



CORBIS VIA GETTY

Enrico Fermi in his laboratory in 1931.

PHYSICS

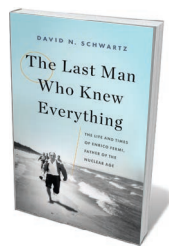
A doubly dextrous physicist

Catherine Westfall lauds a candid life of Enrico Fermi, pioneer of nuclear fission.

Nobel laureate Enrico Fermi contributed to the discovery of nuclear fission and was part of the Manhattan Project, which built the first atomic bombs. Unlike his contemporaries, Fermi was proficient in both theory and experiment, knowing everything there was then to know about physics. It is therefore surprising that political scientist David Schwartz's new biography is one of just a handful.

Until a few years ago, Fermi featured in only two full-length accounts. In 1954, the year he died, his wife Laura Fermi published *Atoms in the Family*, a charming, sometimes cheeky account of their marriage and family life. In 1970, *Enrico Fermi, Physicist* by former student Emilio Segré nicely added explanations and details of Fermi's physics. Segré's nephew Gino and co-author Bettina Hoerlin provided a more complete life and work in their lyrical *The Pope of Physics* (Henry Holt, 2016), reviewed in these pages (G. Farmelo *Nature* **538**, 168–169; 2016).

Now, Schwartz's *The Last Man Who Knew Everything* offers the most comprehensive



The Last Man Who Knew Everything: The Life and Times of Enrico Fermi, Father of the Nuclear Age
DAVID N. SCHWARTZ
Basic: 2017.

description of Fermi's work so far, as well as fresh insights into his personality. (Interestingly, Schwartz's father, physics Nobel laureate Melvin Schwartz, met Fermi in 1953 and passed up the chance of working with him.) Fermi's tribulations and successes were framed in tumult. He emigrated from Italy to the United States in 1938 to ensure that his Jewish wife escaped the anti-Semitic laws of Benito Mussolini's fascist government. By then, he had already conducted ground-breaking theoretical research in Italy that illuminated the weak interaction and beta decay. The famous 'Rome School' of physics he founded gathered many up-and-coming young researchers (including Bruno

Pontecorvo and Emilio Segré) and put Italy on the physics map.

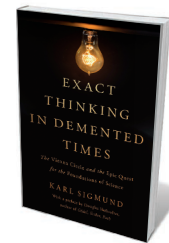
With this group, Fermi performed radioactivity-inducing experiments with the newfangled neutron, which James Chadwick had discovered in 1932. These experiments revealed (among other results) that the particles are captured more readily when they are slow. The resulting expertise — and his genius for practical, intuitive problem-solving and painstaking experimental execution — enabled Fermi to make key advances. He demonstrated the first self-sustaining nuclear chain reaction, and built the world's first nuclear reactor at Stagg Field, at the University of Chicago in Illinois. It was this proof of concept that spurred the US military, with support from Britain and Canada, to develop the atomic bomb during the Second World War.

In particular, *The Last Man Who Knew Everything* reveals much more about the context of Fermi's contributions. Schwartz deftly positions Fermi's early research on beta decay within the overall development

HISTORY OF SCIENCE

Warring with chaos

Jordi Cat on a history of the Vienna Circle, which wielded science to counter the turmoil of the 1930s.



Exact Thinking in Demented Times: The Vienna Circle and the Epic Quest for the Foundations of Science
KARL SIGMUND
Basic: 2017.

standards through book series, the philosophical journal *Erkenntnis*, conferences and lectures. The model they conceived was, first, based on formal concepts and rules — linguistic, logical or mathematical — similar to mathematician David Hilbert's attempt to unify and formalize his field through axioms. But any such models had to be backed up by empirical evidence and be given empirical meaning. For instance, theories about human emotion had to be reducible to precise, objective, observable descriptions of behaviour or physiological states, countering ideas then prevalent in biology and psychology, such as vital forces or the ego.

Along with Hilbert, luminaries who influenced the Vienna Circle included physicists Albert Einstein and Ludwig Boltzmann, scientist-philosophers Ernst Mach and Henri Poincaré, and philosopher of mathematics Bertrand Russell. The circle argued that Einstein's ideas on space-time, for instance, sounded the death knell for philosopher Immanuel Kant's concept of space and time as forms of intuition. The charismatic, reclusive logician Ludwig Wittgenstein was both a revered and a polarizing influence. The group mulled over his ideas, such as the limits of expressible thoughts, and viewed his 1922 *Tractatus Logico-Philosophicus* as a ▶

of quantum mechanics. He also sets Fermi's work as an adviser and ad hoc problem solver at Los Alamos against the full drama of the Manhattan Project. In those intense and hectic days, Fermi's door was always open to provide on-the-fly solutions to any technical problem experienced by an engineer or a physicist designing the weapons. At the same time, Fermi and Laura heartily joined in the social life of Bath tub Row, the street where J. Robert Oppenheimer and other project members lived. (Schwartz notes, however, that Fermi watched the square dancing with some puzzlement, while Laura joined in.)

The book is rich in political, historical and technical detail. But its prose style is awkward. And I was irked by Schwartz's tendency to dwell on an issue, puzzling through various philosophical considerations and conflicting interpretations. In my view, for instance, there is no need to ponder whether Fermi should be called the father of the nuclear age. His work with the first reactor clearly qualifies as a seminal event in the development of nuclear power, even if Fermi was not, as Schwartz notes, an architect of the first bombs.

Eventually, however, I learnt to appreciate the wrangling with Fermi's personae and legacy. Like other biographers, Schwartz shows Fermi's sweet side: his loyalty to friends and family, humour and quiet dignity. This is a man who accepted his own abrupt diagnosis of terminal cancer in 1954 without fuss, noting that the timing of his death would probably boost sales of his wife's book. But we also meet the Fermi who could be cold and lost in his work, to the detriment of relationships, particularly with his family — as Graham Farmelo noted in his review of *The Pope of Physics*. This is the man who did little to help his wife adjust to the United States after their immigration, and later alienated his son Giulio.

In short, Schwartz's blunt style cuts through the gauze of hero worship. And ironically, that unflinching gaze accentuates Fermi's stature. *The Last Man Who Knew Everything* yields an intimate and engaging portrait of an extraordinary physicist who was also very human. ■

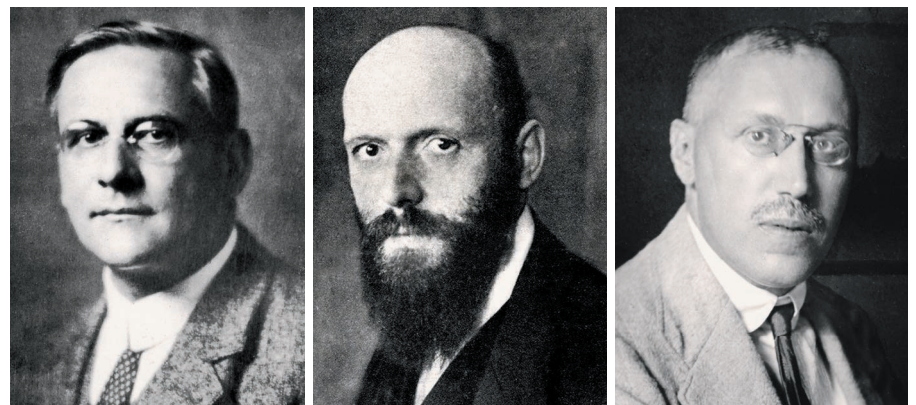
Catherine Westfall is a visiting professor in the history of science at Lyman Briggs College, Michigan State University in East Lansing. She has co-authored two books — *Critical Assembly: A Technical History of Los Alamos During the Oppenheimer Years, 1943–1945* and *Fermilab: Physics, the Frontier, and Megascience*.
e-mail: westfa12@msu.edu

Karl Sigmund is alarmed. In *Exact Thinking in Demented Times*, the Viennese mathematician and pioneer of evolutionary game theory identifies sustained threats to rationality today, from religious fundamentalism to a “debilitating flood of trash culture” and public ennui. Sigmund worries that many scientists ignore these risks to their world view and work.

Sigmund compares our times with Austria between the world wars. Here, between 1918 and 1938, economic and sociopolitical turmoil paved the way for Adolf Hitler's invasion and the Second World War. Against that grim backdrop, a number of philosophically inclined scientists and scientifically trained philosophers formed the Vienna Circle. This intellectual powerhouse developed the scientific world view known as logical empiricism — an assertion of the pre-eminence of scientific knowledge and a rejection of metaphysics. After the war, a less ambitious version of this philosophy came to dominate approaches to science.

The public group, loosely based at the University of Vienna, was a starry one. It included mathematicians Hans Hahn, Karl Menger and their student Kurt Gödel; physicist Philipp Frank; political economist and sociologist Otto Neurath; physics-trained philosophers Edgar Zilsel, Gustav Bergmann, Moritz Schlick and Rudolf Carnap; and philosopher Friedrich Waismann. (Philosopher Rose Rand, as the group's recorder, deserves special mention.)

Sigmund reveals how circle members sought to counter their era's dogmatic ideologies and propaganda, even in science, by articulating and communicating scientific



Vienna Circle members (left to right) Moritz Schlick, Otto Neurath and Hans Hahn.