

For some readers, however, that breathless enthusiasm will be a weakness: Those who come to the book with no prior knowledge of physics might easily find it somewhat bewildering. Some weighty concepts in physics and philosophy are brought up quickly, and while the key notions are returned to many times, the density of ideas might seem daunting. To my mind, there's enough charm and personality to the writing to carry that off, but like so many other features of the universe, the ultimate success of the book will depend on the state of the observer.

For readers willing to go with the flow when things start moving fast, *Trespassing on Einstein's Lawn* is a witty and charming tour through the deepest questions of modern physics. It doesn't end up providing any solid answers, but it does manage to better convey the excitement of the search than many other books by people with more impressive physics credentials. And in so doing, it reveals why, for scientists and amateurs turned science journalists alike, that excitement is its own reward.

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Light-Matter Interaction Physics and Engineering at the Nanoscale

John Weiner and Frederico Nunes
Oxford U. Press, 2013. \$110.00
(261 pp.). ISBN 978-0-19-856765-3

Research on the interaction between radiation and matter at the nanoscale has flourished in the past few years due to increasing interest in such novel light-matter coupling phenomena as field enhancement at metallic nano-objects and such far-reaching applications as plasmonic nano-antennas and biosensors. Thus modern books that attempt to introduce students and nonexpert researchers to basic principles in the field are welcome.

Light-Matter Interaction: Physics and Engineering at the Nanoscale is such a text. Written by John Weiner and Frederico Nunes, two of the field's active researchers, it covers basic theory and contains worked examples, end-of-chapter exercises, sections called "complements" that follow two of the book's

five chapters and elaborate on the material therein, and end-of-book appendices. Altogether, *Light-Matter Interaction* is pleasant to read and does a good job of introducing the reader to electromagnetic waves in matter and to nanoscale radiation-matter interactions, with a focus on surface and interface phenomena. The book's distinctive feature is its joining of physics and engineering in its description of surface plasmons: You'll find both a detailed description of the theoretical bases and examples from real metallic systems.

After a crisp introductory chapter on

the history of light and matter—from the works of Leucippus and Democritus to Albert Einstein and Paul Dirac—chapter 2 reviews the theory of electromagnetic wave propagation. It begins with macroscopic fields and Maxwell's equations in matter and discusses classical topics like energy density and the Poynting vector, dipole radiation, and propagation in dielectric and conducting media. The treatment is didactic and rather complete. Some common textbook topics, like Fresnel formulas for reflection and transmission at oblique incidence, are not included;

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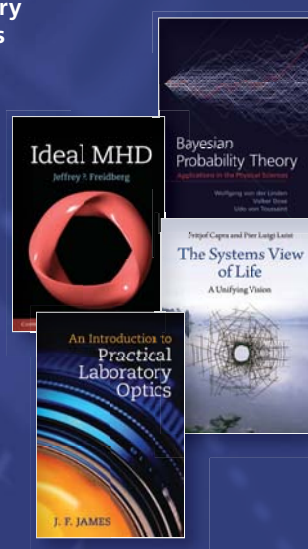
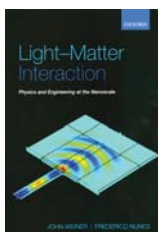
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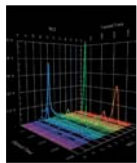
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but such standard material can be easily found elsewhere. Complements on energy flow in polarizable media, macroscopic polarization, and charge oscillators add useful information. The chapter sets the necessary background for the subsequent topics and is similar to treatments in well-known textbooks like John David Jackson's *Classical Electrodynamics* (3rd edition, Wiley, 1998).

Chapters 3 and 4, which deal with surface waves and the equivalent circuit picture, make up the book's core. In chapter 3 the authors present the theory of electromagnetic surface modes, with an emphasis on surface plasmons in planar geometry. They derive the main formulas for surface modes with retardation and discuss surface plasmon polariton dispersion, attenuation constants, and more. Particularly strong features include the detailed formulas for and examples of surface plasmons in real metals and the full account of dissipation effects.

The electrical engineering presentation in chapter 4 covers transmission lines, waveguides, and more complex circuit elements. It also addresses surface plasmons as oscillations in resonant circuits made of lumped elements, principally inductors and capacitors. The detailed description, using matrix analysis, of electromagnetic wave propagation nicely sets up the discussion, based on a comparison to lumped circuits, of nanoscale plasmonic systems—for example, slit apertures and nanospheres.

The fifth and final chapter deals with classical and quantum treatments of atomic emission and absorption, radiative damping, the Schrödinger equation, Einstein's theory of stimulated and spontaneous emission, and related topics; a subsequent complement covers blackbody radiation. The chapter is well written, but its relation to the others is not clearly spelled out. The book is rounded out by appendices on electromagnetic systems of units, vector calculus, cylindrical and spherical coordinates, phasors, and special functions.

Researchers in nanophotonics and plasmonics will find references, formulas, and detailed derivations that often do not appear in specialized reviews. Students and researchers with specific interests will find it useful to go through the derivations and extract the relevant conclusions. However, it would have been helpful if the main results and equations were highlighted with boxes or some other graphical element—perhaps the authors or the pub-

lisher will do that in a second edition.

Light-Matter Interaction will find a useful place in the libraries of students and researchers in the field and could be used as a main or supporting textbook in a one-semester course for undergraduate or graduate students in physics, photonics, or electrical engineering—or even better, in a course with a mixed audience of students from those disciplines.

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A General Relativity Workbook

Thomas A. Moore
University Science Books, 2013.
\$62.50 paper (476 pp.).
ISBN 978-1-891389-82-5

Albert Einstein's theory of general relativity leads to such spectacular predictions as black holes, gravitational waves, and the Big Bang in the early universe, all of which are at the forefront of theoretical and observational physics. Thomas Moore's recent text, *A General Relativity Workbook*, provides an excellent introduction to general relativity and its fascinating implications for cosmology, black hole physics, and gravitational waves. A professor of physics at Pomona College in California, Moore has mainly focused his research on the generation and detection of gravitational waves. He has also authored *A Traveler's Guide to Spacetime: An Introduction to the Special Theory of Relativity* (McGraw-Hill, 1995) and the six-volume text *Six Ideas That Shaped Physics* (McGraw-Hill, 2002).

A General Relativity Workbook is ideally suited for a one-semester, undergraduate-level introductory course in general relativity. The book assumes only a basic knowledge of calculus, classical mechanics, and electromagnetism, and does not require prior knowledge of differential geometry or tensor calculus. Each of the 39 chapters corresponds to a 50-minute class section, which makes it particularly handy for use as a textbook.

After a brief introduction of the principal ideas behind general relativity, the book presents a review of special relativity, followed by five chapters in which tensor fields and the index notation are introduced and explained in detail and Maxwell's equations in ten-

