

BOOKSHELF

Summer Bookshelf

Summer for physicists is the season of conferences as well as (or instead of!) well earned holidays, perhaps providing more time for reading about topics away from mainstream particle physics. This Bookshelf reviews a selection of less technical books for more relaxed reading, at home or on those long plane journeys.

The Martians of Science: Five Physicists Who Changed the Twentieth Century by István Hargittai, Oxford University Press. Paperback ISBN 9780195365566, £8.99 (\$15.95).

The music was enchanting. The Dysons stopped before the door, not wanting to break the magic of the superbly played Bach prelude. When the last cadence had rung down they walked in to find Edward Teller sitting at the piano apologizing that he was just passing by and that the instrument begged to be played while he was waiting for them to return home. It was a remarkable journey that had brought Teller, best known as the father of the hydrogen bomb, to the Dysons' home at Berkeley. Even more remarkably, his journey was not without parallels.

If we were to trace back the wordlines of influential physicists to their birth, we would find several of them to converge in a

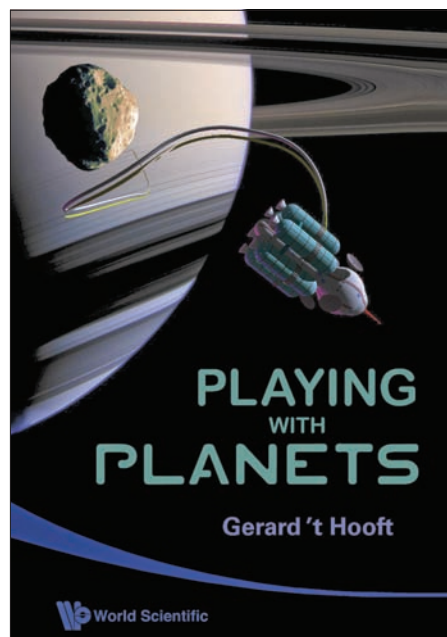
tiny domain of space-time: Budapest, *fin de siècle*. In fact, those of Theodore von Kármán, Leo Szilard, Eugene Wigner, John von Neumann and Edward Teller never really diverged significantly. These compatriots all went from Hungary to Germany and eventually to the US. And they all changed the history of the 20th century.

Kármán Tódor, Szilárd Leó, Wigner Jenő, Neumann János and Edward Teller (Teller Ede in Hungarian) were all born to well-to-do Jewish families living within walking distance of each other. They all completed their studies in Germany, learning from masters such as Ludwig Prandtl, Albert Einstein and Werner Heisenberg. Eventually they found refuge in the US from the menace of anti-Semitism, where they all joined the defence effort: von Kármán helped establish the modern US Air Force and founded the Jet Propulsion Laboratory; Szilard patented the nuclear chain reaction and triggered the Manhattan Project, through a letter signed by Einstein to President Roosevelt; Wigner played an instrumental role in building the first nuclear reactor; von Neumann did important calculations for the Manhattan Project and described the principle of modern computer architecture; and Teller drove the creation of thermonuclear weapons.

In his book, first published in 2006 and now available in paperback, István Hargittai follows the lives of these five "Martians of Science", and asks the inevitable questions: What was behind this remarkable surge of talent? Was it just a random rogue wave? What made these broadly educated, brilliant men seek the ultimate weapon? How did they see the role of scientists in society?

The author makes a critical assessment in the final chapter of their roles and weightings in science in comparison with other scientists of the 20th century. He even ventures to answer the intriguing counterfactual: What if they had stayed in Hungary?

That these five represented just the crest of a bigger wave is borne out in George Marx's *Voice of the Martians* (Akademiai Kiado 2001). In addition to them, Marx presents personalities such as Dennis Gabor, the inventor of hologram; Arthur Koestler, the writer whose *Darkness at Noon* can be compared in its influence to George Orwell's *1984*; Paul Erdős, the vagabond mathematician of "Erdős number 0"; Val Telegdi, whose experiments explored the



nature of weak interactions and who spent much of his time at CERN until his death a few years ago (*CERN Courier* September 2006 p49); and many others. From this long list of portraits a broader picture emerges, that of the fate of the central-European scientist in the 20th century.

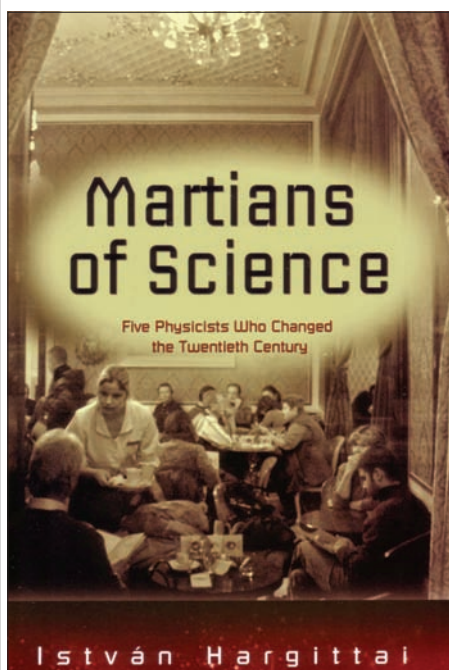
Both authors draw on existing biographies but they supplement them with a wealth of detail from their personal conversations with their subjects or their respective colleagues, friends and family. Even so, with their scope and emphasis on exploring trends and connections, these books cannot do justice to each individual. They are instead excellent introductions that invite, and provide a guide to, further reading.

Károly Banicz, Fermilab.

Playing with Planets by Gerard 't Hooft, World Scientific. Hardback ISBN 9789812793072, £25 (\$48). Paperback ISBN 9789812790200, £14 (\$23).

At the Rijksmuseum in Amsterdam they currently offer an audio tour by the artist Jeroen Krabbé. In a lovely, soft-accented English he recounts his personal experiences with the various exhibits over the many years that he has been visiting the museum – from the view as a child, a painter and actor, a parent and as a grand parent. His insights are both moving as well as fascinating and deep.

While reading *Playing with Planets*, I heard a similar voice in my head. Starting with



personal experiences, Gerard 't Hooft lets his mind wander over the various aspects of life, speculating on the affects of new scientific developments on our lives in the future. The topics that he covers include flying kites (What is the highest you can possibly let a kite fly?), rising sea levels from global warming, modern dike construction and building floating cities on the ocean or in the sky. The topic that really grips his mind, however, seems to be space travel and colonization (mainly by robots), as well as ultimately moving around asteroids or even planets. (The latter is the origin of the title of the book.)

It is clearly important to 't Hooft that each of these speculations is firmly based on current scientific knowledge. They can thus be a motivation or even inspiration for actual scientific progress or technical developments. On this point he seems to take issue with the unfounded, wild speculations that he perceives to feature in most, if not all of, science-fiction writing. I am not much of a sci-fi buff myself, but to me such novels were always more of an enquiry into human nature – by placing people in unusual circumstances – rather than a real attempt at predicting or driving scientific progress. All the same, the author is well aware that he is stretching the limits of the possible when considering astro-mechanics.

My only criticism of his space-related speculations is that I believe they are severely constrained by the limited resources on

Earth. When we realize that we have hit Peak Oil (or the equivalent for other materials), any interest in space travel and colonization will be put on the back burner. Nevertheless, I much enjoyed wandering the world, following this enquiring and original mind.

Herbi Dreiner, University of Bonn.

Superconductivity: A Very Short Introduction by Stephen Blundell, Oxford University Press. Paperback ISBN 9780199540907, £7.99 (\$11.95).

One of the best non-technical science books I read around the time that I decided to study physics was *The quest for absolute zero* (Weidenfeld and Nicolson 1966). In it Kurt Mendelssohn, one of the early workers in low-temperature physics at Oxford University, told the story of the race to liquefy helium and the subsequent discoveries of the remarkable phenomena of superconductivity and superfluidity. With just enough diagrams and equations to make it comprehensible but not unpalatable, the book opened up a fascinating new world of physics that was far more intriguing than most of the syllabus taught at school.

Much has happened since then. Low-temperature superconductors are now regularly put to work in many hospitals in MRI scanners and there have been big strides towards high-temperature superconducting materials. Stephen Blundell, who follows in Mendelssohn's footsteps by working at Oxford's Clarendon Laboratory, brings the story up to date in this volume from OUP's successful series of "Very Short Introductions". In fewer than 150 small-format pages he manages to cover much of the story told by Mendelssohn and what has happened since, in particular the dramatic discovery of "high temperature" superconductors in the 1980s.

Blundell certainly succeeds in squeezing a great deal into the small package. It is a story full of excitement and intrigue, with accidental discoveries and major deception, complete with a cast of Nobel laureates. He keeps the narrative moving at a good pace, peppering it with brief biographical sketches and photos of key players, as well as a few useful diagrams (and no equations!). He not only manages to give space to the connection between spontaneous symmetry breaking in superconductors and particle physics – where he refers to the search for what "probably

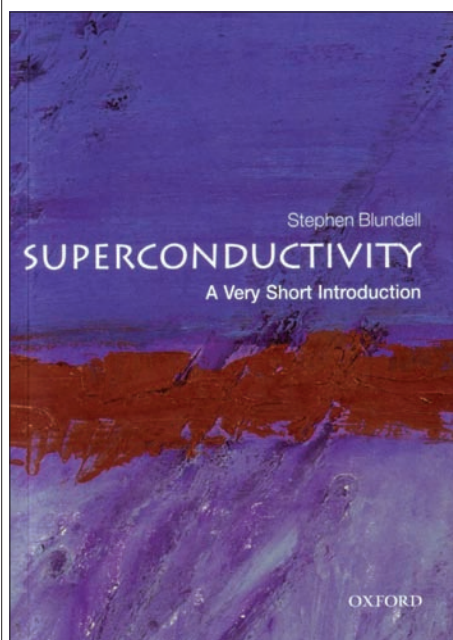
should be called the Anderson-Nambu-Higgs-Brout-Englert-Guralnik-Hagen-Kibble boson" at the LHC – but also refers to the large-scale use of superconductivity at the LHC and mentions the incident that put commissioning on hold in September 2008. There are also interesting "asides" on topics such as the rise of preprints and the server arXiv.org.

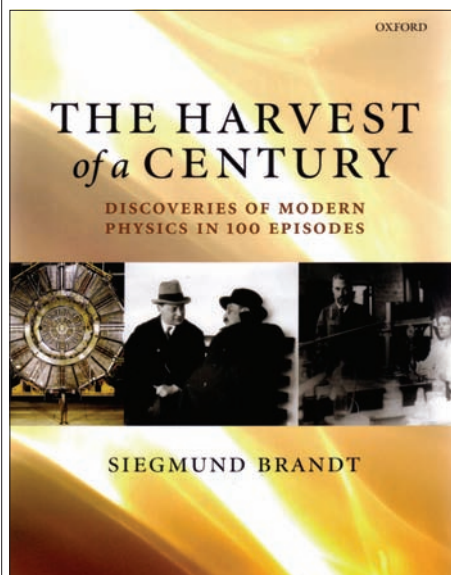
In short, the book is a worthy successor to Mendelssohn's, perfectly geared to today's "faster" times. I hope it inspires future students to look deeper into physics. It is certainly ideal for slipping into your luggage during summer travels, being small and light enough for the even the smallest travel bag. *Christine Sutton, CERN.*

The Harvest of a Century: Discoveries in Modern Physics in 100 Episodes by Siegmund Brandt, Oxford University Press. Hardback ISBN 9780199544691, £35 (\$70).

No century before was so full of advances in physics as the 20th, which witnessed a complete revolution in scientific thinking. There were significant advances in many fields, including medicine, engineering and computing, which all had a deep impact on daily life. While some people consider modern physics to be born in the year 1900, with the landmark introduction of the quantum of action in Planck's radiation law, others prefer to place its birth year in 1895, with the discovery of X-rays, immediately followed by the discovery of radioactivity and the electron, as well as the alpha, beta and gamma rays. This was the option taken, for example, by João Varela in his book *Século dos Quanta Gradiva (The Quantum Century 1996)*. Wilhelm Röntgen's X-rays are also the opening act of *The Harvest of a Century* – a collection of the 100 most important advances in physics, many of them recognized with Nobel Prizes – by Siegmund Brandt, Emeritus Professor at the University of Siegen.

After a brief overview of the 19th century heritage the reader is taken through many fundamental discoveries, which are always described in a very appealing style. Naturally, Brandt gives emphasis to the development and testing of quantum mechanics, to important breakthroughs in atomic and nuclear physics and to recent advances in particle physics and cosmology. But many other "episodes" are also included, such as the invention of the transistor and the laser.





The book is profusely illustrated with photographs of the main players and respective apparatus, often complemented by pedagogical diagrams, and includes detailed references to original publications. It provides a stimulating way of learning about the basic concepts of modern physics and how they were brought to life.

Indeed, this “harvest” will surely please a broad audience interested in concrete examples of scientific progress, whether they are physicists or not. The episodes are often cross-linked and the reader is invited to jump back and forth, unbound by the chronological flow. Moreover, Brandt contributes his own personal memories, such as when he describes the discovery of the gluon, and sprinkles the text with nice anecdotes. For instance, we learn that before entering university Max Planck sought the advice of Philipp von Jolly, professor of physics in Munich, who answered that “he considered the edifice of physics to be essentially completed and that only a few details might still be discovered in this field”. Undeterred, Planck devoted his energy to physics and laid the foundations of quantum theory.

There are, of course, books with much more information about Albert Einstein’s relativity theory or “the eightfold way”, as well as books that place more emphasis on the biographical aspects of 20th century physicists, such as *The Genius of Science: A Portrait Gallery* (OUP 2000) by Abraham Pais (*CERN Courier* December 2001 p41) or *Remarkable Physicists* by Ioan James (CUP

2004). *The Harvest of a Century*, however, provides a much broader collection of interesting scientific discoveries in a single book of 500 pages written in a fluent style. In short, once you start reading this book, it is difficult to stop.

Hermine K Wöhri, LIP Lisbon.

Cosmic Imagery: Key Images in the History of Science by John D Barrow, The Bodley Head. Hardback ISBN 9780224075237, £25.

John Barrow’s latest book, *Cosmic Imagery*, is a collection of 89 short and profusely illustrated essays, mostly related to astronomy, Earth sciences, mathematics and physics. Just open the 600-page book at random and enjoy reading about “aperiodic tilings”, Bucky balls, snowflakes, Kekulé’s benzene ring dream, DNA’s double helix and many other “picturesque” topics, including the symmetries of Leonardo da Vinci’s Vitruvian Man (depicted on the cover).

A cosmologist and mathematician, Barrow highlights the power of pictures in discovering and understanding our universe, selecting many spectacular images of galaxies, nebulae and other cosmic players, as well as equally fascinating mathematical landscapes such as the truly complex Mandelbrot set – the ultimate artful display of nature’s fractal beauty. Despite being packed with facts, the accompanying texts are fluid and clear, and are introduced by curious and often humorous quotations (“Why did the chicken cross the Möbius strip? To get to the other... er, um...”).

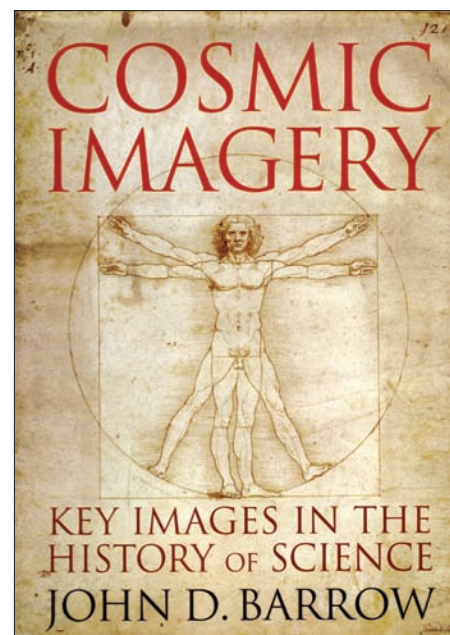
True to his reputation for excellence in communicating science, Barrow’s latest book targets a general readership while leaving hundreds of detailed “Notes” to the last 45 pages. Here we are told, for instance, that Hermann Minkowski triggered David Hilbert’s famous lecture in 1900 – when he listed 23 problems that would become mathematicians’ homework for a very long time – and see the touching words that Hilbert pronounced when Minkowski died suddenly, aged 44. Another note reports that the Mandelbrot boundary, a curve on a flat surface, “needs as much information to specify as a whole two-dimensional area”. This book is sure to provide enjoyable summer-time reading, despite a few minor “misprints”. For instance, Pedro Nunes was a 16th century Portuguese mathematician (not a 15th century navigator) and the Nobel Prize

was awarded to David Politzer, David Gross and Frank Wilczek in 2004 (not in 2005).

Just searching for suitable quotations to introduce the chapters in a spirited way must be a long-term job for prolific writers such as Barrow. Consider, for instance, what Marcus Chown must have endured to find the quotation that opens one chapter in *The Universe next door: Twelve Mind-blowing Ideas from the Cutting Edge of Science* (Headline 2003): “Time is nature’s way of keeping everything from happening at once,” attributed to “graffiti, men’s room, Austin, Texas”.

This pocket-sized book, which presents some amazing ideas that Chown came across as cosmology consultant to *New Scientist*, is ideal to take on a long flight (I read it on a trip to Japan). It has no pictures but these weird chronicles will certainly twist the most imaginative minds. Can there be regions in the universe where time runs backwards? And an invisible universe made of mirror matter occupying the same space as the visible universe? Chown clearly shares Max Tegmark’s view: “Nature is under no obligation to make things easy for human brains” or to “respect our sensitivities and behave in a way that appeals to everyday common sense”.

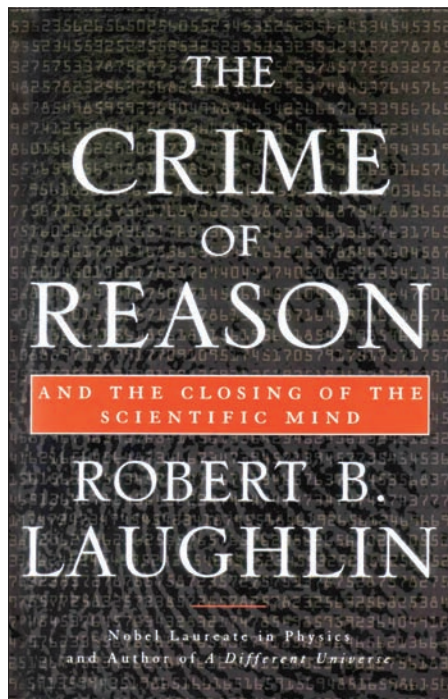
Richard Feynman had a more poetic perspective when he wrote: “Nature has a great simplicity and, therefore, a great beauty” (*The Character of Physical Law* MIT Press 1965). This viewpoint connects the 11 (not always easy) pieces that compose a



book that looks at invisible beauty in science, *It Must be Beautiful: Great Equations of Modern Science* (CERN Courier March 2002 p45) – a compendium of essays edited by Graham Farmelo, which also makes good summer reading. After guiding us through Schrödinger's waves, agitated by Copenhagen's winds, Arthur I Miller compares the difficulties in interpreting quantum theory's subtle concepts with Pablo Picasso's simultaneous representations of many perspectives on a single canvas. Christine Sutton presents the Yang-Mills equation with so many twists and turns it almost seems a detective story. Equally fascinating is Frank Wilczek's detailed report on Paul Dirac's equation: a "piece of magic", both "obviously right" and "catastrophically wrong", whose discovery is an example of creative physics resulting from the recognition of patterns, the trying of explanatory assumptions, and the recognition of mathematical beauty. Further insight into the dramatic evolution of our understanding of this equation comes in the "afterword", where Steven Weinberg – maybe inspired by Magritte's "*Ceci n'est pas une pipe*" – explains that the correct representation of an electron is a quantum-mechanical field-operator (not a wave function and without direct connection to the probability of finding the particle) that satisfies an equation mathematically identical to the wave function equation of Dirac; it is "by coincidence" that Dirac's equation gives correct numerical solutions. This adds another twist to Dirac's comment: "My equation is smarter than I am." *Carlos Lourenço, CERN.*

The Crime of Reason: And the Closing of the Scientific Mind by Robert B Laughlin, Basic Books. Hardback ISBN 9780465005079, £15.99 (\$25.95).

Robert Laughlin, Nobel laureate in physics, presents a gloomy, doomsday outlook in his latest literary offering, *The Crime of Reason*. The title is defined by the author as "the unsocial nature or outright illegality of understanding certain things". He suggests that "Information Age" is a misnomer for the current era, which should be re-named the "Age of Amnesia", owing to the inaccessibility of valuable knowledge that could be used for monetary gain or considered life-threatening. Such knowledge is not truly free to access and in some cases considered private property



and secret. Those who find out such things could find themselves sued or in prison.

Knowledge is dangerous, Laughlin admits, beginning to sound paranoid when he suggests that such things as knitting needles, lace curtains or pruning shears could be lethal. When he turns to the threats of nuclear weapons plans or biological cloning, however, his concern seems valid.

In discussing the scientific community he notes that university professors whose research findings do not correspond to – or even go against – their big company or government donors could find themselves having difficulties in procuring additional funding for further research proposals and problems with promotions. However, Laughlin does not provide concrete examples about how these researchers have been "silenced". He also points out that gene sequences, certain physical principles pertaining to nuclear energy, and software codes are now patented or classified by governments.

The book is a quick read of just 149 pages but the author falls short of successfully making all of his points. He provides many intriguing arguments, such as the notion that the worldwide web has created a sense that the world is at our fingertips, but in reality inundates us with useless information while not disseminating any real knowledge. This is not fully explored, however. For those

Nicola Armaroli Vincenzo Balzani **Energia per l'astronave Terra**

Quanta ne usiamo, come la produciamo,
che cosa ci riserva il futuro



CHIAVI DI LETTURA ZANICHELLI

working at CERN, where there is a sense of openness in publishing physics results and sharing ideas with colleagues, Laughlin's suggestion that important details may be purposely left out of technical documents to keep a monopoly on knowledge and therefore generate money, may seem wide of the mark.

Finally, it seems strange to have a book that discusses such weighty subjects as the deliberate hiding of valuable information from the general public, to end on a daydream of living on the Moon and wishing that they would "send up more girls" from Earth. Remarks like this, and the lack of concrete examples, in the end detract from what is potentially an important subject for debate. *Carolyn Lee, CERN.*

Energia per l'astronave Terra by Nicola Armaroli and Vincenzo Balzani, Zanichelli. Paperback ISBN 9788808063915, €11.50.

"A politician cares about the next election, a statesman cares about the next generation." This quote by Alcide de Gasperi, chosen by the authors to introduce the last chapter of this book, illustrates the spirit of the work. Throughout the book, Nicola Armaroli and Vincenzo Balzani emphasize the fact that the energy problem can only be understood (and solved) if each one of us accepts the responsibility to do something about it.

The authors are experts of energy-related problems at Consiglio Nazionale delle Ricerche and the University of Bologna, respectively. In this book they address the problem of energy management on our planet and emphasize its importance by showing the countless links with human activities, which may jeopardize the survival of the environment. Thanks to this book, the reader realizes that this is "the" problem of the planet and that, technically speaking, "the" solution doesn't exist yet.

Unlike other publications on the subject written for the general public, this book is enriched with scientific facts, which make it attractive to a more specialized audience. However, thanks to the effort that the authors have made to integrate and explain the mathematical statistics, any reader will understand the figures and the conclusions that they lead to.

I found the book interesting overall, although in some places a little superficial, with logical shortcuts that lead to too general

conclusions. However, I really appreciated the capacity of the authors to focus the attention of the reader on the two basic facts that actually "make" the energy problem: first, the planet's resources (whatever they are) are limited and, second, only a better redistribution of them among the Earth's population can lead to real and durable progress. Regarding this second point, a striking fact mentioned in the book is the observation that, if you take the global stock of primary energy (the energy that is globally available) and divide it by the number of inhabitants, you obtain about 60 GJ – that is the energy consumption of a citizen of a Balkan country. In Western Europe today, we consume three times as much.

In May the book received a prestigious award in Italy (the Premio Letterario Galileo) for the best science popularization publication. The jury was composed of 2500 young students from more than 100 high schools.

Antonella Del Rosso, CERN.

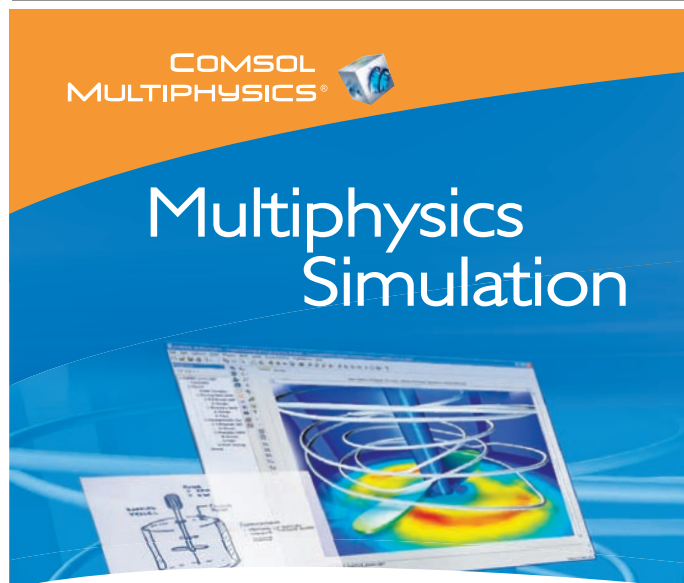
Books received

Nobel Faces: A Gallery of Nobel Prize Winners by Peter Badge, Wiley-VCH.

Hardback ISBN 9783527406784, €72.90.

Peter Badge's striking black-and-white portraits, accompanied by short biographies, result in a fascinating word-and-image tableau of all of the Nobel Laureates alive at the time of writing (2007).

The book consists of more than 270 photographs of Nobel Prize winners including Nelson Mandela, the Dalai Lama, author J M Coetzee, physicist Roy J Glauber, molecular biologist James Watson and former US president Jimmy Carter. Each portrait is accompanied by a brief description celebrating the laureate's outstanding contribution to science, literature or world peace, written by journalist Chris Richmond with scientific advice from Jürgen and Leonore Uhlenbusch. There is also an "afterword" by the well known German filmmaker, playwright, photographer and producer, Wim Wenders.



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