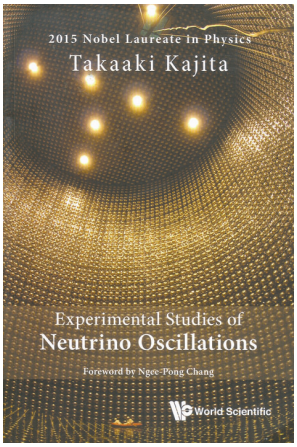

Experimental Studies of Neutrino Oscillations. Takaaki Kajita. World Scientific Publishing Co. Pte. Ltd, 5 Toh Tuck Link, Singapore 596224. 2016. vii + 98 pages. Price: US$ 18.

The book under review is a collection of articles by Takaaki Kajita, on the subject of atmospheric, solar and long-baseline neutrino oscillation physics. These articles recount the spectacular success story of solving the solar and atmospheric neutrino puzzles, as well as the considerable challenges that lie ahead. Kajita's guided tour of this exciting scientific expedition makes this a truly pleasant read.

Kajita won the 2016 Nobel Prize in Physics, for his outstanding contributions towards understanding the nature of neutrino mass and flavour mixing, through his role at the Super-Kamiokande collaboration. He shared this honour with Arthur McDonald, who played a similarly stellar role for the Sudbury Neutrino Observatory. This book is a collection of seven of his articles, previously published as stand-alone reviews or proceedings based on talks at notable conferences. As Ngee-Pong Chang remarks in a celebratory foreword, this volume is a record of and glimpse into the rise of Asian research at the frontiers of neutrino physics. It goes without saying that Kajita conveys the developments of the field from the thick of action, where he was a key player.

Chapter 1 provides a brief history of the neutrino, the physics of neutrino oscillations, the solar and atmospheric neutrino problems, and future directions. For readers unfamiliar with neutrino physics, this chapter provides a lucid self-contained introduction to the field.

Chapter 2 summarizes the state of solar and atmospheric neutrino oscillation data circa-2000, when both LMA-I and LMA-II solutions were allowed. Within a few hectic years, by 2002, the situation had changed, and chapter 4 describes the growing evidence for the LMA MSW solution, in no small part due to the data obtained at Kamiokande, leading to the solution of the solar neutrino problem.

Chapter 3 provides a circa-2002 overview of the JHF-Kamioka neutrino project. A neutrino beam with oscillation maximum at <1 GeV with a baseline of 295 km is proposed, with a 50 kton Super-K detector at the far end. Plans for the measurement of $\sin^2 2\theta_{23}$, Δm^2_{23}, and discovery of a nonzero θ_{13} are discussed.

Chapter 5 outlines the capabilities and plans for the Super-Kamiokande, K2K, and JPARC projects, while chapter 6 gives an overview of the neutrino oscillation data. Both these chapters, written in 2004, revisit some of the measurement goals in chapter 3, and a comparative reading reveals the rapid pace of progress in 2002 to 2004. This progress has continued since, and neutrino physics is now deep into the precision era.

Chapter 2 argues the case for large-water Cherenkov detectors, circa-2005, with exposure in the ballpark of a few hundred megaton years, as a promising tool to study atmospheric neutrinos in the future. With emphasis on measurement of the θ_{13} and sign of Δm^2_{23}, it is pointed out that precision of about 10–20% is achievable.

It is heartening to note that many of the goals outlined in these early proceedings were met and exceeded by several experiments, including by those where Kajita and his collaborators played a major role.

This book reveals the scientific passion of Kajita in a most unadulterated manner, displaying both the ambitious plans and the meticulous work that led to their fruition. Readers interested in the history of neutrino oscillation physics, especially the resolution of the solar neutrino problem and subsequent developments, will find this to be a revealing diary of those exciting times.

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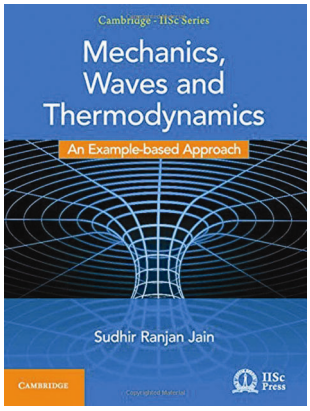

Mechanics, Waves and Thermodynamics: An Example-based Approach. Sudhir Ranjan Jain. Cambridge–IISc Series, Cambridge University Press, 4843/24, 2nd Floor, Ansari Road, Daryaganj, Delhi 110 002. IISc Press, Bengaluru 560 012. 2016. 210 pages. Price: US$ 55.99/Rs 595.

Classical mechanics is the oldest branch of physics and is the one most closely associated with our daily experiences. It is therefore not surprising that it is the subject of a large number of books written for readers at diverse levels. As a result, it is now difficult to write a book which will present classical mechanics in a new way. This is exactly what Sudhir Jain has succeeded in doing. He has used a variety of examples from real life to illustrate a number of concepts in classical mechanics. He then develops the necessary theoretical formalism which a reader can use to understand the ideas more deeply. This book differs from standard textbooks (like the well-known one by Goldstein) in that the problems from daily life provide a motivation for going deeper into the mathematical analysis. As a result, the book should be of interest to those who only want to understand some things without going into too many equations as well as to undergraduate (UG) students who want to see a more detailed treatment.

To give an idea of the wide variety of phenomena that the author has discussed, here are some examples. There are discussions of how high different animals can jump in comparison to their body sizes, why writing with a chalk on a blackboard can produce squeaking sounds, how the observed relation between velocities of stars and their distances from the centres of their galaxies led to the notion that there must be some

hidden mass (called dark matter) in the universe, the physics and mathematics of music (both Indian and Western classical), why different fluids have different viscosities, the frequency of the sound of running water, and the velocity of waves produced by a tsunami. It is clear that the author has thought carefully regarding which phenomena to talk about, making the book a delight to read.

Although the book is not large, the author has presented the most important and beautiful ideas in classical mechanics. These include Newton's laws of motion, circular motion, the principle of least action, work and energy, pendulums, the motion of rigid bodies, friction, collisions, central forces, dimensional analysis, oscillations, waves and fluid mechanics.

The final quarter of the book presents some concepts from the kinetic theory of gases, thermodynamics and statistical mechanics. These are not commonly discussed along with classical mechanics, but the author presents them in a way which looks like a smooth continuation of the material in the earlier parts of the book. Even in these final chapters one finds some unusual topics like the Van't Hoff equation of state which makes a connection between dilute solutions and ideal gases.

The author has a flair for explaining difficult concepts in interesting ways without oversimplifying the mathematics. He has also provided several references which a curious reader can look at to learn about some areas in more detail. In conclusion, this book provides a lovely introduction to classical mechanics. It can be used either by itself or as a supplement to a more detailed textbook for teaching an UG course on this subject. It can also be used for independent study by anyone who wants to learn at his/her own pace.

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Annual Review of Physiology, 2016. David Julius and David E. Clapham (eds). Annual Reviews, 4139 El Camino Way, PO Box 10139, Palo Alto, California 94303-0139, USA. Vol. 78, ix + 573 pp. Price: US$ 109.

This volume begins with a gripping and refreshing narrative by Terje Lømo in an article entitled 'Scientific discoveries: what is required for lasting impact'. Lømo addresses two broad areas of scientific studies with which he was personally involved. First, a discovery, in this case, long-term potentiation, which though initially slow to gain acceptance and publicity has withstood the test of time, particularly in relation to understanding the physiology of learning and memory in the hippocampus. Second, the exploration of a much publicized 'breakthrough', in this case, the neurotrophic hypothesis (1970), which proposed that denervation supersensitivity resulted from a lack of trophic factors rather than from impulse activity. In the case of the latter, while the much heralded hypothesis led to a large body of work that allowed for a better understanding of trophic interactions, the original hypothesis fell by the wayside. The article, however, is more than a personalized update. Lømo discusses his tryst with science including 'experiments that did not work', the issue of 'credit' for discovery and the reception to novel findings, among others. The article will appeal to all those who have had their moments of long periods of struggle and their brief moments in the sun. It will also appeal to all students who search for the path and process behind truly great discoveries.

The special topic in this volume focuses on 'mitochondria' – a feast for, in the words of the Editor, D. Julius, committed 'mitochondriacs'. The article by Pernas and Scorrano entitled 'Mito-morphosis: mitochondrial fusion, fission, and cristae remodeling as key mediators of cellular function' focuses on mitochondrial morphology, and the fact that aberrant alterations in mitochondrial shape and mutations in shaping proteins have profound effects on human health. This is particularly true of ischaemic and atrophic disease states.

There have been an increasing number of epidemiological studies which have demonstrated an association between muscle function, often using a simple measure such as handgrip strength, and cardiovascular risk factors as well as mortality. While there are many intuitive explanations for this, e.g. muscle function as a surrogate for physical activity, the article by Rai and Demontis entitled 'Systemic nutrient stress signalling via myokines and myometabolites', provides a readable and compelling review of how muscle can affect the function of other tissues and the body as a whole. Myokines are muscle-derived growth factors and cytokines, and while not necessarily exclusive to muscle, assume special importance because muscle accounts for about 40% of body weight and is highly vascular. Myometabolites which are muscle derived metabolites are discussed to a somewhat lesser extent. The article highlights another set of potential mechanisms by which behavioural change in the form of physical activity and exercise can beneficially impact human health. In addition, myokines have also emerged as important diagnostic tests for myopathies and age-related diseases, and have the potential in the future to be used therapeutically to mimic the healthy effects of exercise.

The article by Bedrosian *et al*. on 'Endocrine effects of circadian disruption' brought memories of the early work of Jürgen Aschoff, one of the founders of chronobiology. Circadian rhythms are cyclical events in the body of approximately 24 h duration. Aschoff had demonstrated the roughly 24 h cyclical rhythm of body temperature and had constructed an underground bunker to study the effects of free-running cycles in humans in the absence of 'zeitgebers', a term which he coined to describe environmental time cues which could 'entrain' free-running rhythms. Circadian disorders have become increasingly important in the modern world because of shift work, transmeridian travel and jet lag, sleep disorders and enhanced lighting at home. The authors provide an update of the central endocrine mechanisms involving the pineal and pituitary glands, and peripheral events involving the adrenal gland and energy homeostasis. They further outline the consequences of disrupted endocrine rhythms, especially in relation to inflammatory disorders and cancer, and obesity and metabolic disorders.

Obesity and its sequelae, including type-II diabetes, cardiovascular disease, cancer, sleep apnea and others, continue