

APS CONGRESSIONAL SCIENCE FELLOWSHIP 2018-2019

THE AMERICAN PHYSICAL SOCIETY is currently accepting applications for the Congressional Science Fellowship Program. Fellows serve one year on the staff of a senator, representative or congressional committee. They are afforded an opportunity to learn the legislative process and explore science policy issues from the lawmakers' perspective. In turn, Fellows have the opportunity to lend scientific and technical expertise to public policy issues.

QUALIFICATIONS include a PhD or equivalent in physics or a closely related field, a strong interest in science and technology policy and, ideally, some experience in applying scientific knowledge toward the solution of societal problems. Fellows are required to be members of the APS.

TERM OF APPOINTMENT is one year, beginning in September of 2018, with participation in a two week orientation sponsored by AAAS. Fellows have considerable choice in congressional assignments.

A STIPEND is offered in addition to allowances for relocation, in-service travel, and health insurance premiums.

APPLICATION should consist of a letter of intent of no more than 2-pages, a 2-page resume: with one additional page for publications, and three letters of reference. Please see the APS website (<http://www.aps.org/policy/fellowships/congressional.cfm>) for detailed information on materials required for applying and other information on the program.

**ALL APPLICATION
MATERIALS MUST BE
SUBMITTED ONLINE BY
CLOSE OF BUSINESS
ON JANUARY 15, 2018
(5:00 PM EST).**

BOOKS

Perhaps the most thought-provoking court cases Haggard discusses involve the delicate issue of whether a hazardous weather event constitutes, legally speaking, an "act of God." Meeting that standard means that a weather event was so unprecedented, unforeseeable, and overwhelming that it erased human error as legally relevant to an accident or disaster. In a nutshell: Could defendants have anticipated the factors that led to a given weather-related hazard and implemented procedures or safeguards to mitigate damages? Predictably, defendants often claim acts of God to absolve themselves of legal responsibility. Less predictable is how such tactics are translated into debates about, for example, the likelihood that a given bridge or roadway can withstand a 50- or 500-year storm. In those terms, guilt becomes a matter of defining risk, and the chaos that usually accompanies a disaster is boiled down to charts, statistics, and graphs.

Credibility is another interesting issue that Haggard explores in his book. What makes a good forensic meteorologist? How do trained meteorologists convince a jury and a judge that they are credible authorities on past meteorological conditions? Three factors were fundamental to Haggard's success, at least according to his account. First, he, his wife Martina Haggard, and his staff produced accessible and visual representations of atmospheric conditions, and they made sure the presentations were directly relevant to the case. Second, while on the stand, Haggard succeeded in convincing the jury that the data themselves were officially certified by relevant government agencies, which itself is a curious but underdeveloped side story of forensic meteorology. Third, and perhaps most importantly, Haggard was certified by the American Meteorological Society through a process that estab-

lished his "high ethical standards and technical competence."

Haggard's consulting work certainly leads to interesting questions about the role of meteorologists in contemporary society. But one of the drawbacks of his book is the cursory attention he pays to the business or competitive side of the forensic meteorology profession. The author occasionally alludes to the slow growth of his business, which is primarily based on word of mouth. He graciously acknowledges the artistic talents of his wife and the work of other colleagues who assisted him as he expanded his business during the 1980s and 1990s.

Even so, the reader is left with little understanding of the challenges and hurdles Haggard faced as he sought to bridge the gap between science and business. Indeed, he writes in his conclusion that being a forensic meteorologist was "exciting, challenging, and filled with the fun of meteorological detective work." But what were the challenges? Did he have competition? What it meant to him to develop a career in forensic meteorology, and to presumably have competed with others who were equally committed to developing a career, remains relatively opaque.

Ultimately, Haggard has produced a volume that gives us valuable insight into forensic meteorology in the courtroom—both how it operates in practice and the legal issues it confronts. However, much remains to be discussed about the profession of forensic meteorology outside the courtroom, including not only the business side but also the historical forces that have created and sustained the field. Hopefully, Haggard's book will inspire others to explore this fascinating field from new angles.

Gabriel Henderson

*American Institute of Physics
College Park, Maryland*

Statistical Physics

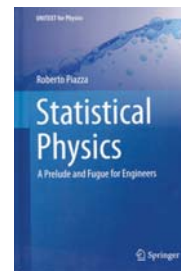
A Prelude and Fugue for Engineers

Roberto Piazza

Springer, 2017. \$79.99 (453 pp.). ISBN 978-3-319-44536-6

Upon receiving a copy of Roberto Piazza's new book, I was immediately intrigued by the title, *Statistical Physics: A Prelude and Fugue for Engineers*. I

have to admit that the whimsy of the title evinced a slight suspicion that Piazza's treatment of a deep



scientific topic might be given over to periodic flights of fancy. But, as the saying goes, you shouldn't judge a book by its cover, and, happily, I found my worries were not realized.

Johann Sebastian Bach was a master of counterpoint, a compositional technique that weaves together interdependent voices. The intricate music that emerges is characterized by an unmistakable economy of form. Piazza's treatment of statistical physics is also frugal in the best sense of that word. The book is billed as a text that will meet the needs of graduate students in chemical, mechanical, and materials science engineering, and it succeeds in that objective.

Statistical Physics begins with a discussion of classical thermodynamics followed by an introduction to the fundamental ideas behind statistical thermodynamics. It then builds to an exploration of quantum statistics. The transition from one section to another is natural and unlabored. Piazza's analyses are comprehensive and entertaining, yet they remain uncluttered, and they prompt serious reflection. Interspersed throughout the book are frequent anecdotal asides featuring Ludwig Boltzmann, James Clerk Maxwell, Sadi Carnot, Lord Kelvin, and other distinguished historical figures in the field. To repeat an oft-stated aphorism, they are the giants on whose shoulders all statistical physicists stand.

The classical thermodynamics of the first two chapters covers standard fare, including the first, second, and third laws; reversibility; the Clausius theorem; free energy; and the Gibbs paradox. The discussion of entropy and its significance is particularly well done. In many introductory texts, that classical material is not given the subtle treatment it deserves and, in my experience, leaves students wondering just what all the fuss is about. Piazza manages to avoid that pitfall. I would, however, have liked to see Legendre transforms discussed, since without them students may wonder just how enthalpy and the Helmholtz and Gibbs free-energy expressions seem to appear out of thin air. As is the case throughout the text, Piazza's little discursions from the main topic are often illuminating. A good example is the discussion on page 28 of the relationship between speed and irreversibility in an idealized heat engine.

The middle part of the book, chapters 3–5, applies the basic tenets of statistical physics to build important models that include the van der Waals equation of state, the Einstein model for the specific heat of a solid, and the Debye–Hückel equation. In many other texts, the material is discussed with an intimidating formalism that hides the underlying concepts and forces students to struggle with the mathematics instead of spending time reflecting on the often enigmatic nature of the subject. Piazza, however, encourages students to both master the mathematics and grapple with the subject's fundamental principles.

In chapter 3, for example, the material moves seamlessly from the canonical distribution function to the application of that function to simple classical and quantum systems, including paramagnetic systems. The well-done discussion of the inconsistency between the predictions of the Einstein model and experimental data for specific heat close to absolute zero temperature is interspersed with intermezzos of delightful anecdotes about the work of earlier scientific pioneers.

Chapters 4 and 5 cover the application of statistical physics to fluids and ferromagnetic systems. The material is standard, but the author's treatment is refreshing. It includes a simple exposition that uses the classical partition function to derive the van der Waals equation of state along with more sophisticated discussions of, among other things, the Poisson–Boltzmann equation, critical phenomena in the Landau–Ginzburg model, and elementary considerations of the renormalization-group approach. Chapter 6 belatedly introduces the grand canonical ensemble and its application to adsorption and colloids. It is the skimpiest part of the book, an interlude, before chapter 7, which focuses on quantum phenomena like Bose–Einstein condensation and superfluidity. Once again, the material, which will be especially useful to students of materials science engineering, is covered in many books, but the author's presentation is excellent.

Piazza's book is a welcome addition to the statistical-physics canon. There are no sample problems to hone one's understanding of the material, however, so for a fuller appreciation of the book, I recommend that students first practice their scales by completing introductory courses in thermodynamics

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and quantum mechanics. Once that is achieved, Piazza's choice of material and his lucid presentation of abstract, sometimes difficult concepts will make

for instructive and enjoyable reading.

Eldred Chimowitz
University of Rochester
Rochester, New York

Observatories and Telescopes of Modern Times

Ground-Based Optical and Radio Astronomy Facilities Since 1945

David Leverington

Cambridge U. Press, 2017. \$175.00 (502 pp.). ISBN 978-0-521-89993-2

In his book *Observatories and Telescopes of Modern Times: Ground-Based Optical and Radio Astronomy Facilities Since 1945*, David Leverington tells a concise history about those many astronomical structures. That is a lot of observatories and telescopes, and he admits that it may "read a little more like an encyclopedia." An encyclopedic tour it is. Though a tad skewed toward US-Anglo examples, *Observatories and Telescopes of Modern Times* examines most of the significant telescopes around the world.

The book is divided into two parts that cover optical- and radio-wavelength telescopes. In the first part, Leverington starts with the Palomar Observatory in Southern California and then moves to other observatories located in the US, Chile, South Africa, and Australia. After giving a brief history of an observatory site, Leverington offers technical specifics of its telescopes, such as mirror size and focal point. Three interpolated chapters are devoted to mirror designs, optics, and interferometry. The author's decision to organize his book around telescopes rather than scientific achievements allows each chapter to be read independently. An attempt to interweave scientific discoveries and developments with the telescopes would have likely resulted in an overly complex structure.

The chapters on optical observatories follow a roughly chronological order. As the section progresses, the operation of the observatories Leverington describes becomes increasingly complex. By the end of part 1, the observatories can no longer be called single-institution or even single-nation enterprises. Whereas Caltech and the Carnegie Institution for Science operated the Mount Wilson and Palomar Observatories under a fairly

complex partnership at the end of World War II, today's observatories and telescopes operate on a percentage share among institutions and countries.

In the radio astronomy section, observatories in Australia, the UK, and the US receive the most attention, although the author covers ones in Europe, Canada, Central America, South America, Asia, and the South Pole. The smaller number of radio observatories permits Leverington to devote more time to each site's background and characteristics. In the chapter on radio observatories in Australia, for example, Leverington traces the developments at different locations and puts together a cohesive narrative about the history of Australian radio astronomy. For the Mullard Radio Astronomy Observatory at the University of Cambridge, he delves into the role of individual astronomers and how their personalities shaped the group.

Leverington intends the book for both technical and nontechnical readers. For the latter audience, a basic knowledge of physics and observational astronomy will come in handy, as some basic terminology is used without explanation. For instance, newcomers to astronomical observation may not understand the meaning of $f/5$ or the significance of terms such as Cassegrain and coudé focus. Overall, though, Leverington strikes a good balance by imparting sufficient information without going into too much detail.

Perhaps the biggest shortcoming of *Observatories and Telescopes of Modern Times* is the author's tendency to focus on the *what* of the events that happened with little attention to the *why*. Technological developments for observational astronomy after 1945 were strongly in-

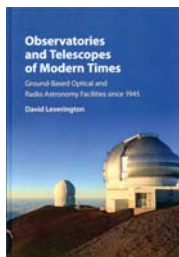
fluenced by the Cold War, for example. However, most of the book treats telescopes and technologies separately from the rest of human affairs, and the result can be dry reading. I think the book would have benefited from placing the construction of the telescopes and observatories in their larger political and social contexts more often. The South African government's involvement with the Southern African Large Telescope after the ending of apartheid is one of the few places where Leverington dwells on the significance of politics. And he does give fair coverage to the environmental issues surrounding the Mount Graham International and Mauna Kea Observatories.

I also wish that Leverington, who has held senior management positions at the European Space Agency and British Aerospace, had included more about his own experiences. In a few places, such as the sections on the Very Large Telescope and the Sloan Digital Sky Survey, he does offer footnotes with opinions on management. Expanding on those opinions to further examine large projects that require extensive management would have made the book unique and more interesting.

Despite those criticisms, *Observatories and Telescopes of Modern Times* offers technically informed readers an excellent reference. Readers will come away from the book with a better understanding of existing telescopes and observatories along with some of their scientific specifications and achievements.

Eun-Joo Ahn

University of California, Santa Barbara



NEW BOOKS

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Signal Analysis of Hindustani Classical Music. A. K. Datta et al. Springer, 2017. \$129.00 (250 pp.). ISBN 978-981-10-3958-4

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Understanding Acoustics: An Experimentalist's View of Acoustics and Vibration. S. L. Garrett. Springer, 2017. \$129.00 (896 pp.). ISBN 978-3-319-49976-5

Astronomy and astrophysics

From the Sun to the Stars. J. B. Kaler. World Scientific, 2017. \$32.00 *paper* (239 pp.). ISBN 978-981-3143-24-1