Preface

This book summarizes the developments over the past several decades in the field of strong interactions at high energy. This is the first ever book almost entirely devoted to the physics of parton saturation and the color glass condensate (CGC).

Our main goal in this book is to introduce the reader systematically to the ideas, problems, and methods of high energy quantum chromodynamics (QCD). Over the years, these methods and ideas have led to a new physical picture of high energy hadronic and nuclear interactions, representing them as the interactions of a very dense system of tiny constituents (quarks and gluons) having only a small value of the QCD coupling constant. Owing to the high density of gluons and quarks the interactions in such systems are inherently nonperturbative; nevertheless, a theoretical description of these interactions is possible due to the smallness of the QCD coupling. Our main goals in the book are to show how these new ideas arise from perturbative QCD and to enable the reader to enjoy the beauty and simplicity of these emerging methods and equations.

The book's intended audience is advanced graduate students, postdoctoral fellows, and mature researchers from the neighboring subfields of nuclear and particle physics. We assume that graduate student readers are familiar with quantum field theory at the level of a standard graduate-level course based on the textbooks by Peskin and Schroeder (1995) or Sterman (1993). We also recommend that students should have taken a theoretical particle physics course before attempting to read this book. Nevertheless, we have tried to make this book as self-sufficient as possible, and so we refer to the results of quantum field theory only minimally.

The book is structured as follows. In Chapters 1 through 5 we present general concepts and the results of high energy QCD at a level accessible to a graduate student beginning his or her research in the field. Chapters 6 though 9 deal with more specialized topics and are written at a somewhat higher level; now the reader is expected to do more independent calculations and thinking to follow the presentation. Sections marked with an asterisk $*$ can be skipped in the first reading of the book.

The field of high energy QCD has been developing rapidly over the past few decades, generating vast amounts of new and interesting results. It is impossible to fit all the recent advances into a single book: inevitably some important results have had to be left out. We have tried to overcome this shortcoming by incorporating sections on further reading at the

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ends of most chapters. In these sections we provide the reader with the references needed to further develop his or her understanding of the subject.

At the ends of many chapters we provide exercises for readers. Fairly difficult problems are marked with an asterisk $*$ and very hard problems are marked with a double asterisk $**$.

In this book we have aimed to bring the reader to the forefront of research on high energy QCD. We would be thrilled if our readers were able to pursue work in the field after reading this book, generating new theoretical ideas and results which ultimately could be compared with experiment.

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