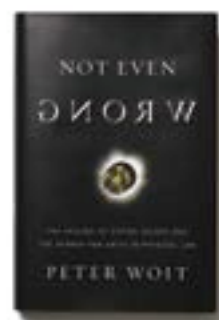


{REVIEWS}

GUIDE TO GLOBAL SCIENCE CULTURE

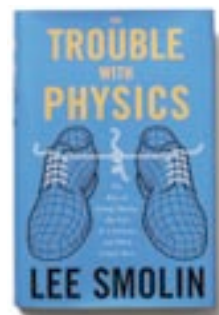
NO STRINGS ATTACHED

String Theory is the darling of theoretical physics but there's no way to test it—does this qualify as a dead end? By Charles Seife



Not Even Wrong

By Peter Woit (Basic Books)



The Trouble With Physics

By Lee Smolin (Houghton Mifflin)

Is string theory like masturbation? In the past, hostile physicists have likened the stringy “theory of everything” to onanism—a self-gratifying dead-end in the search for the Ultimate Answer. It’s now been half a century since Albert Einstein’s death and scientists still don’t have a single overarching theory that reconciles quantum theory and relativity, explaining the behavior of all the particles and forces in the universe. Physicists are stuck with two mutually contradictory sets of rules, while they believe that nature herself has only one law.

Of all the attempts to create a “theory of everything,” superstring theory is by far the most famous. Despite the theory’s complexity—it posits that the tiniest motes of matter and energy are infinitesimal strings that inhabit 10 or 11 dimensions—it has become a staple of pop-science culture. Popular books, newspaper and magazine articles, websites and TV specials have brought multidimensional mathematics to the masses. As a result, string theory is perceived as the pinnacle of modern physics theory—at least to the cocktail-party cognoscenti. Within the ranks of physics, it gets more complicated.

Now two books, Peter Woit’s *Not Even Wrong* and Lee Smolin’s *The Trouble With Physics*, attempt to knock string theory off its perch. Together they make some pretty damning claims: both argue that string theory might be fashionable, but that it’s a false idol—and that, for all its tantalizing promise, string theory isn’t really even science.

The basic complaints aren’t new; for more than a decade, physicists, journalists and other critics have argued that string theory has strayed too far from its experimental moorings. A particle accelerator powerful enough to probe the

theory directly, for example, would have to be much bigger than the solar system (barring almost unfathomable technological advances). This leaves open the nagging fear that string theory is untestable, and therefore unfalsifiable—which would mean it’s natural philosophy rather than science.

String theory has evolved since the first critics emerged, and, to some extent, so have the arguments against it. For example, within the past few years, some scientists have started attacking the “landscape problem”: the idea that there are an immense number of models, based on string theory, that can explain our universe—more models by far, than there are atoms in the universe. But the most powerful anti-string-theory arguments are fundamentally the same as they were a decade ago: that the theory fails to meet the definition of science. Woit and Smolin are the latest to take this tack, but their books go further to express a grim warning that theoretical physics has taken a very wrong turn.

Woit’s book is the more strident of the two. Even the title drips with scorn; “not even wrong” was the worst insult that quantum physicist Wolfgang Pauli could throw at a theory, deeming an idea so poor that it doesn’t even rise to the level of being wrong. Woit, a mathematical physicist at Columbia University, has devoted much of his recent career to attacking string theory (largely via his well-trafficked blog which, not so coincidentally, has the same name as his book), and many of his barbs hit home. For example, Woit spends a thought-provoking chapter attacking the large “landscape” of superstring theories. Because the landscape is so vast, no matter what you observe in nature, you’ll be able to find a theory that will fit the observations—which means that it’s impossible to prove the overall idea wrong. See something that contradicts your favorite string theory? Just move around on the landscape a little bit until you find one that suits you better. Woit argues that this prevents string theory from ever being truly testable; every time you find something that seems to disprove it, the theory can reshape itself to fit the available facts. Conversely, this means that string theory as a whole doesn’t give you any concrete predictions—and a scientific theory without predictions isn’t a scientific theory.

Smolin, a theoretician at the Perimeter Institute for Theoretical Physics in Waterloo, Canada, also takes issue with the landscape. But as a proponent of a rival theory known as loop quantum gravity, Smolin has a slightly different perspective. While string theory modifies the structure of subatomic particles—proposing that they’re stringy rather than pointlike—loop quantum gravity modifies the structure of space and time, positing that they are gnarled and

tangled rather than smooth like relativity implies. Smolin, who’s worked on string theory in the past, struggles to keep his book from seeming like a partisan attack from a rival. “I can only insist that I am writing this book not to attack string theory or those who believe in it, but out of admiration for them and, above all, as an expression of faith in the physics scientific community,” he writes. However, when he accuses string theorists of “groupthink,” it’s hard to imagine it’s done out of admiration.

When the two books are placed side by side, Smolin’s comes out ahead. Woit’s *Not Even Wrong* is uneven; the focus is a bit fuzzy, the prose is occasionally stilted and passive and the

could have been said of inflationary theory two decades ago, which virtually all physicists now accept without qualms. (Only very recently have cosmologists gained the ability to test which of the many versions of inflation is correct.) Yes, string theory is too malleable; it allows its proponents too much leeway to tweak their work to fit evidence, cleaving to positive results and ignoring negative ones. However, many scientists—Smolin included—will put on rose-colored glasses when their theories are constrained by contrary data. Though he only brings it up as a point of comparison, in one chapter Smolin describes an alternative gravity theory (MOND) without indicating that it has been badly under-

See something that contradicts your favorite string theory? Just move around on the landscape a little bit until you find one that suits you better.

level of detail is inconsistent—some technical terms like “synchrotron radiation” and “eigenstate” are left unexplained, making it likely that the lay reader will give up before the payoff in the later chapters. (However, the persistent will be rewarded by, among other things, a first-person account of Woit’s investigations of a scientific quasi-hoax: the curious case of the two French brothers whose publications left physicists wondering whether they were the victims of a joke.) Smolin’s *The Trouble With Physics* is much more polished. His prose is much smoother and the text is more coherent than Woit’s. He also possesses a talent for presenting physics from a novel and interesting perspective—such as an insightful chapter in which he presents all of the great discoveries in physics as “unifications” of one sort or another.

Nevertheless, both of these books suffer from the same flaw: a nagging double standard. Yes, string theory has a vast landscape of possible solutions and it doesn’t make any predictions that can be tested in the near future. The same

mined by telescope data. He then uses cosmic ray observations from an observatory (AGASA) that seem to have a systematic flaw in them; alludes to a measurement of light spectra from the Keck telescope without mentioning that there are several solid observations to the contrary; and hints at a breakdown of gravity on small scales, even though the group that did the experiment didn’t publish the results because it was unable to replicate them.

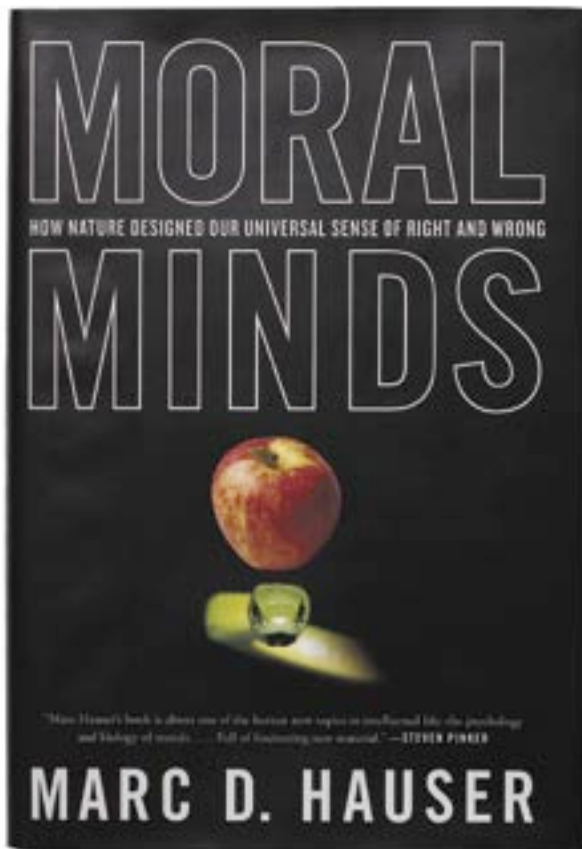
Scientific progress is always subject to human failings, and the line between science and philosophy, between universal truth and cloying falsehood, isn’t always clean. String theory might be completely wrong—it may be a passing fad that will be as embarrassing as the idea that a beam of light is really a disturbance of a substance called ether. But when someone comes up with a more compelling idea, physicists will shift allegiances very quickly. Until then, the debate will go on, and physicists will continue arguing about their subatomic motes and beams of light. ∞



06.6 CANCEL MY WAKE-UP CALL

A certain caterpillar has learned to come out at night—when its chief predators are not active—without relying on light cues. Ecological researchers in Japan have shown that *Mythimna separata* detects gases emitted by corn only at night, prompting the wiggly creatures to rise and shine. By exposing the insects to the night gas and the day gas—and removing and reversing the light cues—the researchers proved that the caterpillars awake on scent alone.

SEED PICKS

**Moral Minds**

By Marc D. Hauser (HarperCollins)

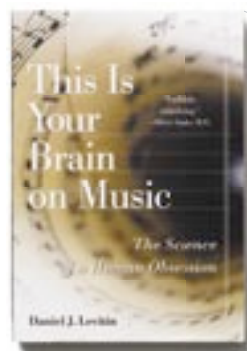
Philosophers have long debated the nature of morality, but Harvard professor Hauser contributes the fresh perspective of an evolutionary psychologist. Drawing insight from Chomsky, Rawls and his own research, Hauser proposes a revolutionary theory: Although cultures differ in certain ways, all humans share an inherited universal moral grammar.

IN-A-WORD

Simon Singh on *The Da Vinci Code*, Ron Howard's blockbuster adaptation of Dan Brown's best-seller:

“ERCOIDEM”

Singh is a writer and television producer specializing in science and mathematics; he is the author of *The Code Book*, a history of cryptography.

**This is Your Brain on Music**

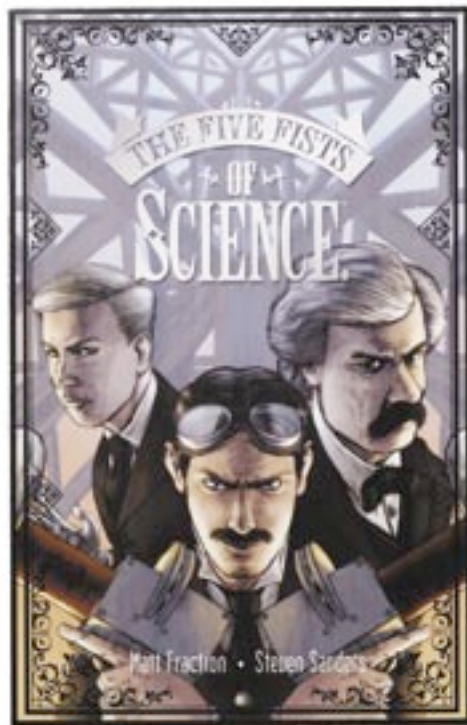
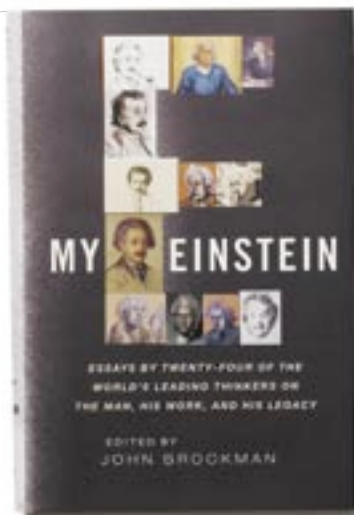
By Daniel J. Levitin (Dutton)

Once upon a time, Daniel Levitin was a record producer. Now he's a neuroscientist, studying music from the perspective of the brain. This book is an amalgam of his two careers. Using examples from the Billboard music charts, Levitin lucidly explains how a cacophony of soundwaves becomes an emotional experience or a best-selling pop-jingle. For those who like their Beatles deconstructed.

My Einstein

Edited by John Brockman (Pantheon Books)

Mr. Brockman is back with a collection of personal essays from distinguished physicists and science scribblers, this time on the *grand homme* of their trade, Albert Einstein. You won't learn much here about the man himself, but you will see how his legacy inspired this group—which includes a former high school dropout and a plumber—to take up his prolonged quest for a final theory.

**The Five Fists of Science**

By Matt Fraction and Steven Sanders (Image Comics)

This graphic novel is a satirical look at the titans of late-Victorian science and society, through a glass darkly. Mark Twain and Nikola Tesla construct a giant robot to promote world peace, but they run into trouble when the sinister occult cabal of Andrew Carnegie, J.P. Morgan, Thomas Edison and Guglielmo Marconi gets wind of the plan. Hilarity, of course, ensues.

**Life**

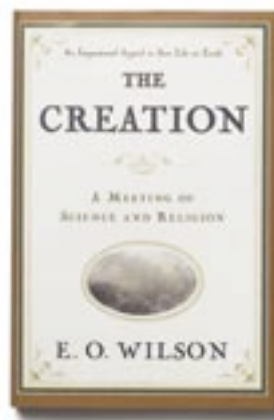
By Frans Lanting, Edited by Christine Eckstrom (Taschen)

With dazzling imagery that ranges from the exotic stromatolites of Shark Bay to the common snails in his own backyard, veteran wildlife photographer Frans Lanting guides readers through the nooks and crannies of every ecological niche imaginable. *Life's* lofty ambition is to trace the evolution of Earth's biosphere through photography, and the result is a visual feast.

Bedrock

Edited by Lauret E. Savoy, Eldridge M. Moores and Judith E. Moores (Trinity University Press)

Normally, if you wanted E.M. Forster's account of the formation of the Ganges, Mark Twain's version of the anthropic principle, Langston Hughes on the paths of rivers and James Joyce on geologic time—you'd be sifting through a lot of books. But here, in this beautifully edited anthology of "writers on the wonders of geology," poets and authors expound in kumbaya unison on the science of the Earth.

**The Creation**

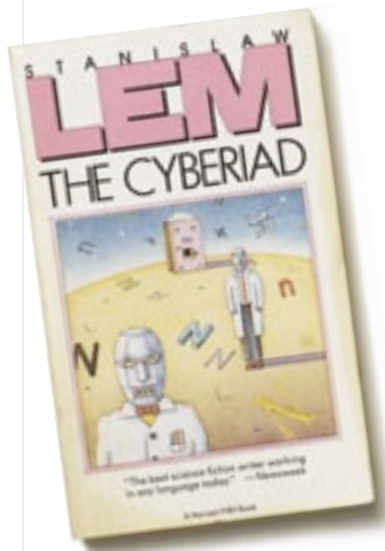
By E.O. Wilson (WW Norton)

In his 20th book, eminent biologist Edward Wilson uses both science and scripture to make a passionate, direct plea to Christian leaders to fulfill their obligation to protect the natural world. Eloquent and enlightening, *The Creation* establishes without ambiguity that we have but one option remaining: for science and religion to cooperate.

RETRIEVAL

THE CYBERIAD

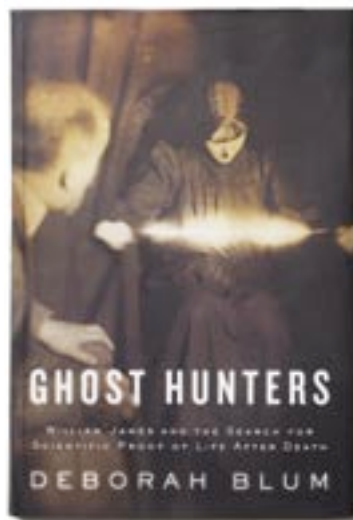
By Stanislaw Lem
Translated by Michael Kandel
Original publication date: 1967



Many recall the name of the late Polish writer Stanislaw Lem from big screen versions of *Solaris*, whether Tarkovsky's exquisitely rendered masterpiece or Soderbergh's overlooked follow-up. But great novelists like Lem deserve foremost to be read, and the ebullience and wit of his prose have no finer exemplar than *The Cyberiad*.

The Cyberiad relates the picaresque adventures of two genius "constructors," Trurl and Klapaucius, whose escapades traverse an imagined universe at once medieval and futuristic. Together they devise elaborate solutions to whatever problems they encounter, creating fanciful, scientific machines that save the day as often as ruin it. The result is masterful slapstick where Lewis Carroll-like wordplay meets Borgesian profundity to outrageously comic effect.

Lem began his career as a scientist and doctor, publishing poetry before settling into science fiction. This trajectory made him unique among his peers, as the verse "Love and Tensor Algebra" in *The Cyberiad* illustrates. Lem's allegories sparkle with mathematics, consciousness and physics, completely reimagining the genre science fiction he ridiculed. So profound were his insights that his stories appear in a compendium on the mind by Douglas Hofstadter and Daniel Dennett, and frequently show up on cognitive science syllabi. Few satirists, in any genre, can be said to be as relevant to the big scientific questions as Lem has been. It is truly unfortunate, with his death in March, that he is no longer around to receive the Nobel Prize that he deserves. —Joshua Roebke

**Ghost Hunters**

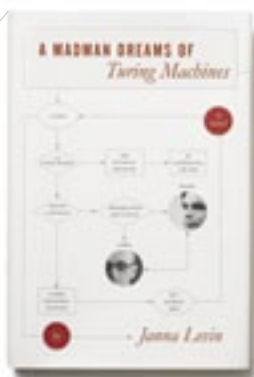
By Deborah Blum (Penguin Press)

In the naturalistic post-Darwinian climate of the late 19th century, a group of prominent scholars—including William James, John Ruskin and Alfred, Lord Tennyson—attempted to stretch the boundaries of science by investigating the supernatural. Blum takes us inside this rarified circle, conveying their excitement and perseverance, while also offering a compelling contemplation of the nature of science.

A Madman Dreams of Turing Machines

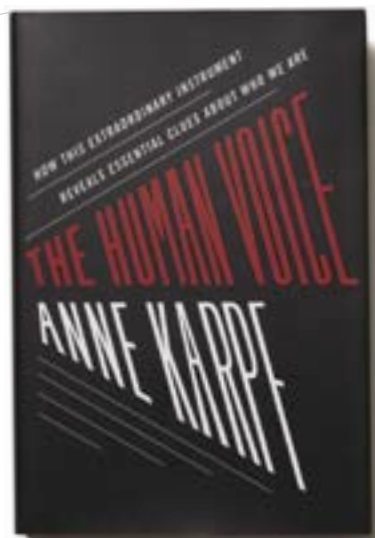
By Jenna Levin (Knopf)

Like a lyrical mash-up, Levin interweaves the personal narrative style of her first book with taut prose evocative of Alan Lightman's *Einstein's Dreams*, creating a deft, if somewhat discordant, novel on the price of mathematical genius. Levin skillfully twists nonfictional accounts of Turing and Gödel's lives and demises into a tale of brainy introspection on the nature of love, knowledge and madness.

**The Human Voice**

By Anne Karpf (Bloomsbury)

As society progressed from an oral to a literary (and electronic) tradition, people lost respect for the human voice. But sociologist Karpf argues that science is just beginning to understand its power—and that the voice is an exquisitely designed informational tool. Through the voice, she says, we can project and detect demeanor, occupation, social status and even illness. (Now read this again out loud.)

**Hollow Earth**

By David Standish (Da Capo Press)

What do Edgar Allen Poe, Edmond Halley and Pat Boone all have in common? At some point in their lives, each has been involved with the idea that our planet is hollow. A monumental work of screwball scholarship, *Hollow Earth* is a highly entertaining romp through the history of a theory that went from scientifically legitimate to the far reaches of fringe theory to, ultimately, too good to be true.

MUSEUM

THE LOS ALAMOS HISTORICAL MUSEUM

Los Alamos, NM

The Los Alamos Historical Museum, tucked in an old stone cottage among ponderosa pines, looks every bit the old guest house it once was. And were it not for an accident of history, there would be little reason for its notability.

Operated by the Los Alamos Historical Society, the small museum pays quick homage to the region's sublime geology and early human history—the volcanic eruption that created the mesa and the native pueblos that followed—before getting to the heart of the matter: the birth of the atomic bomb.

A WWII sentry shack ("PASSES MUST BE PRESENTED TO GUARDS") leads to a collection juxtaposing the mundanities of wartime life with

the epochal work done by the resident scientists. A slide rule is displayed next to welder's glasses issued for the first atom bomb test and a memo stating "Mr. Oppenheimer would like a nail in his office to hang his hat on." Oppenheimer and other Manhattan Project veterans will be overlooking the premises themselves this fall, when photographer A.J. Melnick exhibits his portraits of the infamous collective.

At the back of the museum a mockup of a tiny apartment recreates the simple living space of the city's wartime residents. Grim panoramic photos of post-bomb Hiroshima and a melted porcelain pocket watch serve as reminders of the eventual outcome of all that transpired here. —John Fleck



PHOTO: LOS ALAMOS HISTORICAL SOCIETY AND MUSEUM

MARK WEISS