

BOOKS

'If the result confirms the hypothesis, then you've made a measurement. If the result is contrary to the hypothesis, then you've made a discovery.' —Enrico Fermi

A Supreme Experimentalist

The Pope of Physics
By Gino Segrè and Bettina Hoerlin
Henry Holt, 351 pages, \$30

BY ANDREW CRUMEY

IN MARCH 1939, at the Navy Department in Washington, Adm. S.C. Hooper was informed of a visitor. "There's a wop outside," the desk officer announced. The man in question, who overheard the slur, was Enrico Fermi. He had just won the Nobel Prize and had come to warn of the danger posed by his own recent discoveries in nuclear physics. Fortunately for his newly adopted homeland, he had a thick skin. America, not Italy, would build the bomb.

Really it was Nazi Germany that Fermi (1901-54) feared more than the country that he and his Jewish wife, Laura, had fled only a few weeks earlier. Fermi, almost single-handedly, had dragged Italian physics research into the modern age of quantum theory and relativity, and his emigration left Mussolini without the one scientist who might have given him a nuclear weapon. But if things had gone a little differently, might Fermi have done for Il Duce what Werner Heisenberg attempted for the Führer? After reading Gino Segrè and Bettina Hoerlin's superb biography, "The Pope of Physics," I am left with the nagging thought: maybe.

The book's co-authors, husband and wife, actually met Fermi, though they were too young to receive any lasting impression. Mr. Segrè's uncle, Emilio Segrè, was Fermi's student in Rome, choosing exile not long before Il Papa, as Fermi was half-jokingly nicknamed on account of his apparent infallibility. Bettina Hoerlin's father was also an émigré physicist and, like the elder Segrè, worked for the U.S.'s nuclear-weapons program. Given the authors' personal connections, their scientific expertise (Mr. Segrè is a physicist at the University of Pennsylvania), and the wealth of research they have undertaken, it is clear that they have produced a definitive study of Fermi's life and work. It is also apparent that, even for the people who knew him best, Fermi was enigmatic. Urbane, genial, a team player with a generous spirit, he nevertheless kept his emotions hidden. "Not cold, but not warm either" was how one colleague described him. According to his daughter, Nella, "It wasn't that he lacked emotions, but that he lacked the ability to express them."

Fermi's childhood offers some clues. For the first 2½ years of his life he was in the paid care of a "farm family" so that his parents, a civil servant and a teacher, could cope with their careers and two other children. When finally brought back to Rome, he cried with alarm, only to be chastised by his



CHARGED UP Fermi in 1951 at the controls of his particle accelerator in Chicago.

mother, who told him: "In this home naughty boys are not tolerated." The repressed atmosphere worsened when Fermi was 13, with the sudden death of his older brother. While the parents withdrew into anguish, Fermi increasingly absorbed himself in mathematics, his talent for which was noticed by a family friend who took the boy under his wing. Recognized as a prodigy, Fermi rose through Italy's most prestigious educational establishments, publishing his first paper in 1921 while still an undergraduate. In the following year, Mussolini became prime minister, and much of Fermi's finest scientific work was to be carried out under the auspices of the fascist regime.

Fermi's first major discovery came in 1926: a paper on quantum statistics that put him in the vanguard of theoretical physics. Three years later, when Mussolini created an exclusive academy of artists and scientists to promote the nation's intellectual achievements, Fermi was offered membership. It came with a substantial lifetime stipend and an expectation that the recipient would join the Fascist Party. Fermi accepted. Both in Italy and later in America he would present himself as apolitical, interested only in physics. Whether this claim was pragmatism, cynicism, naiveté or a further manifestation of emotional withdrawal is impossible to determine.

Arguably his greatest achievement

as a theorist was to predict the existence of a new fundamental force, now known as the weak interaction, in 1933. But Fermi was also a supreme experimentalist. He developed a way

Fermi found what seemed to be a new element in 1934. The Italian press clamored to call it Mussolinium.

of producing free neutrons—particles normally trapped within atomic nuclei—and firing them into other nuclei, in the hope that they would lodge there. In this way he and his co-workers soon announced the creation of a new element, number 93 in the periodic table. The Italian press immediately suggested calling it Mussolinium, but Fermi's team proposed Ausonium, from the Greek name for Italy. In fact, as later became clear, there was no new element in their samples. Instead of enlarging atoms, the team had split them; the neutron bullets had provoked fission. Fermi realized that if a disintegrating atom were to eject further free neutrons, the process might continue in a chain reaction. Fermi's apolitical stance was shaken

in July 1938 when Mussolini began a campaign of persecution against Jews. Fermi's Jewish father-in-law, an admiral in the Italian navy, remained tragically loyal to his country and would eventually die in a German concentration camp. Fermi, however, quickly began planning a research trip to America from which he and Laura would not return. His effort to secure a long-term visa was made easier by the Nobel Prize, collected en route.

A few weeks later he was at the U.S. Navy Department, having been asked by physicist Eugene Wigner to alert the government to the possibility of creating a nuclear weapon. Fermi proved unpersuasive; so Szilard penned a letter that was signed by Einstein and delivered to President Roosevelt, initiating what became the Manhattan Project. Fermi's key role was to use his neutron skills to create the world's first nuclear reactor. Mr. Segrè and Ms. Hoerlin's account of this famous episode is their book's high point, admirably conveying both the technical detail and the extraordinary tension of the operation.

Fermi knew that if he could assemble enough uranium in the right shape, then the naturally released neutrons would be sufficient to initiate a chain reaction, producing heat. Removable absorbers could control the rate of reaction, yielding anything from mild warmth to a potential inferno. Over 15 days in late 1942, Fermi and his team assembled a reactor in a University of Chicago squash court out of almost a million pounds of graphite bricks loaded with uranium. "Fermi's steady hand did not waver throughout the construction process . . ." the authors write. "His precision, down to forecasting exactly when the last brick had to be placed, was a source of wonder." Fermi's genius as an experimentalist enabled him to recognize impurities in the components as a significant obstacle. In Germany, Heisenberg's team would fail to reach that insight, leading them down a blind alley in their effort to build a bomb.

Fermi acted as a roving consultant on the Manhattan Project, revealing nothing to Laura even after witnessing the test detonation, where he estimated the explosive yield by calmly dropping scraps of paper and seeing how far they blew in the gust. A decade later, dying from stomach cancer, he calculated the quantities of nutrients being fed through his drip, made predictions of how many more days he might have left, and showed no trace of fear or regret. The bomb, and life itself, were for Fermi interesting problems of science, not matters for moral reflection. One can't help feeling that had he met another, Aryan woman, and not had to leave Italy, history might have been very different.

Mr. Crumey's most recent novel is "The Secret Knowledge."

MYSTERIES: TOM NOLAN

A Thriller Of Manners



MATTHEW, a 30-year-old first-rate chef (and one-time drug dealer) is feeling "a curious lassitude" when

meet him at the start of James L. Dun's elegant and disturbing novel. He's intensely aware of "a feeling of being adrift, and of not quite having the willpower to do anything about it." Worldly accomplishments, relationships, money: "it was beginning to feel rather remote . . . [H]e was close, in fact, living off pure fumes of just about everything. It wasn't something he experienced as a great hardship, but he was aware that the moment was approaching when even those fumes would run out."

One enduring constant in Matthew's life has been his friendships with his well-off cousin, Charlie, an ex-banker turned "socially responsible" investor, and Charlie's wife, Chloe, a former graphics artist who "had once been one of Condé Nast's go-to photographers for fruits and berries."

Grateful for Charlie's largesse—the form of house-guest invitations and occasional cash "loans"—Matthew nonetheless feels intellectually superior to his successful cousin. "You could see," Matthew thinks, "he was destined to become one of those kingly, leonine old men who appear in ads for golfing resorts and upscale retirement communities." Meantime, his vision of Chloe verges on adoration; she was "idealized composite in whose daughter, sister, cousin, mother, mistress, friend and mystical other half were all miraculously commingled." He seemed to enter a "transcendent like state" in her presence, in which he felt "simultaneously hyper-alert . . . and dazed to a point of happy unconsciousness."

That changes, though, during the trio's stay at Charlie and Chloe's mountaintop retreat in upstate New York in the summer of 2012. Matthew discovers Chloe is having

An investor, a chef and a photographer set off for a mountaintop retreat. What could go wrong?

affair with a fellow vacationer. Conflicting feelings of jealousy and protectiveness cause him to stalk and surveil Chloe—and then her lover.

"It seemed to him he had been presented with some difficult problem to which he alone could provide the solution." Should he keep his guilty knowledge to himself and maintain a shaky status quo? Should he tell Charlie and destroy their summer and no doubt their friendship? Matthew feels aggressive rage towards the interloper who's lured Chloe into adultery and turned secret-sharer Matthew into "a kind of surrogate cuckold." Perhaps Matthew should hint to Chloe that he knows what she's up to. Maybe that will prompt her to scare her—into stopping.

What Matthew settles on

The Language of the Universe

Calculating the Cosmos
By Ian Stewart
Basic, 346 pages, \$27.99

BY MARIO LIVIO

THE PHYSICIST Eugene Wigner famously wrote in 1960: "The miracle of the appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift which we neither un-

writes, "to realize that what makes terrestrial objects fall is the same thing that holds celestial objects up." Mr. Stewart beautifully describes how Newton's laws can still produce surprising results. Only a few years ago, for instance, it was shown that three bodies could "chase" each other endlessly in an unexpected figure-8 orbit. He then goes on to use those same laws to explain a variety of phenomena, ranging from the formation of the solar system to its properties and constituents (including planets.

Mr. Stewart's approach is his emphasis on the fact that all scientific theories are provisional. They are accepted only as long as there are no observational facts that contradict them or no competing, simpler theories that explain all the known facts equally well. Under the best circumstances, as new, discrepant observations emerge, the old theories can be incorporated into a broader perspective. In other cases, theories may be

considered to constitute about a quarter of the cosmic energy budget but seems "remarkably shy whenever anyone actually looks for it."

My only slight reservation concerning his otherwise healthy skepticism is that sometimes the non-expert reader is not given enough information to be able to judge to what extent the unconventional theories have a solid basis. After all, there are usually fairly strong reasons why a certain theory becomes the governing "mainstream."