A new favorite textbook on stochastic analysis

Applied Stochastic Analysis. , Weinan E, Tiejun Li, and Eric Vanden-Eijnden, American Mathematical Society 2019. $85.00

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Richard Sowers

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with his Jewish identity. Having turned away from his religious upbringing in his teens, Einstein thought of himself in his Swiss years as someone with no religious affiliation. But in Prague, he found himself in a rich and vibrant Jewish cultural space that included many prominent figures in the Zionist movement. One influential friend was Bergman, an early and ardent member of the Zionist student group the Bar-Kochba Association who later became the founder of the Hebrew National Library in Jerusalem and dean of the Hebrew University. Einstein never supported the establishment of a Jewish national state in Palestine, but within a few years of leaving Prague, he became a prominent supporter of cultural Zionism, as demonstrated by his 1921 trip to the US to raise money for the establishment of the Hebrew University.

Gordin tells the story of Einstein in Prague in much greater detail than any previous writer has done, and he does so with subtlety and nuance. But in order to situate and appreciate this moment in Einstein's life, Gordin does much more than narrate Einstein's story. Readers learn about Prague as the capital of the Holy Roman Empire when Tycho Brahe served as court astronomer to Emperor Rudolf II and Johannes Kepler served as Brahe's assistant. We follow the long and complicated history of Bohemia, the larger region around Prague, and its relations with its national and imperial neighbors. We learn about the religious and ethnic history of Prague and the surrounding region, as the balances shift among the Czech, German, and Jewish inhabitants. Gordin tracks the effects of those demographic developments on politics, which explains, among other things, why during Einstein's time in Prague there was both a German-speaking and a Czech-speaking university.

We learn about philosophy in Prague, from neo-Aristotelian philosopher of psychology Franz Brentano to physicist-philosopher Philipp Frank, a prominent representative of the group known as the Vienna Circle and an advocate for its logical empiricist philosophy of science. Einstein strongly recommended Frank as his successor in Prague, and Frank went on to become one of Einstein's most important biographers after they resumed their acquaintance as émigrés in the US in the 1930s. And we learn about the place the theory of relativity occupied in the charged intellectual and political space of Eastern Europe and the Soviet Union after World War II. By then Czech-Jewish communist and philosopher of science Arnošt Kolman had emerged as a prominent arbiter of the interpretation of relativity in the communist East.

Gordin's *Einstein in Bohemia* affords us a refreshingly different kind of perspective on Einstein in context. The book treats its location in space and time—Prague in 1911 and 1912—not merely as a backdrop, but as an integral part of the drama.

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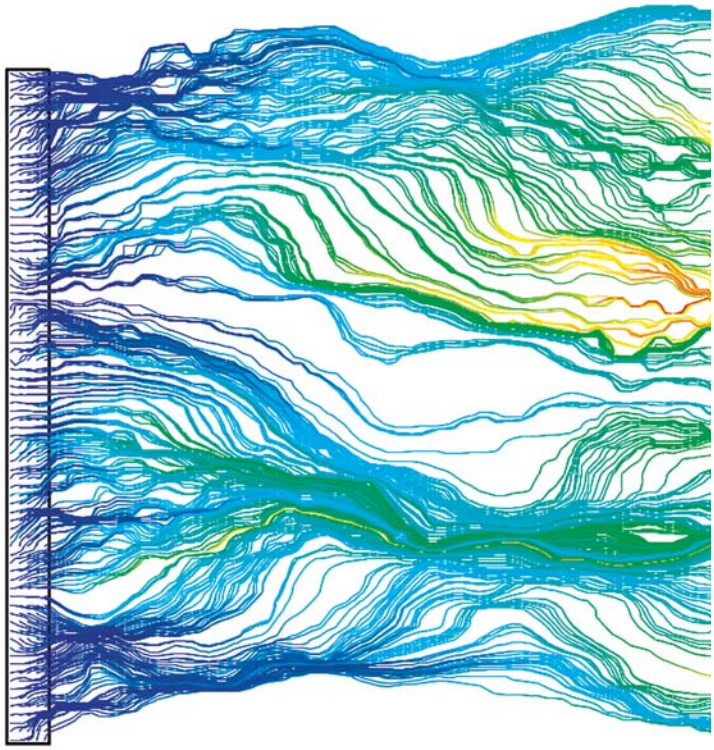

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A new favorite textbook on stochastic analysis

Applied Stochastic Analysis
Weinan E, Tiejun Li, and Eric Vanden-Eijnden
American Mathematical Society, 2019. $85.00

The textbook *Applied Stochastic Analysis* by Weinan E, Tiejun Li, and Eric Vanden-Eijnden is a well-thought-out treatment of a range of ideas central to stochastic analysis. The authors, noted experts in the field, use their expertise to show the reader the most important relevant mathematics research. *Applied Stochastic Analysis* might occupy a place on one's bookshelf somewhere near J. R. Norris's now-classic 1997 book *Markov Chains*.

Stochastic analysis has been remarkably successful at revealing the ways in which various random phenomena tend to organize. Energy analyses, limit theorems, Markovian invariant distributions, ergodic measures, and statistical mechanics all provide physicists with powerful tools for understanding the large-scale behavior of microscopically defined random models. *Applied Stochastic Analysis* covers those topics with clear, succinct, and complete proofs when possible and

points to standard references for more involved proofs.

The book is divided into two broad sections. The first, Fundamentals, covers topics such as random variables, limit theorems, Markov chains, Monte Carlo methods, stochastic processes, and stochastic differential equations. The second section, Advanced Topics, has chapters on path integrals, random fields, rare events, statistical mechanics, and chemical reaction kinetics.

Most of the applied material promised in the title is contained in the second half of the book, which is oriented toward physical and chemical systems. Theory and applications have had a long interplay in the study of such systems. The authors review some basic results in statistical physics and chemical kinetics to give the reader an understanding of how stochastic tools can lead to meaningful conclusions and descriptions. Almost all readers will find a novel calculation or approach in the material.

One revealing perspective of a given graduate-level text is the last chapter, in which the authors usually open the throttle on a subject of their interest. In *Applied Stochastic Analysis*, the last chapter is an introduction to chemical kinetics. E, Li, and Vanden-Eijnden introduce the major ways that the formalism of stochastic processes can be used to create macroscopic dynamical models of interacting chemicals. The authors cover macroscopic ordinary differential equation models and then develop Poisson-driven stochastic differential equations to model individual molecule counts before moving on to cover diffusion limits. They then bring the theory of stationary distributions to bear, followed by a multiscale analysis. The time spent understanding the entire presentation is well worth it. Stewart Ethier and Thomas Kurtz's definitive 1986 book *Markov Processes: Characterization and Convergence* develops a lot of machinery used in this chapter; *Applied Stochastic Analysis* shows why that machinery is important.

This book gives students of stochastics or mathematical physics a wonderfully solid starting point and is likely to be a favorite among physicists. By the end of it, readers should have a solid understanding of core tools in stochastic analysis.

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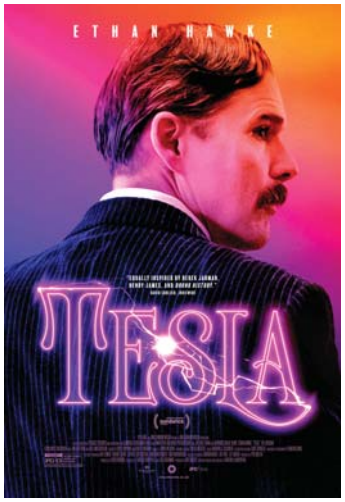
NEW BOOKS & MEDIA



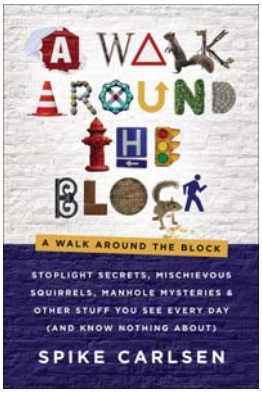
Tesla

Michael Almereyda (writer, director, and producer)
IFC Films, 2020

Starring Ethan Hawke as the titular character, *Tesla* centers on the conflict between inventors Nikola Tesla and Thomas Edison over which electricity supply system should prevail: AC or DC? Although nominally a biopic, director Michael Almereyda's version is decidedly quirky, with J. P. Morgan's daughter Anne (Eve Hewson) using a laptop to pull up Google search results on Tesla and Hawke as Tesla at one point singing the Tears for Fears song "Everybody Wants to Rule the World." Winner of the Alfred P. Sloan Feature Film Prize at the 2020 Sundance Film Festival, *Tesla* is an intriguing take on the enigmatic inventor. –CC

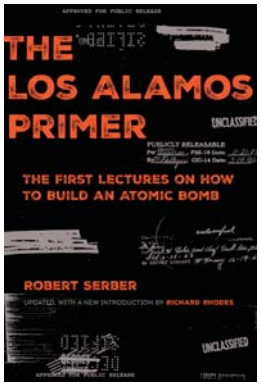
A Walk Around the Block

Stoplight Secrets, Mischievous Squirrels, Manhole Mysteries and Other Stuff You See Every Day (and Know Nothing About)



Spike Carlsen
HarperOne/HarperCollins, 2020. $24.99

Inspired by frozen pipes one winter to learn where the water in his home comes from, author Spike Carlsen embarked on a quest to learn about the world outside his front door. Carlsen, a former carpenter, has since descended into sewers, toured electricity-generating plants and recycling centers, visited a US Postal Service processing and distribution center, and performed numerous other investigations into such everyday things as bicycles and asphalt. A mix of history, technology, personal profiles, and even the etymology of terms, including "fire plug" and "Bluetooth," *A Walk Around the Block* is an entertaining and informative read aimed at a general audience. –CC



The Los Alamos Primer

The First Lectures on How to Build an Atomic Bomb

Robert Serber
U. California Press, 2020. $17.95 (paper)

In 1943, at the newly constructed Los Alamos Laboratory, physicist Robert Serber presented a series of lectures on the cutting-edge physics and engineering required to build a nuclear weapon. Fellow physicist Edward Condon took notes, which became known as *The Los Alamos Primer*. Classified until 1965, the information was first published in book form by the University of California Press in 1992, along with extensive annotations by Serber and an introduction by Pulitzer Prize–winning historian Richard Rhodes. Almost three decades later, this seminal work has been updated and reissued in paperback, with a new introduction by Rhodes. –CC