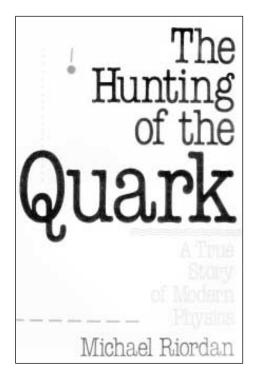
## Particle Physics for Regular People

By Mike Perricone, Office of Public Affairs

Psychologist Oliver Sacks has Robin Williams portraying him on screen. Cosmologist Carl Sagan's fictional heroine explores the universe in the glamorous guise of Jodie Foster. Biologist Stephen Jay Gould muses about the Red Sox in the PBS megadocumentary "Baseball."

Where are all the particle physicists? They're on a high-energy bookshelf near you.

The authors of the best plain-language literature in particle physics might not yet have reached stardom, but their books offer a literate, accessible and engaging introduction to a field of science that has been known to intimidate the uninitiated. The stories of the discoveries of the particles at the heart of matter offer all the thrills of a good chase—one of the biggest chases of 20th-century science. From the wide field available, readers can start with a half dozen of the "best of the best" books for gaining an understanding of the reason for all the excitement.



Take your cue from Leon Lederman, 1988 Nobel laureate and former director of Fermilab. And take a clue to his approach from his witty title—"THE GOD PARTICLE: If the Universe Is the Answer, What Is the Question?"

Prompted by an imaginary dialogue with the classical Greek mathematician-philosopher Democritus, whom he calls "the first particle physicist," Lederman leads us on a trail that begins with the smell of baking bread in ancient Greece and culminates in the quest for the Higgs boson, the "God particle" of the title—so-named, Lederman says, because it is "so central to the state of physics today, so crucial to our final understanding of the structure of matter, yet so elusive."

It's easy enough to focus on Lederman's humor and zero in on his groaning board of puns. Example: When the Greek philosopher uses a knife to halve a piece of cheese innumerable times, the result is a "feta-compli." Groan.

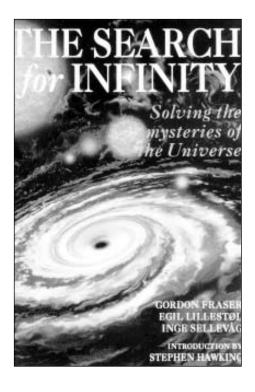
But the prime significance of "The God Particle," and the power of its appeal as an introductory work, lies in the clarity of Lederman's explanations, the sense of his comparisons, the tangible and unbreakable thread of the story through time and his own experience.

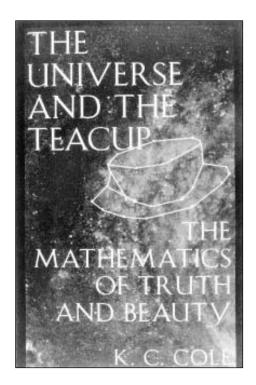
Another veteran of the chase is Michael Riordan, who is also one of its best chroniclers in "THE HUNTING OF THE QUARK: A True Story of Modern Physics."

If you're a mystery fan, this is the "police procedural" of the particle physics era—the background, the evidence, the investigators, the relentless and systematic pursuit, the false trails and surprises, the accidental discoveries, and the sense of groping that seems to be absent in many treatments of science. Riordan covers the 20-year search for the quark, from the first intimations in the 1960s to the series of discoveries in the

1970s that made the quark "real." Riordan's goal is to show "how our mental image of the subatomic world was transformed between 1964 and 1980."

You must form a mental image before you can transform it, and you'll find spectacular introductory images in "THE SEARCH FOR INFINITY: Solving the Mysteries of the Universe," by the European team of Gordon Fraser, Egil Lillestol and Inge Sellevag. Illustrated as impressively as any coffeetable book, "The Search for Infinity" begins by "Looking In" (The Exploration of Matter), and concludes by "Looking Out" (Understanding the Universe). The excellent overviews of particle physics and astrophysics are enlivened with vignettes of the scientists associated with them. Wolfgang Pauli, who first predicted the existence of the neutrino, supposedly once offered encouragement to a colleague who was distraught after finding an error in his own work. "Everybody makes mistakes," Pauli said sympathetically. "Except me."





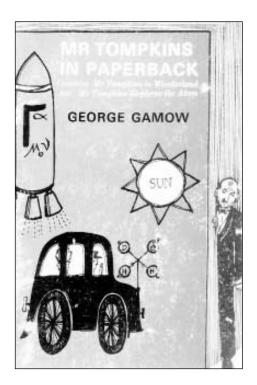
Not as colorful as "The Search for Infinity," but at least as valuable, is "THE PARTICLE EXPLOSION," by Frank Close, Michael Marten and Christine Sutton. Focusing exclusively on the subatomic realm, "The Particle Explosion" is a primer on atomic structure and each of the known particles. It also includes a powerful secret weapon: an exhaustive Table of Particles, charting each particle's physical properties, its history of discovery (and discoverers) and its role in matter, all keyed to the appropriate sections of the text. The Table is the kind of reference you'll want to keep in an honored (and secure) place and hand down to the next generation, especially if there's an exam coming up.

There's no physics without funding, and ultimately there's no physics without mathematics. Award-winning science writer K.C. Cole has a new gem, "THE UNIVERSE AND THE TEACUP: The Mathematics of Truth and Beauty," with the title offering a subtle resonance with the top ("truth") and bottom ("beauty") quarks.

In counterpoint to the nearunanimous "maleness" of physics and its literature, Ms. Cole has a refreshing chapter on Einstein, relativity, and the little-known but critical contributions of Emmy Noether. A brilliant mathematician, Noether was refused a university position in Göttingen, Germany, because she was a woman—though she had recommendations from eminent mathematician David Hilbert and from Einstein himself. But it was Noether who later gave credibility to relativity by proving mathematically that energy was conserved in four-dimensional space-time. So in a real sense, relativity, particle physics and Fermilab all owe their ongoing well-being to the work of Emmy Noether.

They also owe a debt to George Gamow, one of the originators of the big bang theory of the birth of the universe.

Gamow was one of the first popularizers of relativistic physics and quantum theory. He wrote two whimsical little books in the 1940s about a traveler, bank clerk C.G.H. Tompkins (c, for the speed of light; G, the gravitational constant; h, the quantum constant), in a realm of highly exaggerated relativity. "MR. TOMPKINS IN WONDERLAND" and "MR. TOMPKINS EXPLORES THE ATOM" were later combined in a single slim volume, "MR. TOMPKINS IN PAPERBACK," that was still being used as a supplementary college text in the 1960s and 1970s—and it's still going strong. Some of the language is amusingly antiquated, and Gamow would certainly be surprised at today's take on his chapter entitled "The Gay Tribe of Electrons." But "Quantum Billiards" has a collision between two billiard balls resulting in "innumerable balls, all of them very vague and gruelly...rushing about within an angle



of 180 degrees round the point of impact." And "Cosmic Opera" matches expansion vs. steady-state theories in contesting arias. Dated, yes; but musty old Mr. Tompkins is worth any allowances.

Lederman, Riordan, Gamow and company flavor their science with myth, mirth, poetry and history. They offer a high quality of armchair companionship when you unwind from the hunt at the end of day and consider the words of Democritus, that first particle physicist, who said 2,400 years ago: "Nothing exists except atoms and empty space; everything else is opinion."



## For Further Reading...

Like atoms and space, physics books are everywhere. Whether you buy or borrow, your book is likely to be checked out by a device that scans a bar code with a laser beam—a direct outgrowth of physics research. A list of the best (and many of the rest) is on page 8.

## For Further Reading...

in 20th Control Physics  Robert K. Adain  Robert K. Adain  Robert K. Adain  The great white particle Loss of equations. Good field, no hit.  Robert K. Adain  Robert K. Adain  Robert K. Adain  The great white particle Loss of equations. Good field, no hit.  Robert K. Adain  Robert M. Robert M. Robert Selection  Robert Delivery process of early pricises. Similarly in science.  Robert M. Robert M. Robert Selection  Robert Delivery process of early pricises. Similarly in science.  Robert M. Robert M. Robert M. Robert Selection  Robert M. Robert M. Robert Selection  Robert M. Robert M. Robert M. Robert Selection  Robert M. Rober	The Physicists: The History of a Scientific Community in Modern America	Daniel J. Kevles	Vivid saga of atomic weapons scientists and their postwar role. New preface details politics behind death of SSC.
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Great Men or Physics: The Humanistic Element  Emilio Segre, Joseph Kaplan, Loanard Shiff, Edward Teler  Newton and Einstein: and Neibs Born. Slim book, quick reading.  The New Physics for New-Schools  In Search of Strondings's Cat Quantum Exercise  The New Physics of New-Schools  In Search of Strondings's Cat Quantum Physics and Reality  John Gribbin  John McPhe  Jo	Blind Watchers of the Sky	Rocky Kolb	, , , , , , , , , , , , , , , , , , , ,
In Scientific Work  Learner of Schriding Novice and Einstein and Neils Both. Simit book, quick reading. Taking the Quentum leap: The New Physics for Mon-Scientists  In Search of Schridinger's Cat!  John Gribbin  Same Same Same Same Same Same Same Same	Men Who Made a New Physics	Barbara Lovett Cline	Basic bio sketches of early particle physicists. Slim. Light on science.
The New Physics for Non-Scientists  In Search of Schrödingers Cat: Quantum Physics and Reality Quality moves beyond.  John Gribbin  Solid beginning to the second tier of reading. Starts with basics but quickly moves beyond.  Loss of diagrams, lots of math laid out plain and simple. Another solid primer for the second ser, provided or Particle Physics  Sill a classic by the British astrophysicist.  Solid Bagg. Quantum Physics and Cosmology  John Gribbin  Stephen W. Hawkling  A "must" for the second tier, when you're ready.  A brief History of Time  Stephen W. Hawkling  A "must" for the second tier, when you're ready.  A step beyond, into abstraction and philosophy. Nobel winner Gell-Mann named the quant.  Adventures in the Simple and the Complex  Adventures in the Simple and the Complex  Achilles in the Quantum Universe  Richard Morris  Bichard Morris  Delightful musing on Infinity as a driving force in physics and mathematics. Great examples.  The First Three Minutes  A Modern New of the Origin of the Universe  Steven Weinberg  Tief Cassas: popular work on the origin of the Universe  And Tierus Theory  Steven Weinberg  Literate consideration of the whys and hoves of a single through of everything  Jeremy Bernstein  Essays by a noted physicist, from The New Yorker, The Atlantic, Schmilder, American, etc.  The Physics of Star Trek  Lawrence M. Krauss  What the saries got right and wrong.  The Curve of Binding Energy  John McPhee  Noted journalist collaborates with bomb designer Ted Taylor to explore danges of noticer weapons profiteration.  "Surely You're Joking, Mr. Feynman1"  Bichard P. Feynman  Bechard P. Feynman  Farcial physicist crambing, accessible explanation of methods used to explore the infinite and the infinitesimal.  James Clasic  Chrismic American Utrary  How Loderman and David N. Schramm  Certificate Implication of Physical principles  Scientific American Utrary  Philip and Phylic Morrison, and the Office of Charles and Ray Eames  In the University of Chicago physical tringes the particle search up			
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