

BETTMAN/GETTY

Enrico Fermi at the controls of the synchrocyclotron particle accelerator at the University of Chicago, Illinois, in the 1950s.

## PHYSICS

# Fallible pontiff of physics

Graham Farmelo assesses a biography of star theorist-experimentalist Enrico Fermi.

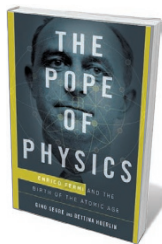
The megalomaniac physicist Edward Teller “was always certain that he was smarter than all his colleagues on the Manhattan Project, except one”, a younger colleague of his (Robert Sachs) told me in 1993. That exception was Enrico Fermi, “the nearest we physicists had to a Pope”.

Fermi’s infallibility is one of the prominent themes of *The Pope of Physics*, the first popular cradle-to-grave biography in English of the most famous Italian scientific investigator since Galileo Galilei. The authors are married: Bettina Hoerlin, formerly a health executive, and Gino Segrè, a nephew of one of Fermi’s most distinguished colleagues, Emilio Segrè. They each met their subject independently, and plainly found his career an inspiration.

Fermi’s many contributions to nuclear science and technology — such as the creation of the first nuclear reactor — have been recounted ad nauseam, so he might not seem the most promising candidate for a biography. Segrè and Hoerlin, however, seek a new perspective. They quickly hit their stride with

a lucid account of how Fermi was born in 1901 to a middle-class family in Rome and became one of the very few physicists to be in the front rank in both theory and experiment. The authors engagingly describe how Fermi taught himself basic mathematics and physics to a high standard by the time he was 17. Blessed with a prodigious ability to identify the essence of every physics problem, he matured as a researcher in the 1920s, at just the right time to make his mark on two open frontiers: nuclear science and quantum theory.

Fermi was often quicker than more formal thinkers to apply abstract ideas to improve the understanding of nature. In 1926 he became



**The Pope of Physics: Enrico Fermi and the Birth of the Atomic Age**  
GINO SEGRÈ AND BETTINA HOERLIN  
Henry Holt: 2016.

the first to use quantum theory to study large aggregations of electrons, one of a class of subatomic particles later called fermions, and he later set out the first quantum field theory of radioactive  $\beta$  decay. Yet his forte was experimental physics, as he demonstrated at the Sapienza University of Rome, which appointed him a professor at the age of 24. He made the Italian capital one of the world’s most productive centres of modern physics.

Fermi and his talented colleagues found that slow neutrons are remarkably effective at inducing radioactivity in some heavy chemical elements. That won him the physics Nobel in 1938. However, when Fermi and his group studied the products of some of the nuclear reactions that they induced, their interpretations were sometimes wrong, as he later acknowledged. To be fair, the great radiochemist Otto Hahn and his group in Berlin made the same mistake at about the same time, before they recognized that uranium nuclei undergo the process later called fission.

The authors describe movingly how the rise of Fascism in Italy led the Fermi family to emigrate to the United States. Fermi arrived in New York City on 2 January 1939, and soon took up a post at Columbia University. Although some US officials were wary of putting foreigners in leading positions in secret projects, Fermi was indisputably the best person to lead the development and construction of the first nuclear reactor, CP-1, which began operation on 2 December 1942: a crucial stage in the development of nuclear weapons. Robert Oppenheimer invited him to join the Manhattan Project and created a unit named after him. ‘F division’ dealt with especially tough problems in experimental and theoretical nuclear physics.

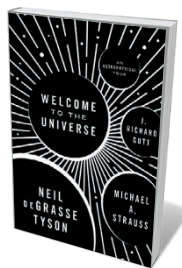
The biography sometimes has a hagiographic whiff. Segrè and Hoerlin agree with the consensus that he was largely apolitical and was “a scientist pure and simple”, as his Hungarian colleague Leo Szilard once described him. I suspect that the truth is deeper, although it will probably remain hidden. The authors tiptoe around some of his less endearing characteristics, such as his ability as a father. Fermi’s daughter told me in 1992 that he was “always a distant figure”, and that 40 years earlier her father had approached her out of the blue one day, suggesting that they get know each other better by doing a few experiments around the house on the then-new material Silly Putty. He did not repeat this initiative, which did little to improve their relationship.

In my view, Segrè and Hoerlin underplay Fermi’s considerable influence on young physicists after the Second World War. It would have been revealing to read, for example, more from the great theoreticians Murray Gell-Mann and Chen-Ning Yang, who worked closely with him. Likewise, it would have been rewarding to have heard more about Fermi’s ideas on the origin of cosmic rays and his thinking about the future of subatomic-particle accelerators. In January 1954, he gave a far-sighted lecture in which he envisaged the possibility of building an ultrahigh particle accelerator that girdled the entire planet by 1994.

Ten months later, he was dead. Lying in his hospital bed the day after he had learnt that he had terminal stomach cancer, he told the astrophysicist Subrahmanyan Chandrasekhar: “For a man past 50, nothing essentially new can happen.” Had he lived two decades longer, that would not have been true. Physicists were soon to make discoveries that fundamentally altered their understanding of nature — another reminder that Fermi’s foresight was, like that of all putative scientific popes, fallible. ■

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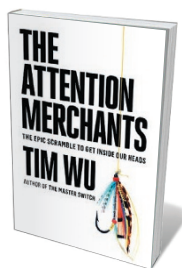
## Books in brief



### Welcome to the Universe: An Astrophysical Tour

Neil deGrasse Tyson, Michael A. Strauss and J. Richard Gott  
PRINCETON UNIVERSITY PRESS (2016)

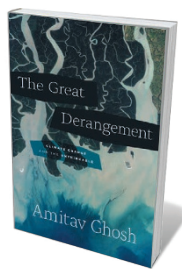
As citizens of the cosmos, we are duty bound to explore it. So opine astrophysicists Neil deGrasse Tyson, Michael Strauss and Richard Gott, guides on this bracing expedition through dusty galactic hinterlands and the vast theoretical vistas of Albert Einstein’s work. Each is a master at untangling the abstruse through metaphor: Tyson crams 100 million elephants into a thimble to illustrate neutron-star density, and Gott recounts John Archibald Wheeler demonstrating entropy by mixing tea and water and throwing it into a ‘black hole’.



### The Attention Merchants: The Epic Scramble to Get Inside Our Heads

Tim Wu KNOFF (2016)

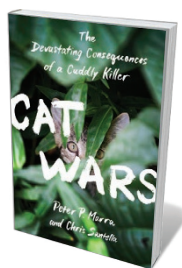
Media scholar Tim Wu plunges into the noisome history of “attention harvesting” — the commodification of human attention by industry and government. It began, Wu reveals, with the juxtaposition of advertisements and lurid news in 1830s gutter journalism, and persisted in the engineered demands of “scientific advertising”, the efforts of propagandist Edward Bernays (who persuaded women to smoke) and the infiltration of fast-food ads into US schools. To evade this induced narcosis and reclaim lived experience, Wu argues, we must wean ourselves off the digital.



### The Great Derangement: Climate Change and the Unthinkable

Amitav Ghosh UNIVERSITY OF CHICAGO PRESS (2016)

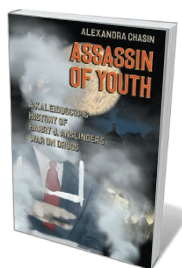
Resistance to the grim realities of climate change is so widespread that the crisis barely figures in literary fiction, notes writer Amitav Ghosh. Branding our era of denial and inertia the Great Derangement, Ghosh looks in turn at literature, history and politics to examine this failure, noting that extreme events such as 2012’s Hurricane Sandy are so freakish that they seem inexpressible. The solution, he argues, lies in collective action as well as scientific and governmental involvement — and in a resurgence in our imaginative capacity to envision human existence anew.



### Cat Wars: The Devastating Consequences of a Cuddly Killer

Peter P. Marra and Chris Santella PRINCETON UNIVERSITY PRESS (2016)

Among the hundreds of millions of domestic cats, many range freely. That group is effectively a death squad for songbirds, killing an estimated 4 billion US avifauna a year; globally, island cats drive 14% of vertebrate extinctions. This deeply researched overview by conservation scientist Peter Marra and writer Chris Santella interlaces discussions of feline domestication and avian conservation with the science of decline and of feline spillover diseases. It culminates with a stark choice: control free-ranging cats or witness the ongoing erosion of affected ecosystems.



### Assassin of Youth: A Kaleidoscopic History of Harry J. Anslinger's War on Drugs

Alexandra Chasin UNIVERSITY OF CHICAGO PRESS (2016)

Harry Anslinger helmed the US Federal Bureau of Narcotics from 1930 to 1962, shaping US drug policy through what Alexandra Chasin calls “an elaborately disastrous set of policies and laws”. In this idiosyncratic chronicle, Chasin paces the trail from temperance to today, when nearly half the inmates of US jails are incarcerated for drug offences. A sorry tale of how one man’s racial prejudice and predilection for prohibition led to a colossal policy failure. **Barbara Kiser**