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.

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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-

gle section on biogenic particles; otherwise excellent treatments of wet and dry deposition do not mention the ways in which these mechanisms may influence interpretation of ice cores in climate analysis. This urban emphasis is not particularly surprising, given that Seinfeld is chairman of the division of engineering and applied science at Caltech and Pandis is a senior faculty member in the department of chemical engineering at Carnegie Mellon University. Nonetheless, the book presents a much more balanced, broad and yet still detailed view of atmospheric chemistry and physics than any of its predecessors.

The authors' aim is to provide a rigorous, comprehensive reference on atmospheric chemistry and physics as well as a textbook for use in the atmospheric sciences. They succeed on both accounts. As a reference, the book contains extremely useful updated tables of concentrations and fluxes for sulphur, nitrogen, carbon and halogen compounds. Extensive reference lists at the end of each chapter provide a roadmap to relevant new literature. The amount of material alone makes it nearly an encyclopedia in its field.

The book is also very well written from a pedagogical point of view. Despite the level of detail, the chapters are surprisingly easy to read. Derivations are done without skipping over dozens of "obvious" intermediate steps, and the resulting final relationships and equations are highlighted with boxes. Problems at the end of the chapters are coded with their level of difficulty. Stimulating and topical examples are interspersed throughout. The major difficulties in using the book as the basis for a single course would be selecting material to omit and getting students over their initial consternation at being confronted with a textbook weighing 2.5 kg.

Like Seurat's masterpiece, *Atmospheric Chemistry and Physics* is a tremendous achievement. It will undoubtedly soon be considered an essential element in the library of students and professionals in the atmospheric sciences.

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Quantum Optics

Marlan O. Scully
and M. Suhail Zubairy
Cambridge U. P., New York, 1997.
630 pp. $110.00 hc ($47.95 pb)
ISBN 0-521-43458-0 hc
(0-521-43595-1 pb)

When Paul Dirac showed how the quantum theory of radiation accounts for the creation and annihilation of particles (photons) while still describing the wavelike aspects of fields, the theoretical foundations of quantum optics were essentially put in place. The discipline as presently practiced was created by the development of lasers in the 1960s. Efforts to understand the properties of laser radiation vis-à-vis all previously known kinds of light culminated in the quantum theory of optical coherence. Laser theory was formulated both semiclassically and in quantized field theory. New effects such as photon echoes, self-induced transparency and superradiance were discovered, and entire new fields such as nonlinear optics and high-precision spectroscopies were born.

In recent years, concepts of quantum optics have been used in a wide range of fundamentally important experiments. These include tests of Bell's theorem, routes to chaos in lasers and other optical systems, soliton propaga-