

BOOKSHELF

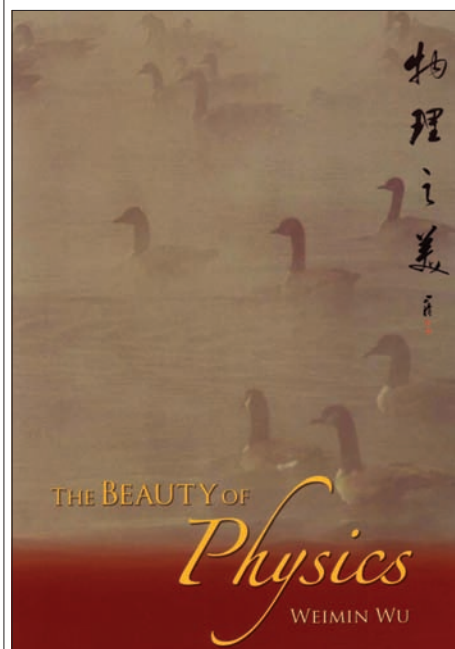
The Beauty of Physics by Weimin Wu, World Scientific Publishing. Hardback ISBN 9812705600 £29 (\$54).

Weimin Wu has led an extraordinary life. Arriving at Fudan University in 1960 at age 17, he was inducted into a special "Section Zero" – by day he studied nuclear physics, in the evenings he helped with research into uranium-enrichment techniques for China's atomic bomb.

In 1965 he moved to Lanzhou University as a graduate student, but a year later the Great Proletarian Cultural Revolution burst over China and graduate students were a major target. Wu was packed off to an arid mountain region, where he worked as a shepherd, lived in a cave and survived on potatoes, wild plants, rainwater and melted snow. When he was allowed back to Lanzhou, he found that his supervisor had been accused of reactionary scholarship and landlordism, and assigned to clean toilets. Wu himself was soon sent to be a labourer. A commissar rescued him in 1969 and employed his skills to help develop the launch control system of China's first artificial satellite.

After the end of the Cultural Revolution in 1976, the Chinese government discovered that intellectuals were "part of the working class". But as Wu writes, "the era that destroyed the talents of many also had cast a dark shadow over them for a lifetime".

In 1978 Wu joined the group tasked with building China's first particle accelerator



Winter Bookshelf

During the year *CERN Courier* receives many books, most of which cover the usual specializations in particle physics. Among them, nevertheless, are books that deal with a broader range of topics or that are intended for a wider audience. In this festive season, "Bookshelf" reviews some of these for more relaxed, broader reading, whether at home or on journeys to visit family and friends.

and in 1980 he came to CERN for two years, joining Jack Steinberger's CDHS neutrino group. Back in Beijing he led the Chinese group involved in ALEP's muon detectors, and in June 1989 he observed the first J/Ψ particle to be seen at BES, the Beijing spectrometer. Three weeks earlier he had participated in pro-democracy demonstrations and witnessed the army's repression in Tiananmen Square. Shortly afterwards he left China and found sanctuary at Fermilab, where he now works on the CMS experiment.

Of the two achievements closest to his heart, one occurred on 25 August 1986 when, despite technical and political obstacles, he sent the first e-mail from China (to Jack Steinberger at CERN). The other achievement was this book of photographs.

Wu has been taking photographs since he was 12. His takes his subjects mostly from nature and from the places and people in his life. Many of his photographs are romantic images of flowers, sunsets, rainbows and landscapes. Several are more mysterious, such as a green swimming pool, lit from within, in a city at night. "To me," Wu writes, "physics and photography are like a pair of twin sisters." Both require elegance, conciseness and the good luck that "is granted only to those who are prepared".

The book includes 12 pages of episodes from Wu's life, 12 pages by him about his photography, and more than 100 pages of his photographs divided into "Flowers", "Landscape", "People" and "The Beauty of Physics" – a selection of photos that remind him of physical concepts, with titles such as *Latticework* and *Multidimensional Space*, including the cover, which shows *Birds of a Feather Flock Together*.

Michael Marten, Science Photo Library.

Das Schicksal des Universums: Eine Reise vom Anfang zum Ende by Günther Hasinger, CH Beck. Hardback ISBN 9783406562037 €22.90.

In *Das Schicksal des Universums*, Günther Hasinger, managing director of the Max Planck Institute for Extraterrestrial Physics in Garching near Munich, presents a comprehensive compilation of today's knowledge on cosmology, meeting well the needs of the interested lay reader. Although there are no formulae in the book, the author explains up-to-date knowledge in astrophysics, with many colour illustrations.



After mentioning Galileo's observations from the beginning of the 17th century, the story begins to take off when Einstein published his theory of general relativity in 1915, as there was no solution to his equations for a universe that is static and limited in space. What follows is a century of discoveries in theoretical and experimental particle physics, quantum mechanics, astrophysics and astronomy. Hasinger explains all of the relevant results obtained in these fields, keeping the balance between what is already confirmed and accepted by the scientific community and what still needs confirmation or is only at the level of hypothesis. He also describes experimental facilities, so that the reader understands how great is the scientific endeavour in this field.

the 1920s). Here David Gross notes that although Einstein recognized the implicit global symmetry (which regulates the laws of motion) in Maxwell's equations and elevated it to space-time itself, he did not follow the route towards local (gauge) symmetry. If he had, says Gross, he might very well have discovered non-Abelian gauge theory or supersymmetry. Michael Atiyah takes up Einstein's geometrized approach towards a unified theory. Geometry has long played a significant role in explaining the fundamental forces of nature – from Newton's three-dimensional *Principia*, to Einstein's profound extension to four-dimensional space-time for general relativity, to recent 10-dimensional space-time string theory.

Ashoke Sen beautifully extends Einstein's realization that space-time is curved and not flat into string theory, which attempts to provide an all-encompassing description of nature both at large (gravitationally dominated) and small (quantum mechanical) distances. String theory postulates that the elementary constituents of matter are not point-like particles, but rather one-dimensional objects (strings). To experimentalists these strings may appear as particles, given the distance that the most energetic accelerators can probe. However, the different oscillation modes of a fundamental string could represent different elementary particles including the graviton – the mediator of gravitational force.

The chapter by Atish Dabholkar further elaborates on how string theory could contribute to explaining the black hole – a solution to Einstein's gravitational-field equations in the absence of matter that describes the space-time around a gravitationally collapsed star. Abhay Ashtekar then moves towards quantum gravity, by extending the one-dimensional string to the higher-dimensional objects known as "branes".

One of the interesting topics in the book was also the subject of Einstein's doctoral dissertation on molecular dimensions. Through Einstein's statistical approach to the motion of suspended particles, Brownian motion had a broad impact not only on the natural sciences, but also on "man made" subjects such as economics and computer science, as Satya Majumdar describes. N Kumar then outlines the dramatic relationship between Bose's route towards

quantum statistics in an attempt to derive Planck's law of black-body radiation and Einstein's generalization of the approach, leading to the famous Bose-Einstein condensation. This phase transition below a critical temperature, which arises from inter-particle interactions that are not normally expected, was finally observed in 1995.

Einstein's legacy for relativistic cosmology is very nicely described by Jayant Narlikar, one of the leading experts and defenders of steady-state cosmology. He reviews the historical account of how cosmology has developed since Einstein's famous 1917 paper. The current observational status that cosmologists face with its serious puzzles linking fundamental physics and cosmology is clearly visible in this and the subsequent chapter on dark energy by Subir Sarkar.

Towards the end, T Jayaraman sheds light on Einstein's personal life, which spanned some of the most tumultuous years of a turbulent century. From the question of world peace to the crisis of the individual's relation to society under capitalism, many of the political and social issues that he sought to address continue to be important today.

Overall the book focuses on various aspects of Einstein's work and thoughts with a general sense that string theory is the answer to his dream of unification. I certainly enjoyed the elegant approach of explaining abstract concepts and their future implications through the words of some of the renowned experts in the field.

Sanjay Padhi, University of Wisconsin-Madison.

Plutonium – A History of the World's Most Dangerous Element by Jeremy Bernstein, Joseph Henry Press. Hardback ISBN 0309102960 \$27.95.

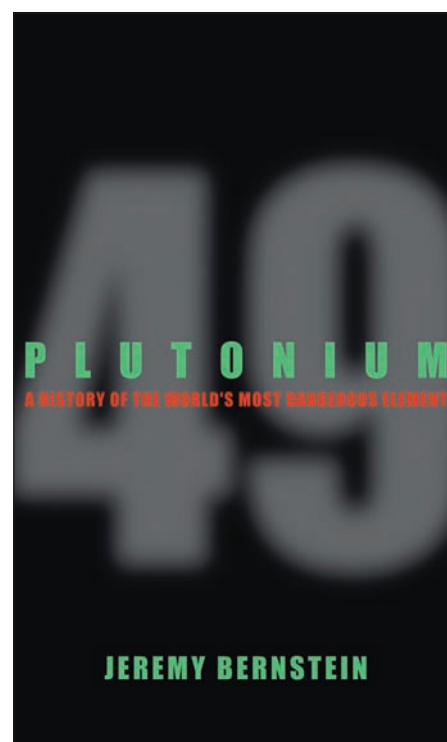
Plutonium is dangerous for two reasons: ingesting milligram quantities can make you very ill indeed; and larger quantities, when appropriately primed, make nasty fission bombs. The problem with plutonium, Jeremy Bernstein points out, is that the world has now accumulated about 2000 tonnes of the stuff, and is still making it at the rate of about 70 tonnes each year. What to do with so much noxious evil?

Bernstein's book spans about 170 pages, of which the first 75 or so are a primer in nuclear physics, setting the scene for plutonium's appearance. After such

a long wait, the saga could have been fleshed out more, for example with the heroic microscopic chemistry used by Glenn Seaborg's team at Berkeley, using Lilliputian equipment made of tiny quartz fibres and capillary straws. (It is described in Richard Rhodes' classic *The Making of the Atomic Bomb*.) Bernstein says that Seaborg "performed an experiment on half a microgram" to show that plutonium was more fissile than uranium.

The motivation for his book, Bernstein explains, was Rainer Karlsch's 2005 book *Hitlers Bombe*, which claimed that German scientists achieved nuclear explosions on German soil. Bernstein sets out to refute this. Nevertheless the knowledge that German scientists had discovered fission spurred the wartime US to outbuild the world, taking engineering to a new level for the huge production plants needed to furnish fissile material. The Hanford reactors, built from scratch by Du Pont in about 18 months, eventually housed some 50 000 workers. Bernstein refers to "some rowdy behaviour"; read Rhodes to learn that workers were not allowed to carry guns, that bodies were found regularly in rubbish bins, and that saloons were built with hinged windows so that tear-gas canisters could be lobbed in.

As momentum increased, wartime



plutonium production moved from the milligram level of the initial Berkeley experiments using cyclotrons, to samples of about a gram at pioneer reactors, before the gigantic Hanford plant began to supply the quantities that were needed to make fission bombs. Rhodes describes how world history was governed by the rate at which fissile material could be produced and manufactured into bombs.

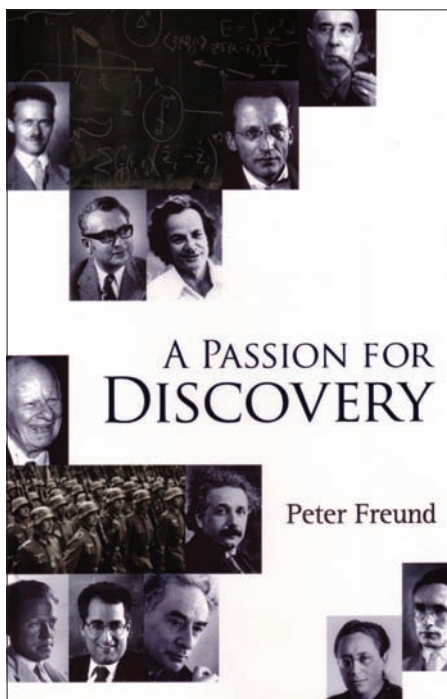
At the central Los Alamos laboratory there were accidents in which workers using primitive apparatus breathed in, swallowed or wounded themselves with plutonium – and lived. Bernstein goes into a lot of detail on the 1974 Silkwood case, in which a plutonium worker who had been accidentally contaminated was killed in a car accident. He could have made more of the earlier episodes, which are also documented.

In 1945, unsure of the exact danger of the new element, Los Alamos wanted to know more, but initially there was not enough plutonium to spare for medical physics experiments. After first using animals, Los Alamos commissioned trials in which 18 “volunteers” were given transuranic doses. Survival times ranged from six days to 44 years. The study was hushed up and only revealed half a century later by Eileen Welsome’s Pulitzer Prize exposé in the *Albuquerque Tribune*. Bernstein prefers the underlying science of the diabolic element, a subject on which he is well qualified to write. *Gordon Fraser, Divonne-les-Bains.*

A Passion for Discovery by Peter Freund, World Scientific. Hardback ISBN 9789812706461 £19 (\$35). Paperback ISBN 9789812772145 £14 (\$25).

In the preface to his book, author and theoretical physicist Peter Freund expresses his desire to “put a human face on the grand story” of the pursuit of physics, and to give readers an idea of the beautiful goal of the physicist’s work, while avoiding technical means. A grand goal, especially as Freund hopes to do this for non-physicists, but one that he falls short of achieving.

The book is essentially a series of anecdotes about physicists and mathematicians, often collected around grand themes in history and science. In the 28 short chapters, one encounters lesser known stories about well known scientists – Einstein, Feynman, Dirac, Oppenheimer – along with



vignettes about those who are more obscure, but who are sometimes more interesting.

Freund is at his best when he focuses on one, perhaps two, scientists in each chapter, such as those devoted to Ernst Stueckelberg de Breidenbach, Wolfgang Pauli and Subrahmanyan Chandrasekhar. Much of the book, however, reveals his tendency to jump from one person and idea to another in a way that can make for difficult and disjointed reading. The chapters devoted to grand scientific themes, with few of the anecdotes that keep the book lively, can be especially tough going. Freund also introduces people and scientific and mathematical concepts – sometimes complex – without explanation or reference, so presenting large roadblocks for potential non-scientist readers.

Throughout his long career, Freund has obviously met many influential scientists and collected many fascinating stories about them and their colleagues. I can easily believe that, as he states in the preface, his students are riveted when he recounts them in person. But in trying to collect them all in one place and bind them together in a series of grand themes, many of the individual stories lose much of their impact.

If you’re already familiar with the history of physics and its greatest players, and you’re searching for some lesser known stories

about them, this book is for you. But be prepared to hunt for the gems.

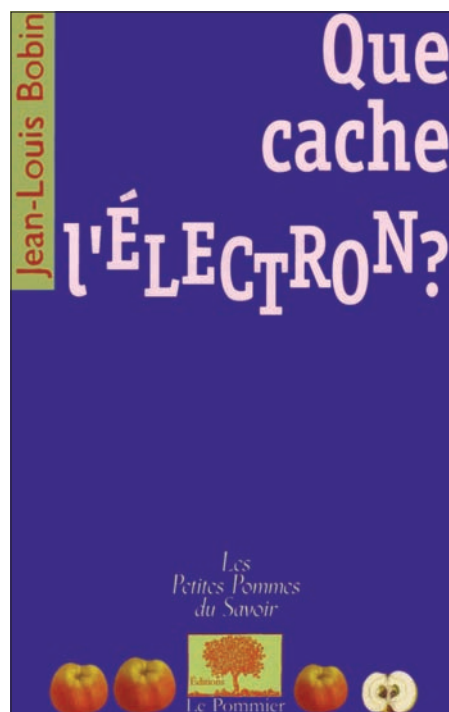
Katie Yurkewicz, CERN.

Que cache l’électron? de Jean-Louis Bobin, Le Pommier. Broché ISBN 9782746503038 €4.50.

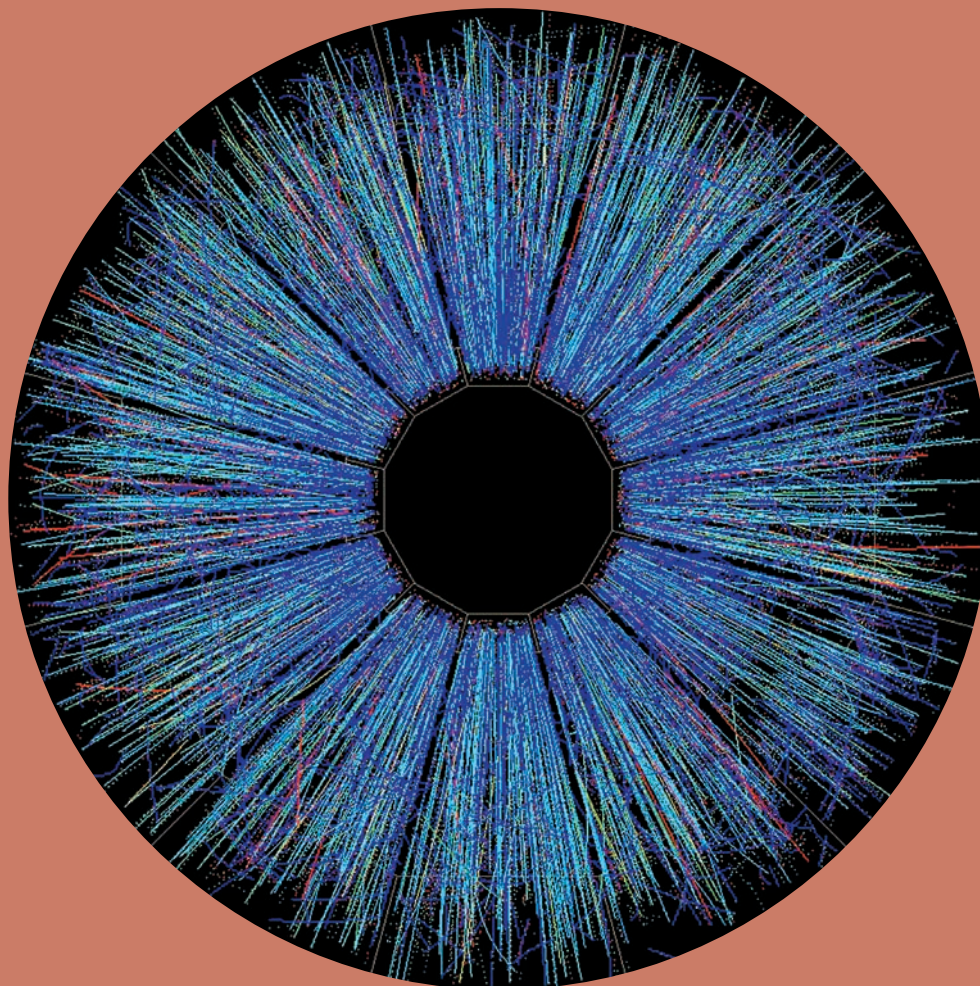
Soixante petites pages et une très grande police pour parcourir toute l’histoire de l’électron, la particule à la base des phénomènes électromagnétiques ainsi que de tous les liens chimiques qui font la matière et les matériaux. Le défi était effectivement énorme. Jean-Louis Bobin a réussi à condenser plus de 100 ans de physique (d’abord atomique, puis corpusculaire et enfin quantique) en très peu d’espace. Le prix à payer est l’effet «survol». Rien n’est vraiment expliqué, tout est simplement mentionné.

La collection *Le Petites Pommes du Savoir*, dont ce livre fait partie, s’adresse à un public non averti mais malheureusement je crois qu’un tel public ne pourrait rien retenir du livre sauf, peut-être, l’idée que rien n’est «fondamental», même pas l’électron. L’idée de parcourir l’histoire de la physique en suivant les recherches menées sur l’électron et ses propriétés, est très appréciable mais elle aurait mérité beaucoup plus de place.

Antonella del Rosso Vite, CERN.



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Image: End view of a collision of two 30-billion electron-volt gold beams in the STAR detector at the Relativistic Heavy Ion Collider at Brookhaven National Laboratory. Courtesy of Brookhaven National Laboratory

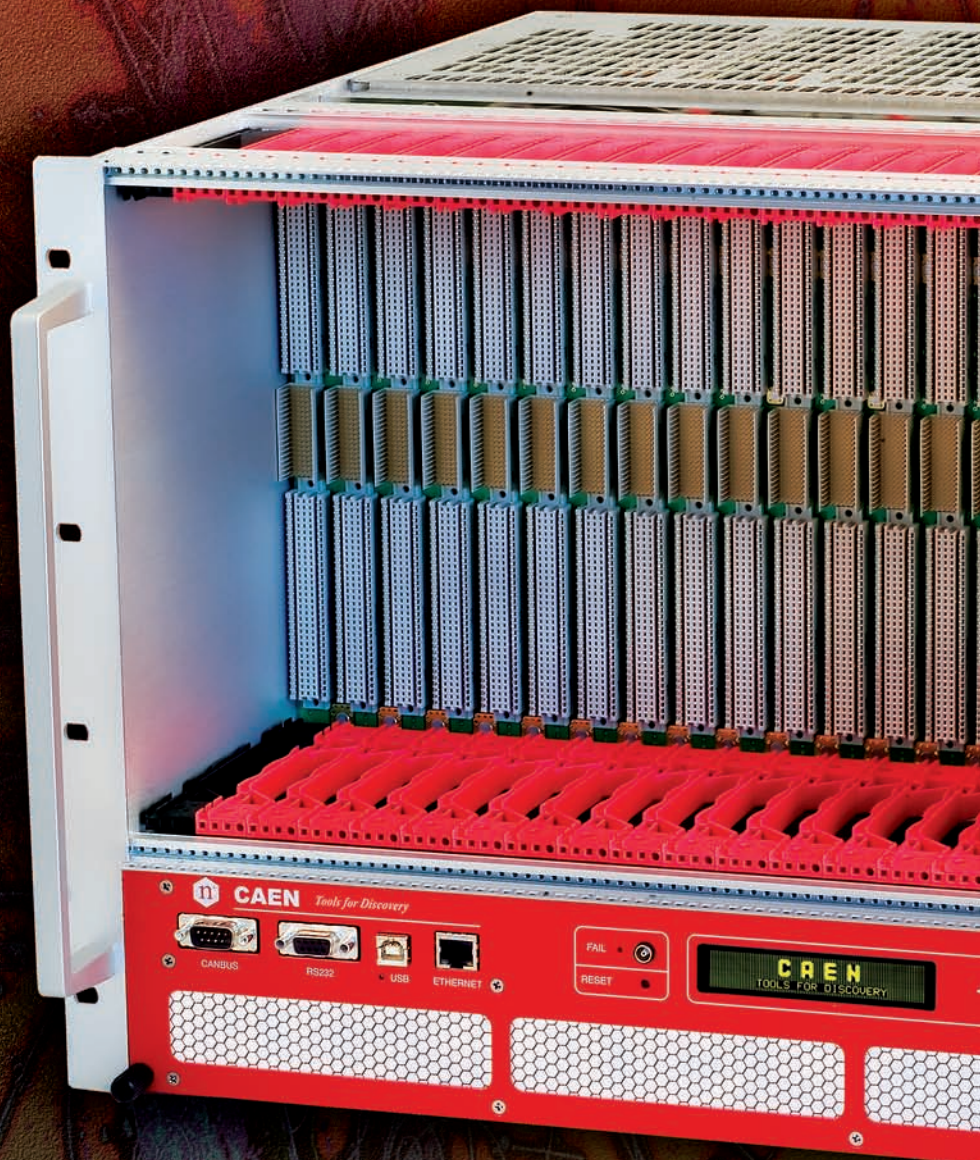
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