
- Large p_T
- Associated jets
- 8. Spin, Polarization, Alignments
 - Higher-order QCD
 - Higher-twist
- 9. Nuclear Effects
 - A-dependence systematics
 - Constituent rescattering
- 10. -- Low p_T
 - Does QCD have anything to offer?

One subgroup was formed to study deep-inelastic phenomena, topics 1 and 2, and a detailed report of their conclusions is included here. High p_T phenomena and jets (topics 3 and 4) were combined under the discussion leadership of J. Owens. No volunteers took on exclusive processes (topic 5), nuclear effects (topic 9), or low- p_T (topic 10). The QCD aspects of heavy flavor production (topic 6) were delegated to the discussion group headed by J. Leveille. A small subgroup studied possibilities associated with the Drell-Yan process (topic 7), and their report is included in this volume. Although interesting spin effects, including polarizations and alignments, may be found in all constituent scattering processes, a separate subgroup devoted its efforts to this specialized topic (number 8), and their report may also be found in this volume.
