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This book provides a pedagogical introduction to the perturbative and non-perturbative aspects of quantum chromodynamics (QCD).

Introducing the basic theory and recent advances in QCD, it also reviews the historical development of the subject up to the present day, covering pre-QCD ideas of strong interactions such as the quark and parton models, the notion of colours, current algebra and the *S*-matrix approach. The author then discusses tools of quantum field theory, the symmetry and quantization of gauge theory, techniques of dimensional regularization and renormalization, QED high-precision tests, deep inelastic scattering and hard processes in hadron collisions, hadron jets, and inclusive processes in e + e− annihilations. Other topics include power corrections and the technologies of the Shifman–Vainshtein–Zakharov (SVZ) operator product expansion, renormalizations and phenomena beyond the SVZ expansion. The final parts of the book are devoted to modern non-perturbative approaches to QCD, such as lattice and effective theories, and the phenomenological aspects of QCD spectral sum rules.

The book will be a valuable reference for graduate students and researchers in high-energy particle and nuclear physics, both theoretical and experimental.

This title, first published in 2005, has been reissued as an Open Access publication on Cambridge Core.

STEPHAN NARISON graduated from the University of Antananarivo, Madagascar and received his Doctorat d'Etat from the University of Marseille. He is currently Director of Research in theoretical physics at the French Centre National de la Recherche Scientifique (CNRS), at the Laboratoire de Physique Mathématique et Théorique de l'Université Montpellier II. He has conducted research in laboratories and university departments throughout the world. Starting his research in the high-precision tests of QED, his main area of research is in non-perturbative aspects of QCD, using QCD spectral sum rules to study the properties of hadrons and low-energy phenomena in terms of the fundamental parameters from QCD first principles. He has worked in this field for more than two decades and has actively participated in its development. Professor Narison has had numerous publications in leading journals, as well as contributing to several books on high-energy physics. He is also the founder and chairman of the QCD Montpellier International Conference Series.

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QCD AS A THEORY OF HADRONS

From Partons to Confinement

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To Larry and Rindra

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He is, at present, a Directeur de Recherche at the French 'Centre National de la Recherche Scientifique' (CNRS) in theoretical physics (section of high-energy elementary particle physics) at the 'Laboratoire de Physique Mathématique et Théorique de l'Université de Montpellier II' (France). He is the founder and chairman of the Series of Montpellier International Conference in Quantum ChromoDynamics (QCD) since 1985 which has been sponsored from 1996 to 2001 by the European Commission of Brussels.

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His first research activity, which made him known in the field, was the estimate of the hadronic contributions to the anomalous magnetic moment of leptons (subject of his 3ème cycle thesis). Since then, his main research activity has been in the non-perturbative aspects of QCD using the method of QCD spectral sum rules for studying the properties of hadrons

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and low-energy phenomena. He has worked in this field since the date of its invention in 1979 and participates actively in its theoretical developments and new applications.

He is a member of the European Physical Society, a correspondant member of the 'Academie Nationale Malgache', a member of the New York Academy of Sciences, nominated in the Who's Who biography by the American Biographical Institute (ABI) (USA) and by the International Biographical Center of Cambridge (IBC) (UK), nominated among the 2000 exceptional men of the twentieth and twenty-first centuries by the ABI and the IBC. He has also been the President-Foundator of the 'Association Culturelle Malgache de Montpellier' (France) since 1993.

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