

Bookshelf

Festive Bookshelf

Once again, it will soon be time for many of us to take a well-earned break with friends and family, probably after a few hectic hours searching for presents in this festive season. To help with the shopping – whether for others or for yourself – this end-of-year Bookshelf presents some suggestions for more relaxed reading.

Madam Wu Chien-Shiung: The First Lady of Physics Research

By Chiang Tsai-Chien (translated by Wong Tang-Fong)

World Scientific

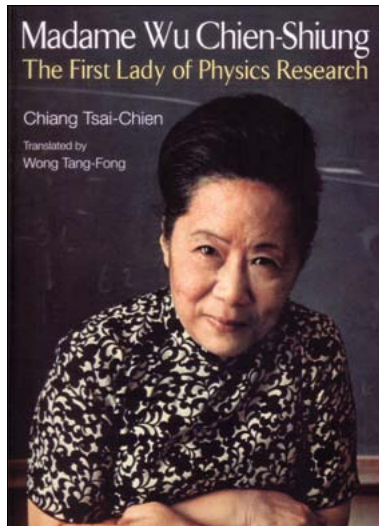
Hardback: £65

Paperback: £32

E-book: £24

The discovery of parity non-conservation was honoured with a Nobel Prize in Physics awarded to Chen-Ning Yang and Tsung-Dao Lee who raised the “question of parity conservation in weak interactions” in 1956 (*Phys. Rev.* **104** 254). Originally the preprint contained a question mark – “Is parity conserved in weak interactions?” – but the editors of *Physical Review* at that time discouraged question marks in the titles of regular articles. The crucial question mark was eliminated forever the same year by the valiant effort of Chien-Shiung Wu and her collaborators – Ernest Ambler, Raymond Hayward, Dale Hoppes and Ralph Hudson. They conducted a memorable experiment at the National Bureau of Standards and the results were published in the first few months of 1957 (*Phys. Rev.* **105** 1413). The concept of their experiment was remarkably simple: take a β -decay source (cobalt-60) and magnetize it with a circular current flowing first in one direction and then in the opposite sense, so that the initial states are the mirror images of each other. The β decays of the mirror-symmetric initial states turned out to be non-mirror-symmetric. Immediately afterwards, two other groups published similar evidence for parity non-conservation – Richard Garwin, Leon Lederman and Marcel Weinrich in Columbia University and Jerome Friedman and Valentine Telegdi in Chicago.

Weak interactions are at the heart of this interesting biography. Of course, Wu was not the first lady working in physics – other remarkable women preceded her in the path to great discoveries. However, as the author argues, she was a person of many



“firsts”, such as the first recipient of the Wolf prize and the first female president of the American Physical Society.

The biography tells the exciting story of a young woman who left the rural China vividly described in the novels of Pearl S Buck and became one of the recognized authorities in the physics of β decay. Wu joined the Manhattan Project and later worked on several other topics, ranging from the Mossbauer effect to exotic atoms. However, her main contributions remain connected to weak interactions. In collaboration with her group in Columbia she also tested the conserved vector-current hypothesis and the universality of Fermi interaction proposed by Richard Feynman and Murray Gell-Mann – a discovery that was essential for the subsequent development of the Standard Model of electroweak interactions.

Wu was above all a scientist who did not like much exposure and dramatic headlines. She also had a wonderful family and various interests, including the rights of women in science. After leaving Shanghai in 1936, she was not allowed back into mainland China for 37 years and so never again saw family members who had died in the meantime. The Cultural Revolution threatened Chinese science but did not succeed. A number of remarkable Chinese scientists, including Wu, contributed enormously to the current success of the standard electroweak theory.

● Massimo Giovannini, CERN and INFN Milan-Bicocca.

Time Reborn: From the Crisis of Physics to the Future of the Universe

By Lee Smolin

Allen Lane

Hardback: £20

E-book: £11.99

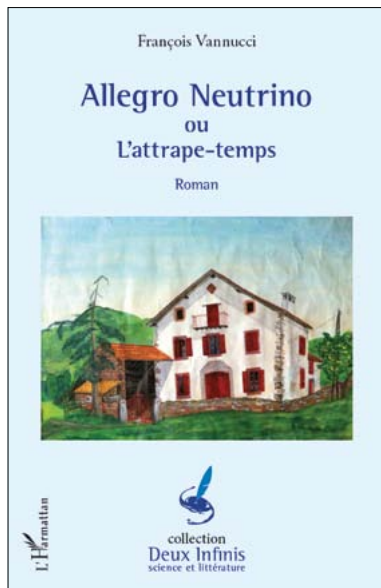
This is a fascinating and thought-provoking book about the nature of time and its role in explaining the universe. Smolin is an original thinker who is unafraid to challenge established orthodoxy. He argues that modern attempts to understand the universe have reached an impasse as a result of the extraction of time from our concept of reality.

The book is presented in two parts. The first offers an historical and philosophical account of how we have arrived at a timeless view of the world. The second develops ideas for a new approach to physics, which incorporates time as a central and fundamental theme. While both parts are interesting and relevant, physicists might find it more satisfying to read the second part first. There is also an epilogue where Smolin discusses some of the implications of redefining our concept of time and reality and how we might meet the challenges of the future, such as climate change and market economics. Finally, he considers the nature of consciousness.

Smolin begins by illustrating, with the simple example of projectile motion, how time can be excluded from our understanding of a physical system by using mathematical constructs. The role of mathematics is to make a physical system abstract, rendering it eternal and timeless. Here Smolin gives an excellent account of the history of the Copernican Revolution, Johannes Kepler and Galileo Galilei. His unique perspective gives new insight into how each world view might have developed and persisted. At each stage the concept of time becomes increasingly obsolete, culminating in the determinism of the Newtonian paradigm. Relativity is no less deterministic, leading us to a timeless “block universe” picture where reality is the whole history of the universe at once.

In what he calls “doing physics in a box”, Smolin examines the applicability of the Newtonian paradigm to cosmology. A physical system can never be isolated from external influences, so the solutions are an approximation to reality. The approximation can be removed by taking the universe as a whole into consideration but such a step cannot be justified because the Newtonian paradigm necessarily applies to a system that is part of a whole. Smolin calls the

Bookshelf

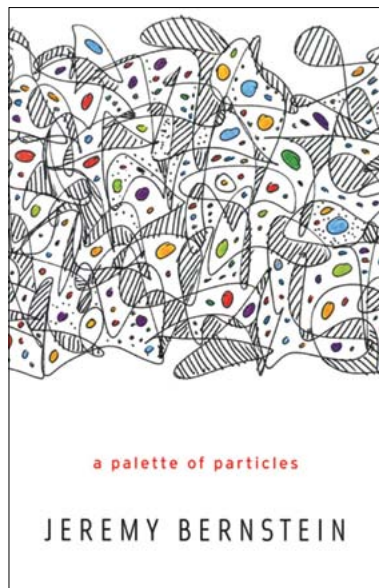


– « une myriade de points lumineux dansant dans tous les sens », points lumineux qui se révéleront être, au fil des pages, des « neutrinos ». Nous y voilà.

Vous l'aurez compris, bien qu'écrit par un physicien des particules spécialisé en physique des neutrinos, ce livre est un roman. L'objectif n'étant pas de vous en apprendre des kilomètres sur ces fameux neutrinos, mais de vous embarquer dans une histoire dont ils sont les protagonistes. Et si l'histoire est contée par un jeune narrateur passionné de physique, il n'en reste pas moins qu'il s'agit d'un enfant, et non pas (encore) d'un physicien des particules.

L'intrigue, si je puis donner à l'histoire cette connotation très romanesque, est somme toute assez simple. Michel, écolier plutôt mauvais en maths mais bon en imagination, vit dans un minuscule appartement parisien avec ses parents. Il va à l'école à pied, trouve ses chaussettes, accompagne sa mère au marché le jeudi et à la messe le dimanche, passe ses vacances d'été à la campagne, collectionne les timbres, adore les truffes au chocolat, et se délecte des histoires de science de son oncle Albert, fonctionnaire tire-au-flanc et lecteur assidu de magazines de vulgarisation scientifique. Mais ce qui anime surtout Michel, moins son histoire, c'est cette étrange capacité à voir des neutrinos.

Mais ne vous méprenez pas, les neutrinos de Michel sont loin de coller à l'idée que l'on s'en fait au CERN. Pour Michel, ce ne sont en effet ni plus ni moins que les constituants de l'âme des êtres vivants,



ou, comme les décrit encore le narrateur, « notre carburant spirituel ». Ce qui explique d'ailleurs que les jeunes en émettent plus que les vieux, et que ceux qui n'en émettent plus sont morts. CQFD.

Au final, ce livre est un long voyage dans la tête d'un gamin de 11 ans, à la rencontre de ses idées farfelues, de ses expérimentations et déductions scientifiques, de ses découvertes triomphantes et de ses confrontations au monde des adultes. Certains passages sont franchement réjouissants, et l'on finit par se prendre d'affection pour le jeune Michel, qui garde précieusement au fond de sa poche, un marron, une bille et une boîte pleine de neutrinos.

● Anaïs Schaeffer, CERN.

A Palette of Particles

By Jeremy Bernstein

Harvard University Press

Hardback: £14.95 €17.10 \$18.95

This book presents a somewhat personal tour through the zoo of more-or-less elementary particles discovered in the past hundred years or so. In general, the content should be well known to most people who are interested in this topic, except for a few original “anecdotes” that Bernstein – a physicist – experienced first hand. Surprisingly, such personal accounts and opinions are limited both in number and impact. Occasionally the author seems tempted to say something but then avoids developing the arguments further, so that the reader ends up not quite knowing what the message is. For instance, after reporting that a Higgs boson was discovered

at CERN (using the clumsy wording “CMS and ATLAS each reported a sigma close to five”), Bernstein criticizes the experimenters at CERN for “claiming victory”. “There was so much pressure to discover this particle that it makes me a bit queasy,” he says. He then implies that his uneasiness will not disappear “until there are more data from the LHC” but he forgets to explain what he thinks the “more data” should show to clarify his doubts. Another example is the much-too-brief mentioning of dark energy, quickly dismissed with the words “its origin is unclear”. The reader is left disappointed that these thoughts are not developed further.

It seems that Bernstein had a hard time trying to find a suitable balance between explaining things accurately and staying within the reach of the “lay reader”. He certainly knows, for instance, that the expression “the electron temperature” is meaningless – single particles have energies not temperatures. And why does he systematically quote the masses of the particles with respect to “the mass of the proton” instead of introducing the mass unit GeV? I wonder if such decisions are imposed by the publishers of “popular science books”, together with the rule of strictly avoiding any equations (except $E = mc^2$). To me, it sounds more confusing. It also seems that the author became confused, judging from the statement that Λ^0 is “a neutral particle about half as massive as the proton”. Hopefully the reader will understand that this is a “misprint” when seeing, in the next sentence, that Λ^0 decays into π^- and a proton. Unless the reader stopped believing in energy conservation after reading about the decays of a Higgs boson “into a W^+ and a W^- or two Z^0 s”. The “lay reader” would appreciate some discussion on how these “most interesting decays” can occur, despite a mass for the Higgs boson less than twice the masses of the W or Z , something that is nicely addressed by Lisa Randall in her short book *Higgs Discovery: The Power of Empty Space* (CERN Courier December 2012 p37).

If I were to recommend a book giving a popular account of particle physics, a few other books would come to mind first, but this one has the advantage of (probably) being the smallest and fastest to read – and it fits in most pockets.

● Carlos Lourenço, CERN.

The Scientific Sherlock Holmes: Cracking the Case with Science & Forensics

By James O'Brien

Oxford University Press

Hardback: £18.99 \$29.95

Devotees of the criminal-investigation TV drama *NCIS* will know that Special Agent

inappropriate application of physical laws to the universe a “cosmological fallacy”. His reasoning draws attention to the distinction between physics-in-a-box and cosmology. “The universe is an entity different in kind from any of its parts.”

Smolin is a strong proponent of Leibniz and the principle of sufficient reason, which states that if there is more than one possibility for things to be as they are, then there must be a sufficient reason for the actual outcome being the case. He uses this to great effect in defining his principles for a new cosmology. In particular, “there should be nothing in the universe that acts on other things without itself being acted upon.” This expresses the philosophy of relationism, where every entity in the universe evolves dynamically, including the physical laws governing the universe. These laws then “become explicable only when they participate in the dance of change and mutual influence that makes the world a whole”. A consequence of relationism, Smolin argues, is that symmetries and conservation laws can only be approximations to reality.

Smolin is keen to emphasize a new approach to a theory of the universe that is not constrained by the Newtonian paradigm. He attempts to provide a framework for a new theory, insisting that it must be able to provide falsifiable predictions. In this sense he is less speculative than those who opt for a multiverse of universes that are not causally connected to our own. He proposes the existence of many universes but with causal connections, which in principle allow their existence to be detected. A possible candidate for the new theory is cosmological natural selection – the subject of his earlier book *The Life of the Cosmos* – in which universes reproduce through the creation of new universes within black holes. The presence of a large number of black holes in a universe is a measure of its fitness in evolutionary terms. The analogy with Darwinian evolution raises the fascinating possibility of novel outcomes, similar to the emergence of new species through natural selection.

This book is great for providing numerous thought-provoking ideas. The reader does not have to agree with all of them to be stimulated into pondering the nature of time. Unsettling and controversial in places, it offers a much needed re-examination of some of our most cherished views.

• Theresa Harrison, Warwick University.

The Adventurous Life of Friedrich Georg Houtermans, Physicist (1903–1966)

By Edoardo Amaldi (Saverio Braccini, Antonio Ereditato and Paola Scamporrì eds.)



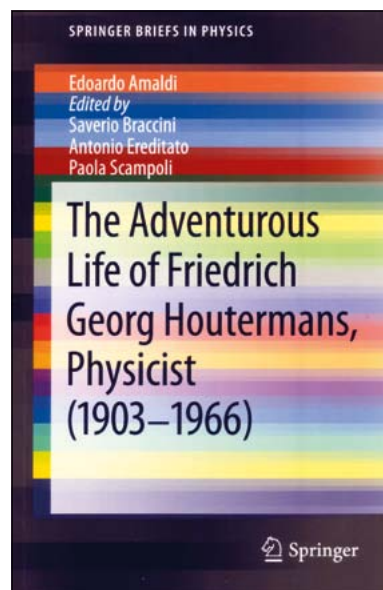
Springer

Paperback: £44.99 €52.70 \$49.95

E-book: £35.99 €41.64 \$39.95

Before visiting a university or physics laboratory, most people imagine today's physicists as peaceful men or women wearing white lab coats and dealing with test tubes, clouds of coloured smoke and mathematical equations. Although the description would be more appropriate for ancient alchemists rather than modern physicists, one word should still stand out – peaceful. However, there was a time when physicists were investigating dangerous radiation, fissile nuclei and particles to trigger a nuclear-reaction chain. These were also the times when Europe was a battlefield and scientific results were regarded as potential material for spies and the tellers of spy stories. In those days, almost every scientist could have made a good subject for writers and Hollywood.

Friedrich “Fritz” Houtermans is no exception. Indeed, his private and professional lives make a good subject for a book. However, in my opinion, the most intriguing aspect of this book is the author – Edoardo Amaldi – and the reason why he decided to write about Fritz, a man who was married four times, spent a few years in Lubianka and other prisons and published several important physics results along the way. Amaldi had seen *L'Aveu* – the film by Costa Gravas about Artur London, the Czechoslovakian communist minister falsely arrested and tried for treason and espionage – and was struck by similarities with the



story of Houtermans. Amaldi began to write about Houtermans but died in 1989. Twenty years later, Edoardo Amaldi's son Ugo gave his father's unpublished manuscript to the Laboratory for High Energy Physics at the University of Bern, where Fritz had done much to initiate research on particle physics. I share the fascination of the editors when they describe how grateful they were to have the opportunity to “meet two outstanding physicists” – Fritz and Edoardo.

The result is a detailed description of both the life of Houtermans and the lives of other friends of Amaldi. It is a beautiful description of Europe and science during the years before, during and after the Second World War. The words Amaldi uses – which are well edited – are not those of a storyteller. Instead, he provides a detailed – almost scientific – report of this almost unknown physicist.

Although Houtermans is an interesting subject, more interesting to me are the chapters where Amaldi explains the “making of” the book and his research into accurate information sources about its subject. I think that soon I will be looking for an equivalent book about Amaldi's life.

• Antonella Del Rosso, CERN.

Allegro Neutrino ou L'attrape-temps

De François Vannucci

L'Harmattan

Broché: €27

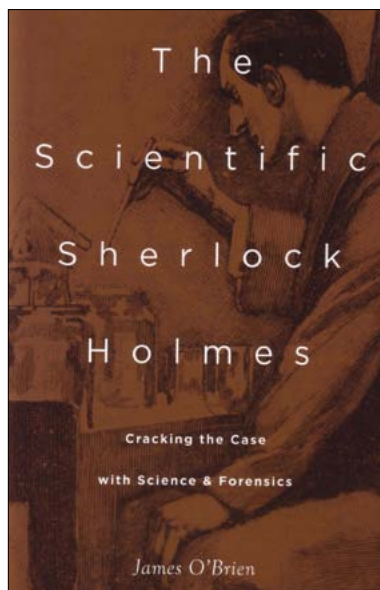
Paris, dans les années 1950. Michel a 11 ans et voit des bulles, ce dont il est très fier. Terme résolument non scientifique, le mot « bulle » désigne pour le narrateur – Michel

Gibbs does not believe in coincidences – it's enshrined in his rule number 39: "There is no such thing as a coincidence." More than a century earlier, the same belief seems to have inspired Arthur Conan Doyle in his creation of probably the best known pioneer of crime-scene investigation – Sherlock Holmes. Conan Doyle was later to explain that detective stories he had read were "nonsense...because for getting the solution to the mystery the authors always depended on some coincidence". Instead, the key to solving the cases in the Sherlock Holmes stories was the central character's knowledge of science and his powers of deduction.

The stories became hugely popular. Fans would eagerly await the next edition of *The Strand Magazine* to read the latest mystery and refused to let Holmes die – famously, Conan Doyle had to bring the detective back from near death at the Reichenbach Falls. Indeed, Holmes continues to live on in peoples' imaginations, long after his creator died. The attraction continues today, as Holmes appears on TV and cinema screens in many different incarnations and has been brought into the 21st century, for example by the popular actor Benedict Cumberbatch.

In *The Scientific Sherlock Holmes*, James O'Brien, an emeritus professor of chemistry, puts forward the case that the scientific element played an important part in the success of the stories. His book is essentially a pocket guide to the science in Holmes's adventures – short enough to read quickly but packed full of facts and quotations from Conan Doyle's 60 stories about the maverick detective. Just like the stories themselves, the book becomes compulsive reading as O'Brien looks in detail at how Holmes used science in his investigations. Most fascinating is the chapter on forensic science, from fingerprints and footprints to the use of dogs. What makes this especially intriguing is the way that the author matches the work of Holmes with real forensic science and some famous cases. The development of the Automated Fingerprint Identification System (AFIS – well known to modern fans of crime fiction), as well as the use of handwriting in apprehending the New York Zodiac Killer and typewritten letters in convicting the Unabomber, are some examples.

O'Brien also looks closely at Holmes's deep interest in chemistry, before covering other sciences. Here he defends Holmes against the criticisms of Isaac Asimov – the well-known chemist, author and "Sherlockian scholar". In Asimov's view, Holmes was a "blundering chemist", while the chronicler Dr Watson describes Holmes's knowledge of chemistry as "profound". After analysing several stories,



O'Brien comes down between the two, ranking Holmes the chemist as "eccentric".

Of course, Holmes was a character in a book – although it is sometimes easy to fall into thinking about Holmes as a real person, as O'Brien and his many sources often seem to do. Instead, the stories reflect the knowledge of Conan Doyle, who had trained as a doctor. The fascination is that Conan Doyle was so up-to-date on the application of forensic science – and that fictionalizations centred on forensic science continue to draw large audiences in many countries, where they can see modern variants on Holmes on TV on almost any night of the week.

• Christine Sutton, CERN.

Books received

The Quantum Divide: Why Schrödinger's Cat is Either Dead or Alive

By Christopher C Gerry and Kimberley M Bruno

Oxford University Press

Hardback: £25



Aimed at undergraduate physics students and anyone else who wants to grasp the essential issues of quantum physics, the authors use a selection of key experiments performed during the past 30 years to discuss the counter-intuitive phenomena of the quantum world that defy explanation in terms of "common sense" and provide the corresponding quantum mechanical explanations with only an elementary use of associated formalism. Most, but

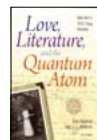
not all, of the experiments described are optical, involving a small number of photons (particles of light). Starting with experiments on the wave-particle duality of electrons, the authors proceed to experiments on the particle nature of light and single-photon interference, delayed-choice experiments and interaction-free detection. The book then moves on to experiments involving the interference of two photons, quantum entanglement and Bell's Theorem, quantum teleportation, large-scale quantum effects and the divide between the classical and quantum worlds, addressing the question as to whether or not there is such a divide.

Love, Literature and the Quantum Atom: Niels Bohr's 1913 Trilogy Revisited

By Finn Aaserud and John L Heilbron

Oxford University Press

Hardback: £35



Niels Bohr ranks with Albert Einstein among the physicists of the 20th century. He rose to this status through his invention of the quantum theory of the atom and his leadership in its defence and development. He also ranks with Einstein in his humanism and sense of responsibility to his science and the society that enabled him to create it. This book presents unpublished excerpts from extensive correspondence between Bohr and his immediate family, using it to describe and analyse the psychological and cultural background to his invention. The book also contains a reprinting of the three papers of 1913 – the Trilogy – in which Bohr worked out the provisional basis of a quantum theory of the atom.

Under the Spell of Landau: When Theoretical Physics was Shaping Destinies

By Mikhail Shifman (ed.)

World Scientific

Hardback: £82

Paperback: £45

E-book: £34



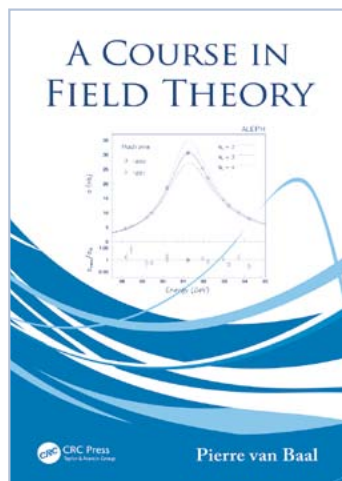
This invaluable collection of memoirs and reviews on scientific activities of the most prominent theoretical physicists belonging to the Landau School – Landau, Migdal, Zeldovich, Smorodinsky, Ter-Martirosyan, Kirzhnits, Gribov, Larkin and Anselm – is published in English for the first time. The main goal is to acquaint readers with the life and work of outstanding Soviet physicists who, to a large extent, shaped theoretical physics in the period 1950–1970. Many intriguing details brought together here were unknown beyond the Iron Curtain of those years.

Particle and High Energy Physics Books from CRC Press

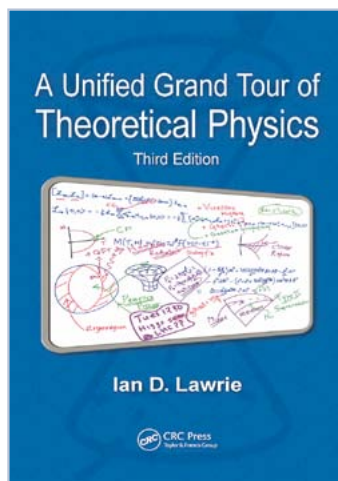


Order from www.crcpress.com using promo code LKM03 Free Standard Shipping available!

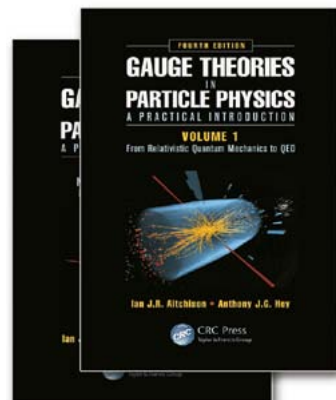
August 2013 | 978-1-4665-9459-3 | £44.99



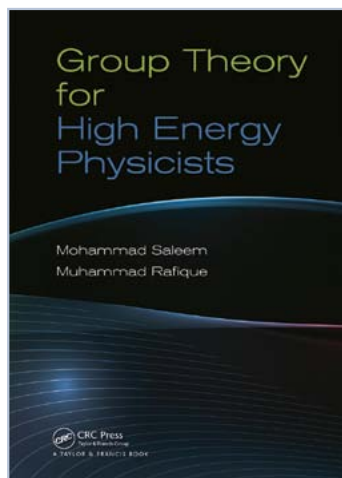
August 2013 | 978-1-4398-8446-1 | £44.99



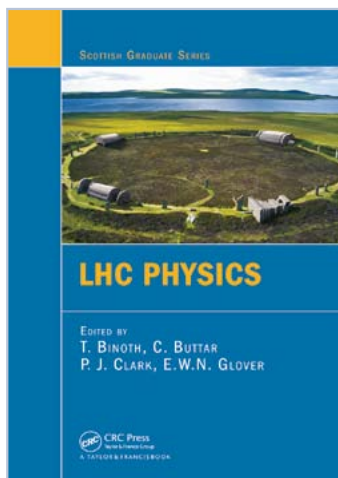
December 2012 | 978-1-4665-1317-4 | £82.00



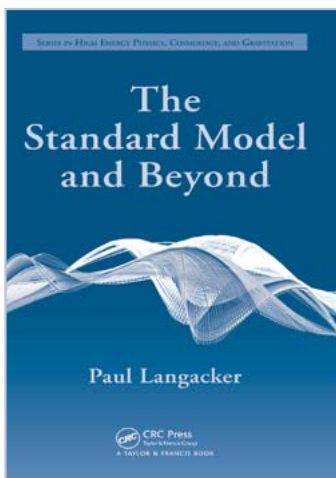
September 2012 | 978-1-4665-1063-0 | £44.99



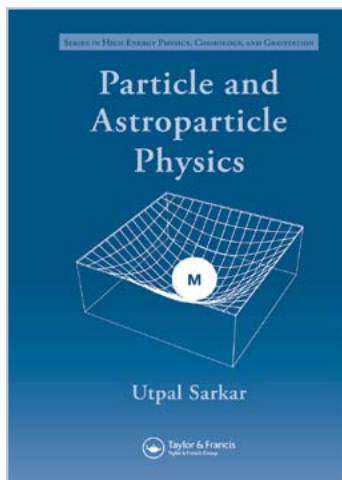
May 2012 | 978-1-4398-3770-2 | £76.99



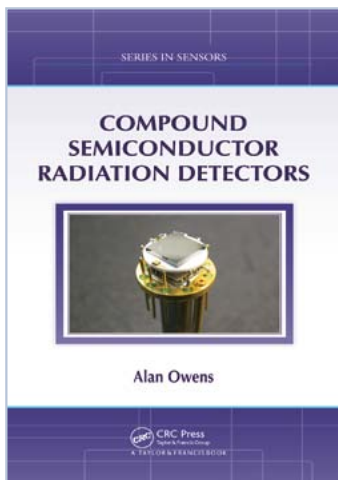
December 2012 | 978-1-4200-7906-7 | £52.99



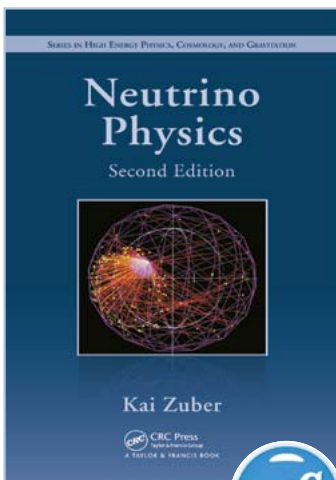
December 2007 | 978-1-58488-931-1 | £69.99



May 2012 | 978-1-4398-7312-0 | £82.00



August 2011 | 978-1-4200-6471-1 | £89.00



a clear edge

think vacuum, think edwards



nEXT Turbopumps



*RV & EM
Rotary Vane Pumps*



*T-Station 75
Turbopumping System*



Measurement and control



nXDS Dry Scroll Pumps



STP Maglev Turbopumps

Edwards offers an extensive range of pumping technologies for R&D and laboratory applications

- A comprehensive range of primary pumps including oil-sealed, scroll, claw, multi-stage roots and screw mechanisms
- A full line of turbo pumps from 40 to 4500l/s including magnetically levitated and conventional ceramic bearings
- Turbocarts including a turbopump, backing pump and controller, supplied fully assembled and ready to run.
- A broad range of measurement and control equipment

Whatever your requirement, Edwards has the solution and application expertise to meet your needs.

Discover more:
www.edwardsvacuum.com
info@edwardsvacuum.com



Vacuum science... product solution.

**730
Digitizer
Family**

8/16 Ch. 14-bit 500 MS/s Digitizer

The **730 Digitizer family**
is a **14-bit, 500 MS/s Flash
ADC Waveform Digitizers**.
It is available in three form
factors:
VME (16 input channels),
NIM (8 input channels),
Desktop (8 input channels).



CAEN
Tools for Discovery

[730 Digit Family webpage >>>](#)



- 14-bit @ 500 MS/s
- VME64/VME64X (16 ch.), NIM (8 ch.) and Desktop (8 ch.) modules
- 0.5 and 2 Vpp input dynamic range with programmable DC offset adj.
- Algorithms for Digital Pulse Processing (DPP*)
- VME, USB and Optical Link communication interfaces
- Multi-board synchronization features
- Demo software tools, DPP Control Software, C and LabVIEW libraries

x730 digitizers can run three Digital Pulse Processing firmware for Physics Applications:

DPP-PHA Digital Pulse Processing for Pulse Height Analysis



DPP-PSD Digital Pulse Processing for Pulse Shape Discrimination



DPP-ZLEplus Digital Pulse Processing for the Zero Length Encoding



WELCOME

CERN Courier – digital edition

Welcome to the digital edition of the December 2013 issue of *CERN Courier*.

This edition celebrates a number of anniversaries. Starting with the “oldest”, 2013 saw the centenary of the birth of Bruno Pontecorvo, whose life and contributions to neutrino physics were celebrated with a symposium in Rome in September. Moving forwards, it is the 50th anniversary of the Institute for High Energy Physics in Protvino, Russia, and also of CESAR – CERN’s first storage ring, which saw the first beam in December 1963 and paved the way for the LHC. More recently, a new network for mathematical and theoretical physics started up 10 years ago, re-establishing connections between scientists in the Balkans. At the same time, the longer-standing CERN School of Computing began a phase of reinvigoration. There is also a selection of books for more relaxed reading during the festive season.

To sign up to the new-issue alert, please visit:

<http://cerncourier.com/cws/sign-up>.

To subscribe to the magazine, the e-mail new-issue alert, please visit:

<http://cerncourier.com/cws/how-to-subscribe>.