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Planck: Driven by Vision, Broken by War

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of gravity. On the mathematical side, the reader might want to know more about singularity theorems, global existence and stability theorems, and black hole uniqueness theorems. However, the author has wisely chosen to write a short book that gives a taste of the subject. *Bon appétit*.

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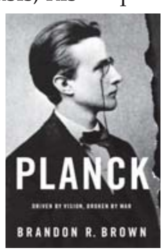
Planck
Driven by Vision, Broken by War

Brandon R. Brown
Oxford U. Press, 2015. $29.95
(258 pp.). ISBN 978-0-19-021947-5

Among physicists, Max Planck is a household name. He is immortalized, of course, by the fundamental constant named after him, and also by the Planck radiation curve, Planck units, the Max Planck Society, and the *Planck* space observatory. With *Planck: Driven by Vision, Broken by War*, University of San Francisco physics professor Brandon Brown has written a captivating biography that covers Planck's main contributions to science and, with greater emphasis, his personal and intellectual life.



The book is organized into 16 chapters, each devoted to a particular month in the period from April 1943 to May 1945, plus a coda. However, it is much more than an account of Planck's troubled life during the last part of World War II. Brown occasionally deviates from the chronological chapter arrangement to go back and forth in time and skillfully paint a full picture of Planck's life. It is an unusual structure, but it works very well.

Planck faced many moral dilemmas as the doyen of German physicists in a troubled era. Those dilemmas are discussed in John Heilbron's acclaimed biography, *The Dilemmas of an Upright Man* (University of California Press, 1986). Although he makes much use of Heilbron's book, Brown offers a different perspective and adds new material and insights.

Following Planck's life from his birth in 1858 in Kiel, Germany, to his last year in Göttingen in 1947 after the fall of the Third Reich, Brown provides a vivid narrative of German science and culture during that most dramatic period in Europe's history. Planck's life was rich in rewards but also had more than its share of tragedy. His oldest son, Karl, was killed in the 1916 battle of Verdun, and his youngest child, Erwin, accused of conspiring against Adolf Hitler, was tortured and executed by the Gestapo in 1945. Brown writes movingly of that cruel episode and how the 86-year-old physicist tried in vain to prevent it.

Much like Heilbron, Brown discusses Planck's problematic role in the Third Reich, including his fruitless meeting with Hitler in May 1933. Brown's treatment is balanced and empathetic. Although the patriotic Planck had no sympathy for National Socialism, he did follow the party line by dismissing the Jewish staff at the Kaiser Wilhelm Society, saluting the swastika flag, praising the Führer in official speeches, and generally advocating an appeasement policy. As Brown points out, Planck "stood with his Fatherland, no matter its warts and crimes." With balance and empathy, without passing judgment, he leaves no doubt that the period under Hitler's rule damaged Planck's reputation as an "upright, honorable character," as Max Born characterized him in a 1920 letter to Albert Einstein.

Although Planck is the book's main character, Brown devotes considerable space to some of the scientists with whom he interacted, and to Einstein in particular. Although very different personalities, the two physicists admired one another and remained on friendly terms even after Germany had become the Third Reich. Brown deals in some detail with their relationship and describes Einstein's scientific theories as much as he describes Planck's. Another Jewish physicist who plays an important part in the book is Lise Meitner, who served for a period as Planck's assistant and over the years received much support from him. Meitner, who held the old theoretical physicist in great reverence, described him in 1958 as having "an unusually pure disposition and inner rectitude, which corresponded to his outer simplicity and lack of pretension."

Well-researched and informative as the book is, it does contain a few errors or questionable statements. For example, Brown exaggerates the significance of anti-atomism in the 1890s when he writes that Planck was one of the few German physicists accepting the reality of atoms. In his account of Einstein's 1905 paper on light quanta, he wrongly presents it as a paper on the photoelectric effect and incorrectly indicates that Einstein's argument proceeds from Planck's radiation law, which Einstein, in fact, did not use. And the German amateur astronomer Johann Soldner's paper on the gravitational bending of light dates from 1801, not 1804.

Nonetheless, the few errors do not significantly detract from the book's high quality. Brown's engaging biography of Planck is beautifully written and will be accessible to a broad readership of physicists and historians. It is popular history of science at its best.

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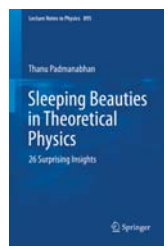
Sleeping Beauties in Theoretical Physics
26 Surprising Insights

Thanu Padmanabhan
Springer, 2015. $59.99 paper
(302 pp.). ISBN 978-3-319-13442-0

When a student wants to be a theoretical physicist, he or she inevitably asks, "What should I study?" Most physicists agree on the answer. At the undergraduate level, a solid foundation is needed in mathematics coupled with undergraduate courses in classical mechanics, quantum mechanics, electromagnetism, and thermodynamics; and at the beginning of graduate school, advanced versions of those same courses are necessary to lay the foundation for field-specific coursework and research and for future studies in general relativity, quantum field theory, and beyond.



But that's only the beginning. What separates students from one another is the unique problem-solving tool kit each one possesses and how adept each is at applying various tricks and techniques when confronted with novel situations. In Thanu Padmanabhan's new book, *Sleeping Beauties in Theoretical Physics: 26 Surprising Insights*, he aims to impart to aspiring theorists some of the important connections and techniques—spanning gravitation, classical mechanics, electromagnetism, and quantum mechanics—that he's learned over his career. In 26 mostly self-contained chapters, he takes the reader through a slew of different lines of thought and showcases many underappreciated nuances, or "sleeping beauties," of theoretical physics.

Much of what's explored will be quite surprising to many students—for example, how to derive exact quantum results by making certain approximations, how to get the temperature and spectrum of Hawking radiation without quantum field theory, how to understand the Casimir effect, and how stability or instability emerges for the Lagrange points. Many of the techniques used are ones students will have come across before, such as Taylor-series expansions, how to judiciously choose which terms to keep to make a problem more tractable, and the importance of obtaining a general result from a fully relativistic theory before taking the nonrelativistic limit.

The few chapters in the book that stand out for their clarity and utility mostly deal with the connection between quantum mechanics and classical mechanics. Most standard undergraduate and graduate texts treat those fields as distinct and self-contained, and the deep links between the two are often glossed over or ignored entirely. The connections drawn in the book are robust, and any students training themselves to be theorists would be well rewarded by working through those chapters in full.

Despite the author's proclamations in the preface, *Sleeping Beauties in Theoretical Physics* is not ideal for senior undergraduates. Most of the equations and techniques in the text—for example, Hamilton–Jacobi equations, the Klein–Gordon equation, and retarded and advanced Green functions—are typically not covered until a first-year graduate course. A few of the self-contained chapters—for instance, chapter 5 on the Newtonian gravitational potential—would be accessible to undergraduates. In addition, this is not a book one can just sift through; practically all its value would be lost. Rather, this is a book that one must sit down with and meticulously work through the equations to appreciate the insights within. That's not necessarily a negative, but it is opposite to how the book is presented.

However, the lecture notes are problematic in a few major ways. Padmanabhan often makes assumptions or takes steps without adequate justification, something that a sharp student will notice. In many cases, he returns to a point, pages later, to explain why things went awry when a given assumption was made; he does not revisit the assumptions for those cases in which he obtains the desired solution. Another frustration is the numerous asides and appendices; they take the focus off the deep connections, many of which unfortunately end up being underemphasized. Many intriguing