

Epilogue

We have tried to put together an elementary introduction to QCD and its modern developments in order to have as far as possible a *complete QCD handbook*, which I hope will be useful for a large spectrum of readers. After reading this book, I hope that the reader have learned more on the developments and aspects of perturbative and non-perturbative QCD, which, owing to the gluonic self-interactions, are based on asymptotic freedom, dynamical symmetry breaking and confinement. The former enables us to apply perturbation theory at large momenta where the coupling is small, and this has given successful predictions for various hard processes in terms of the single-order parameter $\alpha_s(Q)$. The running of the QCD coupling (and of the quark masses) as predicted by QCD and the renormalization group equation has been verified experimentally at different energy scales. On the other hand, the growth of the coupling at low energies indicates that QCD dynamics are governed by the confinement of quarks and gluons into colour-singlet hadronic states. However, a rigorous proof of this property is still lacking and remains one of the challenging problems in QCD. At present, non-perturbative approaches such as QCD spectral sum rules, lattice calculations provide an indirect evidence that QCD also provides the proper pattern of chiral symmetry breaking, where the quark and gluon condensates breaks dynamically the symmetry of the QCD Lagrangian. Thus, we have at present an overwhelming experimental and theoretical evidence that QCD gauge theory is the most robust theory of hadrons, though we have still to tackle the longstanding problem of confinement.

Some remarks concerning the presentation of this book have to be made:

- The readers may have noticed that, some specialized topics, like, for example, monopoles and more generally confinement, have not been discussed in details due to space–time limitations, but, mainly, due to the fact that our understanding on these subjects is not yet mature.
- Unlike, the case of the book and review in [3,2], we have not discussed in detail the derivation of each results from QCD spectral sum rules, but we have only summarized the different results after discussing some particular examples. The readers who wish to look into more details in the derivation of the QSSR results can then consult the previous references and the original papers.

I hope that, after reading this book, the readers have acquired the necessary information and technology for tackling new research projects in this field, which, after looking at the

large number of QCD publications and conferences, has been and still remains one the most active fields in high-energy physics.

'Physics will change even more . . . If it radical and unfamiliar . . . we think that the future will be only more radical and not less, only more strange and not more familiar, and that it will have its own new insights for inquiring human spirit.'

(Oppenheimer, Reith Lectures, BBC, 1953)