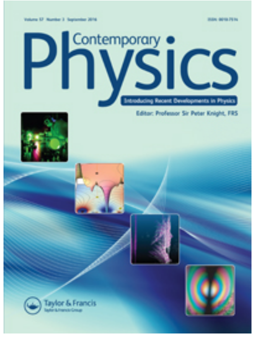

Contemporary Physics

ISSN: 0010-7514 (Print) 1366-5812 (Online) Journal homepage: http://www.tandfonline.com/loi/tcph20

Waves and oscillations in nature. An introduction, by A. Satya Narayanan and Swapan K. Saha

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To cite this article: Miguel A.F. Sanjuán (2016) Waves and oscillations in nature. An introduction, by A. Satya Narayanan and Swapan K. Saha, Contemporary Physics, 57:3, 456-457, DOI: 10.1080/00107514.2016.1205670

To link to this article: http://dx.doi.org/10.1080/00107514.2016.1205670

Published online: 07 Jul 2016.

series will share with international readers the history and present-day status of Chinese physics community'. 'Dark Energy' is a monograph on the long-standing problem of a cosmological constant in Einstein's equations of general relativity and its connection to the behaviour of the universe on the largest scales. The text in the book is an extended version of an earlier publication by the same authors. The cosmological constant, initially introduced in 1917 by Einstein to ensure a static universe (which was the standing paradigm at the time), was given up in 1931 after cosmic expansion had been found experimentally by Hubble. Following the more recent finding that cosmic expansion is accelerating (mainly in the 1990s, Nobel Prize in 2011 to Perlmutter, Schmidt and Riess), concepts similar to a cosmological constant came up in the form of 'dark energy'. There are, however, to the present day, many open questions connected to the concept and the mechanisms, including the famous 'fine-tuning problem', and research is ongoing. The present text intends to lay the foundations for an understanding of important topics of this research. The book has three parts, the first of which introduces the main ideas of general relativity and cosmological implications. The second part reviews the history of the idea of a cosmological constant, the concepts behind 'dark energy' and discusses the classes of dark energy models. These belong to eight families, namely models based on symmetry, anthropic principles, tuning mechanisms, modified gravity, quantum cosmology, the holographic principle, back reaction and phenomenological constructions. These concepts are presented briefly but with mathematical rigour and, like the rest of the book, are fully referenced to scientific journals. The third part thoroughly summarises the experimental findings to date, mainly the results of observational cosmology such as supernovae observations, cosmic microwave background measurements, baryon acoustic oscillations and so forth. It also discusses the constraints on the various models given by the experimental data. The text is meant as an introduction to the dark energy problem, such that the reader is equipped with the terminology and concepts when entering a deeper study. It should be accessible to advanced undergraduate students, in particular of physics and astronomy, after a course of general relativity. The text is concise but clear and the typesetting of equations and notation are up to date. Numerous black-and-white and full colour figures support the text, mainly in part three, where experimental findings are presented. The quality of the printing, of the paper, and of the bookmaking in general are very good. The book deserves recommendation to all who wants a scientific introduction to the 'dark energy' topic, provided they have sufficient background in general relativity.

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http://dx.doi.org/10.1080/00107514.2016.1205669

Waves and oscillations in nature. An introduction, by A. Satya Narayanan and Swapan K. Saha, London, CRC Press, 2015, 551 pp., £63.99 (hardback), ISBN 978-1-4665-9093-9. Scope: textbook. Level: postgraduate, early career researcher, researcher.

Waves and oscillations are ubiquitous in nature and are easily modelled through the help of differential equations. One can find them at large scales, oscillations of stars in galaxies, as well as at microscopic scales, such as neutrino oscillations, whose discovery and thus neutrino mass by Takaaki Kajita at the Super-Kamiokande Observatory and Arthur McDonald at the Sudbury Neutrino Observatory won them the 2015 Nobel Prize for Physics. In the last months, we have heard much about gravitational waves, predicted by Albert Einstein 100 years ago. On 11 February 2016, the LIGO Scientific Collaboration and Virgo Collaboration teams announced that they had made the first observation of gravitational waves, originating from a pair of merging black holes using the Advanced LIGO detectors. There exist different kinds of waves, depending on the nature of the medium of propagation, but also depending on its linear or non-linear character. So that we can encounter hydrodynamic waves, plasma waves, electromagnetic waves, matter waves, etc.

This book deals with different types of waves and oscillations, at an introductory level. It seems to be an extended version of a previous book written by one of the authors: *An Introduction to Waves and Oscillations in the Sun* by A. Satya Narayanan (Springer-Verlag, New York City, 2013), and since the two authors are astrophysicists, it is not surprising that they emphasise the applications to problems in astrophysics.

The first two chapters constitute the foundations of electromagnetism, electromagnetic optics and waves, including antennas and their applications in Radio Astronomy and the Ionosphere. First, it appears a rather detailed and complete introduction to waves and oscillations providing the elementary concepts and definitions, using mainly concepts from the electromagnetism. And later, a rather complete description of electromagnetic waves. Insightful and interesting historical comments illustrate the book all throughout the text.

The title can be a bit misleading, since one would expect a discussion of oscillatory and wave phenomena, however, most of the book is devoted to waves and a clear distinction between oscillations and waves is not made. As a matter of fact, oscillations are briefly described in one of the chapters, including coupled oscillations and a basic introduction to linear and nonlinear waves; with a few comments on solitons. Hydrodynamical waves, including gravity waves, Kelvin, Rayleigh and Rossby waves are later discussed, and again nonlinear waves, such as KdV, Boussinesq and others are mentioned, though the level here is somehow high.

The next two chapters deal with magnetohydrodynamics in uniform media, and non-uniform media, respectively. It includes the basic equations, Alfven waves and magneto-acoustic waves, with nonlinear aspects. An interesting section briefly describes interesting applications to coronal waves and solar physics. A discussion on shock waves and their application in the Sun and collisionless plasmas appear in a later chapter. Again nonlinear waves are mentioned, though it seems that the authors have not been well coordinated concerning this topic.

One of the chapters is devoted to waves in optics, where again there is an application to astrophysics: the astronomical polarimeter. Here, I would like to comment that on page 358, while discussing the velocity of light and Brownian motion is mentioned, I miss not to have mentioned the French physicist Jean Perrin, 1926 Nobel Prize in Physics, who actually was the one who made the experimental determination of the Avogadro number, providing the definite proof of the existence of atoms.

Plasma waves, ion-acoustic waves, nonlinear waves in plasmas, nonlinear Schrödinger equation and other nonlinear wave equations are discussed at the end. And finally, the important question of stability of waves and oscillations is covered in the final chapter of the book, where fluid and plasma instabilities like the Rayleigh–Taylor, Kelvin–Helmholtz, among others, with also several applications in astrophysics are discussed. Needless to say that this can only be a short version of what appears in the great book *Hydrodynamic and Hydromagnetic Stability* by S. Chandrasekhar, (Oxford University Press, 1961).

Every chapter contains a brief section with a list of exercises, which can be useful for the students to face the matters covered within the book.

I agree with the authors when they claim that the book is far from complete. They have attempted to write a book at an introductory level covering several aspects of waves and oscillations that one encounters in nature. Certainly, this attempt is undoubtedly ambitious and difficult to achieve, since from this global point of view, even though different waves have been considered, no mention is made on biological waves, autowaves or other kind of waves appearing in nature.

In any case, I do believe that as the authors hope, the book will be a welcome introduction to researchers working in different areas of physics and could be an excellent reference book.

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http://dx.doi.org/10.1080/00107514.2016.1205670

Elastic and plastic deformation of carbon nanotubes, by Hiroyuki Shima and Motohiro Sato, Stanford, Pan Stanford Publishing, 2013, 300 pp., US$149.95 (hardback), ISBN 9789814310758. Scope: monograph. Level: advanced undergraduate, postgraduate, early career researcher, researcher.

Over the past quarter of a century, the field of carbon nanotubes has undergone a rapid expansion in both academia and industry. Delving into recent literature of carbon nanotubes reveals a daunting wealth of research across diverse branches of science. This breadth in theory and application heavily contributes to the challenge new researchers currently face embarking upon the study of such fascinating nanostructures. Hiroyuki Shima and Motohiro Sato, in their book 'Elastic and Plastic Deformation of Carbon Nanotubes', review the intrinsic mechanical properties of carbon nanotubes and highlight their relevance in any given speciality.

At an elementary level, carbon nanotubes themselves appear in a variety of geometries and types. Thus a comprehensive work exploring the intrinsic electronic, optical, magnetic, chemical or mechanical properties for all carbon nanotubes would cover several volumes. Shima and Sato therefore set out only to address the most universal characteristic; the mechanical properties of carbon nanotubes. Broadly speaking, this book embarks to complete two objectives. Primarily the authors intend to present an overall review of the mechanical properties carbon nanotubes, summarising the historical origins and following the progress of such research to date. Their second objective is to then examine the common themes present across the vastly different fields incorporating carbon nanotubes, wherein the reader gains an insight into how such inherent mechanical properties may contribute to experimental characterisation, production and application of exotic nanotube-based structures and composites. Together, these two objectives successfully combine to guide a novice in this field from an arbitrary understanding of carbon nanotubes, to a position of sufficient proficiency upon which further research may be facilitated.

The book begins with a qualitative discussion on the discovery of carbon nanotubes, healthily presenting well-documented examples which questions the accepted first discovery. This approach, of identifying a concept and establishing the corresponding relevant explanation from the differing observations, remains prominent as the authors build on experimental analysis and theoretical modelling to form descriptions of carbon nanotubes under particular strains and stresses. Through a methodical presentation of theoretical first principles, assumptions made, experimental verification and judicious conclusions, the reader gains a clear picture of the deformations exhibited by nanotubes of varying structures and subject to differing environments.

The real strength of this book lies in its thoughtful structure. Each individual chapter introduces the mechanisms involved, building from from simplistic to sophisticated models, and are aided by diagrams of experimental schematics and results. The clear and eloquent writing encourages the reader to easily digest the state-of-the-art techniques involved in the investigation of carbon nanotubes, and highlights the desire for breakthrough in theoretical and experimental approaches where necessary. This book will hold much appeal to any newcomer wishing