

chapter 2 begins with computing a parabolic trajectory using simple projectile motion—something students may have already done analytically. Giordano then shows the power of numerical methods by extending this familiar problem to the sidearm curveball and the flight of a golf ball. Similarly, the addition of a driving term to the pendulum problem introduces the student to the world of chaos.

The value of this text is not only in its teaching of numerical methods—which it does very well—but in its teaching of the power of numerical methods and of modern physics, something missing from most traditional courses tied to the analytic solution of idealized problems. A course based on this textbook could be the first step in modernizing many a traditional physics curriculum.

An Introduction to Computational Physics by Tao Pang is intended to serve two purposes. The first half of the book is an introduction to computational science, covering the standard topics from numerical interpolation, integration and root finding to Fourier transforms, eigenvalue problems and the relaxation method. The second half of the book is more a survey of advanced methods in computational physics, aimed at students who possess a strong background in physics, math and computing. The result is a book that touches on everything from linear interpolation to quantum lattice renormalization. This extreme breadth is both its strength and its weakness.

Pang divides his book evenly over this broad spectrum of topics, spending, for example, three pages each on numerical derivatives and on the finite-element method. Such limited discussion renders the coverage of more advanced topics virtually useless. For example, the discussion of hydrodynamics and magnetohydrodynamics (also three pages long) does little more than note the fluid equations in finite difference form. The Courant–Friedrichs–Lewy condition for stability of explicit methods is not even mentioned. In fact, issues like stability, efficiency and accuracy are largely ignored after the first couple of chapters.

On the other hand, this book is impressive for its breadth—touching on no less than 40 separate topics in physics and topping it all off with a few pages on symbolic computing and parallel programming. One could use this text in a cursory survey of computational physics. However, students would need a strong, complete background in physics and math (beyond the first year of graduate study) to get anything of value from such a rapid flyby, for this text contains minimal

discussion of the physics and insufficient coverage of the math and computational science to prove useful to a less-prepared student.

As a true introductory text, *An Introduction to Computational Physics* falls short in teaching inexperienced students the ins and outs of computational science. As a more advanced text, it is far too cursory to be useful in any practical application. Perhaps the best use would be as a complement to a more introductory text, thereby providing a bridge between introductory material and detailed discussions of more advanced applications.

JOHN M. BLONDIN

North Carolina State University
Raleigh, North Carolina

Quantum Chromodynamics and the Pomeron

Jeffrey R. Forshaw
and Douglas A. Ross
Cambridge U. P., New York, 1997.
248 pp. \$34.95 pb
ISBN 0-521-56880-3

What exactly is a pomeron? This is the sort of question often heard after a talk on high-energy diffractive scattering or rapidity gap physics. Many particle physicists, especially those in the younger generation, have no idea what to make of the pomeron, if they have even heard of it at all. In their new book, *Quantum Chromodynamics and the Pomeron*, Jeffrey R. Forshaw and Douglas A. Ross aim to correct this by discussing the pomeron in the framework of quantum chromodynamics, a subject with which every young high-energy physics student should feel comfortable.

Strictly speaking, this book is concerned with what is known as the “perturbative” or “hard” pomeron. The original “soft” pomeron was invented in the early 1960s, from a combination of phenomenology and the general properties of the scattering matrix, to describe the rise with energy of the hadronic total cross section. By using the optical theorem, the total cross section can be related to the hadron-hadron forward-scattering amplitude, and at high energies this was argued to be dominated by the exchange of a single particle-like object that carries the quantum numbers of the vacuum. This object is the soft pomeron, and it is purely nonperturbative in nature.

The hard pomeron shares some general features with the soft pomeron. It carries vacuum quantum numbers, and, at high energies, it also produces a rise in the cross section with energy.

But unlike the soft pomeron, it can be calculated directly in perturbative QCD as a resummation of Feynman diagrams, which are enhanced by logarithms of the energy over some other scale in the process. This result is encoded in the BFKL equation (named for Y. Y. Balitsky, V. S. Fadin, E. A. Kuraev and L. M. Lipatov), and it has been the subject of a great deal of interest in recent years. However, much of the literature on the subject is anything but pedagogical, so this book should be a welcome addition to the field.

The first chapter contains a rapid overview of the theory and phenomenology of the original soft pomeron. A derivation of the BFKL equation and its solution follow in the next three chapters. The authors use the traditional approach, defining effective high-energy vertices and introducing the reggeized gluon, which is shown to be self-consistent in QCD. Since this material is highly technical, the authors first derive the resummation in a simpler scalar field theory, where the leading logarithmic contributions come entirely from ladder diagrams. This simple example is useful for highlighting the general resummation procedure; however, the authors should have also introduced more detailed discussion of the approximations involved and their physical motivation and consequences in QCD before embarking on the details of the derivation. As it is, most of the physical intuition is built up during or after the derivation. Apart from this lapse, the book is relatively easy to read, considering the difficulty of the subject matter. In addition, the authors include a summary at the end of each chapter, reiterating the main line of argument. This is especially useful in the long derivations, where a student may not see the forest for the trees.

The remaining four chapters cover various aspects and phenomenology of the BFKL pomeron solution. Since the phenomenology and theory of the hard pomeron are still developing rapidly, the topics and presentation in these chapters can be considered only representative, with the understanding that much interesting research was excluded by necessity. Chapter 5 discusses the diffusion in transverse momentum of the BFKL solution, as well as some attempts to incorporate running coupling and nonperturbative effects to make contact with the original soft pomeron. Chapters 6 and 7 cover phenomenological applications to, respectively, deep inelastic scattering at small x and diffractive scattering. The last chapter discusses an attempt to restore unitarity to the total cross sec-

tion at very high energy, which is lost in the purely leading logarithmic approximation. The discussion in this chapter is based on Al Mueller's color-dipole approach to the pomeron, which is equivalent to the BFKL picture.

Currently, there are no other pedagogical books that cover the perturbative pomeron in detail, and there are only a few review articles on the BFKL equation and recent developments. Thus, this book fills a void by offering a readable introduction that would be

suitable as a jumping-off point for a high-energy theory student interested in entering this lively field of research. It may also be useful to interested researchers in other subfields of high-energy physics and to experimentalist graduate students, assuming that they are motivated enough to work through, or at least accept on faith, the more mathematically technical sections.

CARL R. SCHMIDT
Michigan State University
East Lansing, Michigan

Atmospheric Chemistry and Physics: From Air Pollution to Climate Change

John H. Seinfeld
and Spyros N. Pandis
Wiley, New York, 1998. 1326 pp.
\$89.95 hc ISBN 0-471-17815-2

While the comparison may at first seem a bit peculiar, there are a number of parallels between Georges Seurat's painting *Sunday Afternoon on the Island of La Grande Jatte* and the text *Atmospheric Chemistry and Physics: From Air Pollution to Climate Change* by John Seinfeld and Spyros Pandis. Both are large works: Seurat's canvas covers six square meters; the book contains 24 chapters and two appendices in its 1326 pages. Both contain what on initial inspection seems to be an overwhelming amount of detail, but when seen from a longer view, the detail coalesces into a vibrant whole. The painting is considered to be a masterpiece and a defining example of its style. I'm certain the book will soon be considered in a similar light.

There were a number of very good books on atmospheric chemistry written in the early and mid-1980s, among them Seinfeld's *Atmospheric Chemistry and Physics of Air Pollution* (Wiley, 1986). Given the rapid and comprehensive advances made in atmospheric chemistry and physics in the last 10 to 15 years, however, these books have begun to show their age. While much of the material contained in Seinfeld's 1986 book appears in an updated form in the new Seinfeld and Pandis publication, the 1998 book is far more than a second edition.

The latter half of the title—*From Air Pollution to Climate Change*—gives an inkling of the wider focus and increased scope of the new book. In particular, the chapters on global cycles, tropospheric and stratospheric chemistry, atmospheric chemistry and climate, visibility and climate and chemical transport models all give the new book a much broader range and add a component on background atmospheric processes that was not nearly as well developed in Seinfeld's 1986 book.

Despite this new material, the book retains an emphasis on urban processes, reflected in a number of subtle ways. For example, there is a table that lists motor vehicles as a "typical source" of formaldehyde but does not include the natural oxidation of methane; a very detailed chapter on atmospheric organic aerosols contains a sin-

Aluminum

Antimony
Beryllium
Bismuth
Cadmium
Calcium
Cerium
Chromium
Cobalt
Copper
Dysprosium
Erbium
Europium
Gadolinium
Gallium
Germanium
Gold
Hafnium
Holmium
Indium
Iridium
Iron
Lanthanum
Lead
Lithium
Lutetium
Magnesium
Manganese
Mercury
Molybdenum
Neodymium
Nickel
Niobium
Osmium
Palladium
Platinum
Potassium
Praseodymium
Rhenium
Rhodium
Rubidium
Ruthenium
Samarium
Scandium
Silver
Sodium
Strontium
Tantalum
Terbium
Thallium
Thorium
Thulium
Tin
Titanium
Tungsten
Uranium
Vanadium
Ytterbium
Yttrium
Zinc
Zirconium

HIGH PURITY METALS FROM A TO Z!

Compare Alfa Aesar's broad product range, wide variety of forms and purities (up to 99.99999%), superior service, and fast delivery. When you do, you'll agree: choice is everything.

- Great prices on small quantities
- Virtually all products are in stock for immediate shipment, including bulk quantities of many items
- Thousands of compounds and alloys also available



Wide Range of Forms

- Powder
- Flake
- Shot
- Needles
- Slugs
- Single Crystal
- Ultrathin Foil
- Foil
- Ribbon
- Gauze
- Wire
- Rods
- Tubing
- Sheet
- plus many more

Call (800) 343-0660 to order your FREE 1600 page catalog of pure metals, elements, alloys, and compounds.

Alfa Aesar
A Johnson Matthey Company

CHOICE IS EVERYTHING.

USA

30 Bond Street
Ward Hill, MA 01835
Tel: (978) 521-6300
Fax: (978) 521-6350

GERMANY

Tel: +49 (0)721 840070
Fax: +49 (0)721 849674

UK

Tel: +44 (0)1763 253674
Fax: +44 (0)1763 253649

FRANCE

Freephone: 0800 442 442
Freefax: 00800 3432 3432

Visit our web site and online catalog at:
www.alfa.com

Circle number 49 on Reader Service Card