correspondence on which much of our knowledge of the physicist's early years rests—we know that Einstein was working on what came to be known as the special theory of relativity since at least 1899.

Less obvious but perhaps more troubling is the author's occasional misreading of the letters exchanged between Einstein and Marić. The 20-year-old Einstein's description of a growing estrangement with his mother and sister was not so much an indication of callowness or desperation, as Levenson writes, as it was an admittedly stilted attempt to stress his independence of family and thus ingratiate himself with a new girlfriend. Levenson also misses the point when referring to a passage in which Einstein mentions "our dark souls." That was no more than a playful allusion to a shared mischievousness, not a reproach about Marić's brooding nature—a trait that Einstein would criticize much later in their relationship.

The author really hits his stride when writing about Einstein's time in Berlin. The book is particularly masterful in its evocation of World War I and its importance as a crucible for the struggling democratic Weimar Republic that emerged in Germany in 1919. Clearly, Levenson feels very much at home discussing the strategy, battles, and personalities of that war; with great effect, he devotes considerable space to this topic.

By contrast, the author gives short shrift to Einstein's changing views on Zionism, a central thread that runs through the physicist's Berlin years. The importance of that theme is brought home even more powerfully when we consider that it may go to the heart of a significant mystery about Einstein: How did an individual so dedicated to the pursuit of scientific truth in his early years emerge with passionately held political interests after the war? And where did those political interests come from? We know that Einstein's indifference to political issues, as well as his "agnostic" views on religion and a Jewish cultural identity, changed in Berlin. Is it mere speculation that he forged a new sensibility and willingness to speak out on public issues by confronting what it meant to be a Jew? Such questions are open, but unfortunately Levenson does not pursue them in his book.

It seems the author is after bigger game. His goal, as he puts it, is to instrumentalize Einstein as "a kind of human Geiger counter tracing Berlin's state and fate at any moment for [the] eighteen crucial years" of the Weimar Republic. In addition to using the rather unfortunate metaphor, Levenson sets up for himself an impossible task. Einstein was the archetypal "outsider as insider," a man who remained aloof and is therefore not suitable to serve as a guide to Weimar Germany. The author could have more fruitfully juxtaposed Einstein's growing scientific isolation with an account of the burgeoning, interactive physics communities in Berlin and the rest of Europe.

Throughout the book, Levenson generally does a fine job in getting his German citations and translations correct. The book's index, however, is unfortunately riddled with egregious misspellings.

Einstein does not typify the period or the city of Berlin. He observed and partook of the city's singularity. And yet, even as an observer, he pales in comparison with German diplomat and man-about-town Harry Kessler, whose memoirs have recently been excellently translated into English. Still, there is no denying Einstein's symbolic importance. As Levenson accurately sums up toward the conclusion of his book, Einstein was a "tangible emblem of the city's drive to excel." Describing him in that manner is quite a different and far more acceptable proposition than viewing him as a human Geiger counter.

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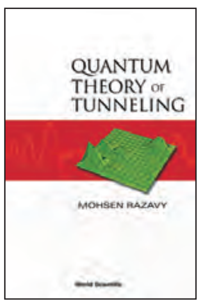
Quantum Theory of Tunneling

Mohsen Razavy
World Scientific, River Edge, N.J., 2003. $88.00, $48.00 paper (549 pp.). ISBN 981-238-018-3, ISBN 981-238-019-1 paper



Tunneling is one of the most striking of quantum phenomena. The term comprises a wealth of different effects having in common the possibility that a quantum system will be found in a classically forbidden region of space. Despite the multitude of tunneling processes, textbooks on quantum mechanics usually limit their discussions to the passage of a particle through a square potential barrier. Several more specialized books exist, but surprisingly, no comprehensive monograph on quantum tunneling had been published before this past year. That lacuna was filled by Mohsen Razavy's *Quantum Theory of Tunneling*. The book provides a good collection of examples of tunneling effects in atomic, molecular, condensed matter, and nuclear physics in the last three chapters; the rest of the book is essentially devoted to a rather impressive sweep of theoretical techniques.

Razavy has considerable experience in the field and has contributed to many of the topics included in his book. He pays a good deal of attention to semiclassical techniques, both in the simple case of a structureless particle in one dimension and in the more complicated multichannel and multidimensional cases. But he also discusses other techniques, such as the variable reflection amplitude method, inverse scattering methods, and techniques involving Feynman path integrals, Wigner functions, Heisenberg's equations of motion, complex scaling, and optical potentials. Other subjects covered include tunneling times, group and signal velocities, classical descriptions, time-dependent barriers, Gamow's theory, solvable models, motion in a space bounded by a surface of revolution, deviations from exponential decay, and decay widths calculated with scattering theory. One subject not addressed is dissipative tunneling, which is Razavy's main area of interest.

Each of the book's 26 short chapters has its own references. Razavy's style is quite laconic. He usually gives a very brief introduction immediately followed by formalism. He offers little or no discussion, but clearly explains the mathematics and works out calculations step by step.

The price paid for the broad scope is a certain lack of depth that, in some cases, can be misleading. I would like to have read an account of the limitations of the Wigner trajectory concept discussed in chapter 14. I also regard chapters 17–19 on tunneling times more as a sample of results than as a balanced review. They do not really do justice to the enormous number of publications on the topic. In particular, chapter 17 would benefit from a discussion going beyond the elementary but unsatisfactory treatment of Ken Stevens's work on evanescent waves. Chapter 19 considers Francis Low and Paul Mende's objections to the use of scattering theory for a Gaussian state that is initially close to a potential barrier, but does not adequately discuss work that has clarified how to handle those objections. Another example of the danger of brevity is the discussion of the time–energy uncertainty principle and tunneling given in chapter 2. I find the arguments vague and unconvincing, as usually happens when the "principle" is invoked without making precise its exact meaning.

A technical shortcoming of the book is the poor resolution of the three-dimensional plots. Moreover, those plots have no axis labels, so interpreting them may be quite difficult for some readers. Some of the 2D plots are also missing axis labels; absent as well are calculational details such as units or masses that are necessary for reproducing or interpreting the displayed curves. I have detected name misspellings and, in chapter 5, displaced reference numbers.

All in all, though, I enjoyed *Quantum Theory of Tunneling* and think that it will be useful for students and researchers alike. The main strength of the book is Razavy's concise summaries of the many techniques he reviews. It would be easy to adapt part or all of the material for various graduate courses—not necessarily about tunneling—because several of the methods discussed in the book are applicable to a wide range of phenomena.

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Compact Blue-Green Lasers

William P. Risk, Timothy R. Gosnell, and Arto V. Nurmikko
Cambridge U. Press, New York, 2003. $130.00, $60.00 paper (540 pp.). ISBN 0-521-62318-9, ISBN 0-521-52103-3 paper

It has been interesting, in fact downright amusing, to witness how in a mere span of four decades the laser has turned from a technology "in search of a problem" into one that many other technologies cannot do without. In that respect, the laser has truly become a gift to humanity that keeps on giving. Equally remarkable is the almost bewildering number of ways in which lasers (or coherent light sources, to the purists) can be made. The accounts in *Compact Blue-Green Lasers* prove once more the time-honored aphorism that "if you hit it hard enough, it will lase."

The designation blue-green in the context of the book really extends to the violet and beyond. These lasers are widely sought in diverse applications ranging from optical data storage, color reprographics, and color display to high-resolution spectroscopy and DNA sequencing. To present the material embodied in the approximately 1000 references they mention, authors William Risk, Timothy Gosnell, and Arto Nurmikko organized the book into three parts along the lines of the principal approaches to blue-green generation: nonlinear frequency mixing, upconversion pumping of rare-earth doped materials, and direct excitation of semiconductors. Those approaches correspond to the areas in which each author, respectively, has established himself as a leading researcher.

The chapters on nonlinear optics—that is, second-harmonic generation and sum-frequency mixing—as a means to produce blue-green light occupy a little more than half of the volume. This section amounts to a self-contained presentation of the history, basics, and latest developments in the field. Following an introductory chapter on the physical principles of nonlinear frequency mixing and the properties of the most promising materials for implementing it, the authors discuss in depth the various ways to accomplish second-harmonic and sum-frequency generation. Those methods include the simple focused single-pass geometry, the more elaborate resonator-enhanced and intracavity arrangements, and the guided-wave approach. The emphasis of this section is on developing a quantitative understanding of real devices and, using numerous examples, providing the readers with the necessary tools to analyze the prospect of potential new devices. Readers who desire more information on the fundamentals of nonlinear optics can find additional notes online at http://publishing.cambridge.org/resources/0521521033.

The second part of the book is on so-called upconversion lasers, which exploit what can be thought of as "ladder-climbing" processes to pump the upper laser level. This part begins with a chapter on the spectroscopy and nonradiative processes of rare-earth ions; the authors spared no details in laying that groundwork, especially in the theoretical justification of the widely used Judd–Ofelt expression, which permits the calculation of the radiative rates of arbitrary transitions based on a few experimentally determined parameters. The next chapter catalogs essentially all the upconversion lasers that had been demonstrated up to the early part of 2001. The authors provide insightful comparisons of the different materials and excitation schemes used in the implementation of these lasers in both bulk and fiber forms. However, the very limited attempt to explain quantitatively the operation of upconversion lasers within the theoretical framework developed in the preceding chapter underscores the tremendous complexity of such devices. Further background material for this portion of the book has also been made available online.

The final part of the book, on blue-green semiconductor lasers, departs in spirit from the first two in that the presentation is entirely descriptive and relatively brief. Such a treatment is somewhat puzzling given that, by all appearances, the diode lasers are poised to eventually outshine the other blue-green lasers in importance. Because of the success they have enjoyed, indium gallium nitride lasers are put center stage in this section, and discussions of the zinc selenide laser serve to elucidate some of the materials issues. As the book states repeatedly, the analysis is hampered by the proprietary nature of much of the critical data. Although the prognosis is not good for extending the wavelength range of III–V devices to the red of violet, the authors failed to point out that it is far easier to down-convert than to up-convert.

The references are current through about the summer of 2001. The completeness of the citations should make this book a valuable resource for those working in the field. The book can also serve as an up-to-date secondary text for a course on lasers or nonlinear optics. With its unusual mix of science and engineering, *Compact Blue-Green Lasers* should be welcomed by practitioners in both camps.

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Asymptotic Giant Branch Stars. H. J. Habing, H. Olofsson, eds. *Astronomy and Astrophysics Library*. Springer-Verlag, New York, 2004. $89.95 (559 pp.). ISBN 0-387-00880-2