GENERAL / GÉNÉRAL

The Physics of Polarized Targets, Tapio O. Niinikoski, Cambridge University Press, 2020; pp. 530; ISBN: 978-1108475075; Price: 218.95.

Theory of Simple Glasses: Exact Solutions in Infinite Dimensions, Giorgio Parisi, Pierfrancesco Urbani & Francesco Zamponi, Cambridge University Press, 2020; pp. 349; ISBN: 978-1107191075; Price: 91.95.

UNDERGRADUATE LEVEL / NIVEAU DE PREMIER CYCLE

Principles of Optics: 60th Anniversary Edition, Max Born & Emil Wolf, Cambridge University Press, 2019; pp. 992; ISBN: 978-1108477437; Price: 79.95.

The Cosmic Revolutionary's Handbook: (Or: How to Beat the Big Bang), Luke A. Barnes & Geraint F. Lewis, Cambridge University Press, 2020; pp. 286; ISBN: 978-1108486705; Price: 25.95.

Theoretical Concepts in Physics An Alternative View of Theoretical Reasoning in Physics (3d ed.) [v], Malcolm S. Longair, Cambridge University Press, 2020; pp. 636; ISBN: 9781108484534; Price: 68.95.

SENIOR LEVEL / NIVEAU SUPÉRIEUR

Invariant Imbedding T-matrix Method for Light Scattering by Nonspherical and Inhomogeneous Particles, Bingqiang Sun, Lei Bi, Ping Yang, Michael Kahnert and George Kattawar, Elsevier, 2020; pp. 262; ISBN: 978-0-12-818090-7; Price: 158.11.

Mean Field Theory, Vladimir M Kolomietz, Shalom Shlomo [v], World Scientific, 2020; pp. 588; ISBN: 978-981-121-177-5; Price: 252.95.

Pear-Shaped Nuclei, Suresh C Pancholi, World Scientific, 2020; pp. 192; ISBN: 978-981-121-759-3; Price: 121.61.

Statistics, Data Mining, and Machine Learning in Astronomy: A Practical Python Guide for the Analysis of Survey Data, Updated Edition, Zeljko Ivezić, Andrew J. Connolly, Jacob T. VanderPlas, and Alexander Gray, Princeton University Press, 2019; pp. 560; ISBN: 9780691198309; Price: 103.58.

Book Reviews / *Critiques de livres*

Further Adventures of the Celestial Sleuth, by Olson, Donald W., Springer, 2018, pp. 334, ISBN: 978-3-319-70319-0, price 32.84.

I selected this book because I was intrigued by its premise: using astronomy to solve mysteries regarding the time, date and location of the origins of works of art. As a secondary school physics teacher, I am always interested in finding other ways to teach students about the applications of the knowledge and skills we teach them in school, and this text did not disappoint.

The book reads much like a Sherlock Holmes case file. Donald W. Olson describes how he and his team from Texas State examined paintings, battles, photographs, and literature through an astronomical lens, to locate, re(examine) and challenge their understandings of the works, as well as the conclusions of other researchers. Clues, such as historical documents (*e.g.,* letters, train schedules, tide tables, newspaper clippings) are combined with modern means (*e.g.,* computer planetarium simulations), to build their own portrait, which includes information about the astronomy, as well as the artists themselves.

Broken into four parts — *Astronomy in Art, Astronomy in History, Astronomy in Literature, The Terrestrial Sleuth* — Olson begins each chapter outlining the questions he and his team had set out to solve. In Part One, the challenge was often to deduce the location and date for a painting. Olson works with an underlying assumption that the artist included an accurate representation of what was present in the night sky from their location. From this, he uses stories about the artists and other references to the work, to deduce his answers. Olson also includes in this section an examination of *Times Square Kiss* — and specifically the shadows on the buildings — to add more information to the ongoing discussion on the as-yet unidentified woman and sailor. In Part Two, the team sought to better understand the factors which influenced strategic battle preparations (such as the case for the Battle of Stirling Bridge or the Battle of Normandy), and worked with data to highlight misconceptions. Part Three focuses on literary passages, to determine their accuracy, in terms of celestial movements and season. Olson uses knowledge of each author's astronomical competence to frame the possible legitimacy of the passages, and then move on to determine whether authors had accurately described astronomical events or celestial movements based on the season or location of a scene. In the final part, Olson turns to two final puzzles: a railway and locating the Millais oak tree.

This is the second ***Celestial Sleuth*** book, and Olson makes reference to other case files in that volume — although not required to understand what is discussed here. The background knowledge required to understand the text is at the secondary level, and new material and terminology is explained succinctly to allow the reader to follow key ideas of analyses. For me, I felt it did provide some interesting options from which to teach physics at the secondary level, such as Chaucer's description of the moon's path in terms of Kepler's Laws of motion. For the higher education educator, I feel the book gives enough information to provide a roadmap of the kinds of information and tools one would need to endeavor on a similar quest.

Tasha Richardson,
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On Gravity — A Brief Tour of a Weighty Subject, by Anthony Zee, Princeton University Press, 2018, ISBN: 9780691174389, price 19.95.

In the preface, Anthony Zee tells his readers that **On Gravity** is supposed to bridge the gap between popular books and textbooks on Einstein gravity. After reading the 142 pages of the main text and the eight-page appendix, I am convinced that he succeeded. The area between popular books and textbooks is somewhat of a no man's land, and

especially for individuals with an interest in a particular field (say, gravity, for instance) this can be quite frustrating. What should you read when you already understand the basic idea of gravitation, know the main players in the history of its development, and have perhaps watched a few documentaries on the topic as well?

Well, you should read **On Gravity**.

The book is divided in four parts which consist of a handful of chapters each, and each chapter is again split into digestible sections with fitting and sometimes tongue-in-cheek headlines. Zee is one of the few physics authors who write so fluently and seemingly effortlessly that I didn't even realize I was already halfway through the book. His tone, as usual, is relaxed, conversational, and laid-back, making the seemingly complicated topic of Einstein's General Theory of Relativity a lot more approachable.

In part I, Zee introduces gravity as the weakest of the four fundamental forces in our Universe and explains the nature of electromagnetic (and gravitational) waves. In part II we learn about Einstein's main idea: the principle of relativity. We also learn why we shouldn't call it "principle of relativity." Part III is devoted to a detailed explanation of the action principle in both classical mechanics and gravity theory. Finally, in part IV we learn about black holes, Hawking radiation, gravitons, as well as the concepts of dark matter and dark energy. In the grand finale Zee highlights the importance of gravitational waves, which, and that's the hope, will provide scientists with new powerful methods of observing and understanding the Universe.

On Gravity takes its time with the reader, and most concepts are explained brilliantly and in quite some detail: the idea of relativity, the action principle, gravitational waves, and even curved spacetime (in the appendix). I wish more professors would read this book and use these explanations in their undergraduate courses! The explanation of Hawking radiation, on the other hand, after a thorough introduction into the quantum uncertainty principle, seems a bit rushed and barely surpasses that given in popular science texts. Moreover, what I would have liked to see (and what is lacking in Zee's treatment) is a deeper discussion of the *limitations* of General Relativity. The Evergreen, a.k.a. the quest for the still elusive theory of quantum gravity, is clearly addressed, but problems at the classical level (say, in the form of gravitational singularities inside of black holes) are not mentioned. I think this is a missed opportunity to make this book more balanced.

Overall, **On Gravity** is a fantastic read. It is supplemented by a whopping 12-page index as well as 13 pages of annotations providing additional anecdotes, insights, and kindhearted encouragements to the reader. Zee's book might be a good choice for undergraduate students who are contemplating to enter the field but don't want to read 800 pages in a standard textbook. And if you work on gravity yourself, and you want to talk to your friends a bit more about your work, give them this book. Seriously. Zee's unique style will surely entice them and present research in gravity from its truly attractive side (pun intended).

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Practical Bayesian Influence: A Primer for Physical Scientists, by Coryn A.L. Bailer-Jones, Cambridge University Press, 2017, pp. 295, ISBN: 9781316642214, price 105.95.

Few fields are as fraught with a history of controversy as that of Bayesian inference. Although born in the 18th century in the work of Bayes and Laplace, its "subjective" view of probability fell out of favours in the 20th century after Neyman, Pearson, and others developed statistics based on a frequentist interpretation of probability. In the former, probability measures degrees of rational belief in the truth of a proposition; in the latter, probability is viewed as the limiting frequency in an infinite number of trials.

More recently, there has been a tremendous resurgence of Bayesian methods, which are at the heart of many successful methods in data science and machine learning. With this growth in popularity has come the need to teach the methods to broader scientific audiences. However, perhaps because of its "insurgent" past, many texts have been original and quirky. Think of the books by Harold Jeffreys, Edward Jaynes, D.S. Sivia, and David MacKay for example. Perhaps what makes such books brilliant and inspirational also makes them harder to teach from. Insights that appear deep to the expert may just confuse the student. (The same critique has been made of the Feynman Lectures.)

Coryn A. L. Bailer-Jones' book is an interesting pragmatic alternative. It is straightforward and clear, if not always original — many of its examples and ways of presenting material come from the "quirky" books above. Still, it may be easier to follow than other, deeper treatments. For example, Chapter 9 goes carefully through the procedure for curve fits using Markov-Chain Monte Carlo (MCMC) and also offers a treatment of data outliers using mixture models. The latter example provides a simple way to automatically identify and, in effect, exclude "bad" points from otherwise "good" data. And the introductory discussion to model selection — clarifies many points, such as why use odds ratios, that are often glossed over in other discussions.

An attractive feature of the book is its many numerical illustrations, supported by explicit code available online. Perhaps unfortunately, the chosen language is R, an open-source program from the statistics community that is not widely used by the physics community (at least that part I am familiar with). Matlab, Mathematica, and Python are more common. Of course, these languages share common features, and transcribing a routine into your favourite language can be a good exercise. A similar critique is that the notation, for example E[x] for expectation rather than $\langle x \rangle$, reflects conventions of statistics more than physics.

In short, Bailer-Jones has written an attractively brief, direct, "practical" introduction to Bayesian Inference. While its presentation and examples are often standard, it is well organized and very clear and should be much appreciated by upper-level undergraduates looking for an introduction to the field, assuming they do not get too hung up on the use of R and statistics notation. For graduate students seeking more depth and derivations, *Bayesian Probability Theory*, by Wolfgang von der Linden, Volker Dose, and Udo von Toussaint, is a comprehensive alternative. And, for inspiration, I still prefer Sivia's *Data Analysis: A Bayesian Tutorial*.

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