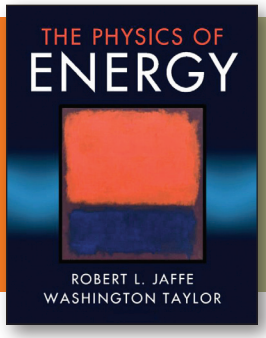


The Physics of Energy

Robert L. Jaffe and Washington Taylor

Cambridge University Press, 2018
894 pages, $79.99 (e-book $38.49)
ISBN 9781107016651

The Physics of Energy, at 874 pages and weighing in at almost six pounds, is the most comprehensive book on energy that I have ever seen. The book is the product of decades of energy and physics classes taught by theoretical physics professors Robert Jaffe and Washington Taylor at the Massachusetts Institute of Technology. Jaffe and Taylor are clearly passionate about physics, and the result is a fantastically thorough and detailed evaluation of the underpinnings of energy and energy systems from a physics perspective.

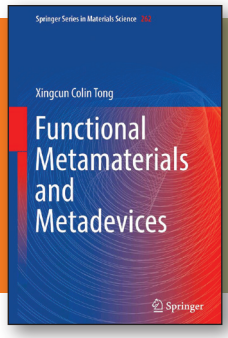
The book has three parts, broken out into 38 chapters and 185 subchapters. Each chapter concludes with a discussion and investigation questions and problems. Chapters are dense with information, but call out physics principles, use illustrations to describe concepts, and have examples with answers to further expand upon and explain concepts. While the technical content of the book is daunting, it is highly approachable. Part I covers Basic Energy Physics and Uses, with the expected topics of mechanical and electromagnetic energy, waves and light, and thermodynamics. Unexpected is a chapter on quantum physics, which the authors warn the reader will need to understand the nuclear energy topics in Part II. Each of the physics concepts is explained with great clarity as applied to tangible concepts, such as energy used while driving a car.

Part II is dedicated to all aspects of Energy Sources, with chapters on nuclear, solar, biological, ocean, wind, and geothermal energy plus fossil fuels. Again, each chapter contains relevant information, specifically the math and physics to break down each topic in an accessible manner, and then explains the relevant application in energy.

Part III on Energy Systems Issues and Externalities contains a disjointed range of topics—from climate change to energy storage—and includes an additional chapter on the thermodynamics of energy efficiency. My only criticism is that "hot" topics, such as electrification of automobiles with lithium-ion batteries and fuel cells, are handled lightly in the energy-storage chapter. Fortunately, each chapter in this part, and throughout the book, stands on its own, so one or two weak chapters in no way diminishes the overall effort.

I see several uses for this book. It can serve as a textbook for senior college undergraduate students and graduate students to learn about energy. The content is broad and thorough and could be used by scientists, engineers, and policy experts with a strong background in physics. The book can also be used to teach introductory and second-level physics. I will keep *The Physics of Energy* in my office to serve as a desk reference for energy concepts. With 185 topics plus appendices on basic concepts in physics and math, this will likely become a standard book, serving as a valued and fundamental resource to professors, students, and practitioners.

***Reviewer: Karen Swider Lyons**, US Naval Research Laboratory.*



Functional Metamaterials and Metadevices

Xingcun Colin Tong

Springer, 2018
277 pages, $159.99 (e-book $119.00)
ISBN 978–3-319–66043–1

Functional Metamaterials and Metadevices is a book that contains basic and advanced knowledge about metamaterials. The book is easy to read, but it is also very specialized, so it is recommended for students, scientists, and engineers in materials, electronics, optics, mechanics, acoustics, telecommunications, or related areas, as well as those who wish to be aware of the state of the art of these fields.

The book is well explained and illustrated, containing a large number of images, figures, graphs, and equations, which help the reader to quickly and adequately understand the text.

Moreover, it can also be very useful for those who are looking for very specific information about any type of metamaterial. The book explains, in a friendly, clear, and concise manner, the fundamental principles of metamaterials and metadevices. Their design, manufacture, and applications are also described according to the classifications established by the author. His classifications are useful and adequate, and they allow the reader to clearly appreciate the interesting world of metamaterials.

In the 12 chapters in this book, the reader will be able to identify the great technological potential associated with the use and application of metamaterials. The author presents a wide variety of current technological examples, as well as those of everyday applications.

The first chapter is an introduction to Metamaterials and Metadevices. It contains the fundamental concepts for the proper understanding of the structure and performance of these materials. It

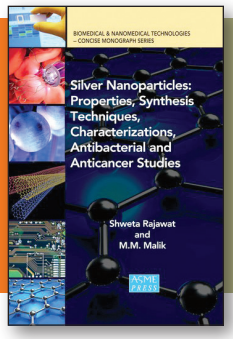
explains the classification and evolution of metamaterials. The author presents an interesting review about Emerging Functional Metadevices.

Chapter 2 describes the Design and Fabrication of Metamaterials and Metadevices. Chapters 3–11 include detailed descriptions of each type of metamaterials and metadevices.

In chapter 6, the author describes chiral metamaterials and metadevices and writes about a single gyrod metamaterial (a chiral structure that covers constant mean curvature). This structure can be found in nature in certain wing scales of butterfly species. The structure can be fabricated using different techniques (described in the book). This is a clear example that the best school is nature. If we observe it carefully and learn from it, we will realize efficient technological contributions that would require a minimum amount of energy and have a minimal impact on the environment.

The bibliographical references are more than adequate, appropriate to each of the sections of the book, and up to date. I enjoyed reading the book; concepts are explained well, with examples of a wide variety of functional metamaterials and metadevices applications. The audience for this book would be students, professionals, or researchers in the areas of physics, optoelectronic engineering, electronics, mechanics, materials engineering or nanotechnology.

***Reviewer: Miriam Sánchez Pozos**, Department of Mechanical Engineering and Sustainable Energy Engineering, Universidad Autónoma del Estado de México, Mexico.*



Silver Nanoparticles: Properties, Synthesis Techniques, Characterizations, Antibacterial and Anticancer Studies

Shweta Rajawat and M.M. Malik

ASME Press, 2018
184 pages, $99.00
ISBN 978–0-791–860–458

This book provides a concise treatment of the properties, characterization techniques, preparation methods based on green chemistry, and biomedical applications of silver nanoparticles, with a focus on their antimicrobial and antitumor properties.

The authors begin with historical anecdotes of the medicinal use of silver in various forms, including colloidal silver and silver compounds. A brief introduction to the birth of nanotechnology follows, with succinct discussion on the unique properties of nano-sized materials compared to bulk materials, with a specific focus on silver nanoparticles. Green synthesis techniques are espoused, based on their more environmentally friendly principles, to reduce the usage of or eliminate the production of toxic substances.

The book progresses as an academic thesis by reviewing literature covering physical, chemical, and biological approaches for synthesis of silver nanoparticles. Readers who are familiar with synthesis techniques of nanoparticles may be better served with more current reviews in journals that also cover composite materials incorporating nano silver. However, readers who are seeking a brief introduction to this topic will find the discussion easy to follow.

The principles of green chemistry are further explored in the third and fourth chapters. Plant extracts from tea leaves, garlic, and onion are used as capping agents and/or reducing agents to form metallic silver nanoparticles. Furthermore, the use of silver precursors from discarded photographic and x-ray films are discussed in detail. Synthesis techniques covered include electrolytic deposition and the Tollens test. The silver nanomaterials are characterized by x-ray powder diffraction, UV-visible spectrophotometry, and electron microscopy, while challenge tests involving various microbes as well as two strains of tumor cells (MCF-7 and HeLa) demonstrate significant potency.

Readers who are actively working with nanoparticle synthesis will find the discussion easy to follow. This book is suitable for advanced undergraduate and graduate students, as well as researchers who are interested in the field.

***Reviewer: Maxine Yee**, University of Nottingham Malaysia.*