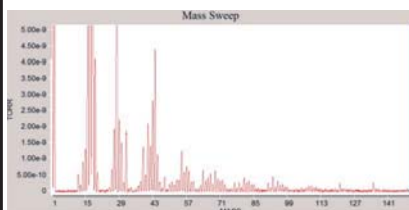


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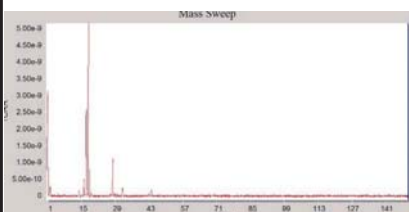


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signatures are  
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in fact, did not use. And the German amateur astronomer Johann Soldner's paper on the gravitational bending of light dates from 1801, not 1804.

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.

**Helge Kragh**  
Niels Bohr Institute  
Copenhagen

## 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.

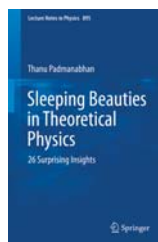
Much of what's explored will be quite surprising to many students—for example, how to derive exact quantum results by making certain approximations, how to get the temperature and

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



points—for instance, the lack of exploration of nonrelativistic quantum mechanics with gravitation—are mentioned once and never addressed again.

All in all, *Sleeping Beauties in Theoretical Physics* is a potentially excellent resource for those looking to add to their mental tool kit and sharpen their theoretical skills. But students taking on the book will find it to be no easy task; they must be prepared to work through numerous digressions and side trails in order to arrive at their destination.

**Ethan Siegel**  
Lewis and Clark College  
Portland, Oregon

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