

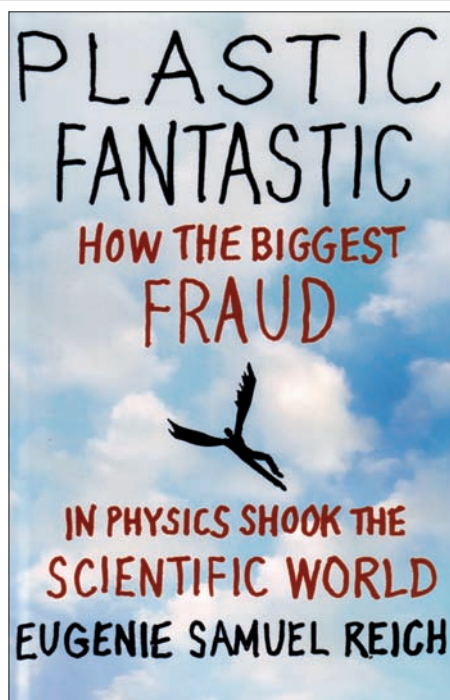
BOOKSHELF

Plastic Fantastic: How the Biggest Fraud in Physics Shook the Scientific World by Eugenie Samuel Reich, Palgrave Macmillan. Hardback ISBN 9780230224674, £15.99 (\$26.95). Paperback ISBN 9780230623842, £12.99 (\$17).

This book devotes 266 dense pages – 20 of them listing hundreds of notes – to a case of scientific misconduct staged at Bell Labs between 2000 and 2002, with Jan Hendrik Schön as the central figure. The plot follows the path leading up to the discovery that Schön's breakthroughs on "molecular electronics" (which included lasers and superconductors made of organic plastics) were fraudulent.

Reich makes a good case in defending the argument that the economic situation at Bell Labs and the need to justify keeping a strong basic-research department in the company made the ground fertile for an ambitious young person to flourish and enchant (fool) the senior people. It is actually quite amazing to see that the co-authors of Schön's papers knew so little about important points of the reported work, and that the fabrication of data was not uncovered earlier than it was, given the frequent questions being asked by many Bell people, including close collaborators, managers and other staff. It helped that many of his papers presented "measurements" that matched predictions. He seemed to write his papers backwards: first the conclusions, then the "data" that supported them, often generated from equations rather than from the apparatus.

In hindsight, it looks preposterous to think that Schön could possibly write more than 20 groundbreaking publications in such a short time period, including seven papers in a single month, November 2001. This, alone, should have alerted people to the possibility that the reported results may have been fabricated. The journals *Nature* and *Science* emerge from this book as not being very careful about reviewing the articles that they publish, placing the emphasis on selecting papers that will make the headlines (the "breakthrough of the year") rather than in ensuring that they provide enough technical details to allow for a good scrutiny of their plausibility and for an efficient verification by other labs. Many people wasted time and money trying to replicate the fabricated results. Schön's publication "success" surely benefited from having signed the papers with a senior co-author, a well known expert



who gave further credibility to the fraudulent results by giving a multitude of seminars on the subject, to the point of being awarded, and accepting, prizes for the "discoveries".

This is an interesting book and Reich clearly convinces the reader that, despite our natural tendency to think that scientists can be trusted (honest people, who might make mistakes), some of them deliberately fudge the measurements to fit with preconceived ideas, old or new. The scientific method needs to be learned, sometimes through years of careful training, modulated by sceptical professors (who can notice patterns that look "too good to be true"). However, I would gladly have exchanged many of the specific details about this single case for more information about other cases, together with a global discussion of the factors that lead to such frauds. Are they caused by young people with inadequate training and supervision? Or by ambitious senior people desperately looking for an important prize and pushing their young partners to search for anomalies and "new physics", neglecting the importance of time-consuming validation checks? Are there branches of science where they are more frequent?

Reich was very meticulous and gives all sorts of details that interrupt the fluidity of the reading. She could have redesigned the narrative, avoiding some repetition, placed

the introductory text of chapter 9 (!) at the start of the book, and removed a few of the lines and paragraphs containing little information. Without an introductory chapter preceding the main plot and giving a broad overview of this field, most readers will lack the minimum background knowledge needed to appreciate the reported saga. As a side remark, it is curious to learn that Nobel laureate Bob Laughlin repeatedly claimed that Schön's results had to be fraudulent but his opinion "didn't count because he was known to be too sceptical".

Carlos Lourenço, CERN.

Perspectives on LHC Physics by G Kane and A Pierce (eds), World Scientific. Hardback ISBN 9789812779755, \$99/£55. Paperback ISBN 9789812833891, \$54/£30. E-book ISBN 9789812779762, \$129.

This book could hardly seem more timely, with the Large Hadron Collider (LHC) having started operations and new discoveries being eagerly awaited (but quite possibly a few years off yet). It consists of 17 chapters, each on a different topic, ranging from a description of the detectors to discussions of naturalness in quantum-field theories of particle physics.

The contributors are particle physicists, several of whom are prominent in the field. However, each chapter has different authors, so the result is inevitably a little patchy. The chapters differ widely in scope, in character and in the level of expertise assumed for the reader. For instance, the chapter on dark matter at the LHC is very basic and could be read by undergraduates, whereas the informative chapter on top physics is of a graduate level. There are also some much more general expansive essays, such as one that explores similarities between the BCS theory of superconductivity and particle physics, and the introductory chapter. The introduction assumes a fair amount of prior knowledge and is much too optimistic for my taste about the chance of discovering supersymmetry at the LHC. The author asserts that supersymmetry must be correct because of several pieces of circumstantial evidence, but I really think that other such a posteriori scraps could be used to prop up the evidence for competing theories.

There are a couple of obvious omissions, for example quark-gluon plasma physics and the ALICE detector. After all, the LHC will

spend some of its time providing collisions between heavy ions, rather than protons, and ALICE will be trying to divine the properties of the resulting soup of quarks and gluons. The other missing topic is that of diffractive physics. It is likely that both the ATLAS and CMS experiments will eventually have forward detectors to measure protons that have just grazed another one in a collision. Under certain theoretical circumstances, it is even possible to produce Higgs bosons in the central detector during these collisions. Such rare events could provide useful experimental constraints on the properties of Higgs bosons. The chapter about the ATLAS and CMS detectors is welcome, but it could benefit from some basics about how particles interact as they travel through matter. This important link in the logical chain is missing from the discussion.

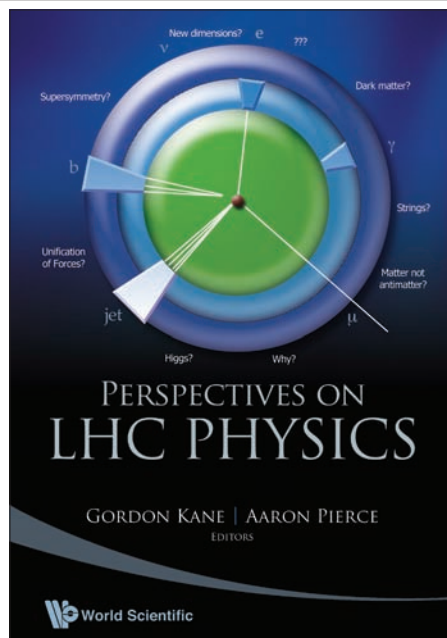
Perspectives on LHC Physics is a timely, heterogeneous offering, with some interesting gems and informative parts, as well as some fairly off-the-wall speculation. I think that there should be sections of it to interest most readers in the physical sciences, but that they may well wish to choose particular chapters to read. Luckily, the format of the book makes this easy to achieve.

Ben Allanach, DAMTP, University of Cambridge.

CP Violation (2nd edition) by I. I. Bigi and A. I. Sanda, Cambridge University Press. Hardback ISBN 9780521847940, £80 (\$160). E-book ISBN 9780511577284, \$128.

At the time of the first edition of this book, 10 years ago, the authors had, in their words, “ample reasons to expect imminent dramatic changes” in the land of discrete symmetries. With this second edition, they return to cover what has indeed happened since then. There was certainly drama in the sense of “action” on the experimental side and many of the players became better defined. Experiments at CERN and Fermilab have measured direct $\Delta S=1$ CP violation in K_L decays, with consistent results and a precision of a few percent, and the B factories have revealed the large CP asymmetries expected in the B sector. Also, precision measurements with the SNO, K2K and KamLAND experiments have opened the way to CP violation studies with neutrinos.

In this second edition, the authors include the new results and update the theoretical

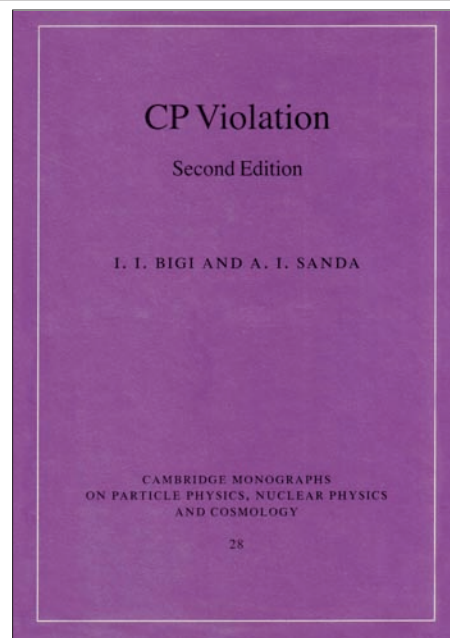


models. They indicate new directions in model building, in particular in the context of supersymmetry and extra dimensions, and are always attentive to questions that remain unanswered. Are there additional sources of CP violation? What happens in the lepton sector? What is the origin of the baryon asymmetry?

The structure of the book remains unchanged, consisting of three parts, slightly rearranged with respect to the first edition. Each chapter includes an introduction, a short summary and a number of problems (but no hints for solutions).

Part 1, on “Basics of CP violation”, follows a pedagogical style, leading from symmetry concepts in classical mechanics and electrodynamics to their translation to the domain of non-relativistic quantum mechanics, and subsequently to relativistic quantum theories. It is completed by two sections on the historical role of strange particles, in particular neutral kaons, in the discovery of CP violation and on the simple “master equations” of time evolution.

In Part 2, “Theory and experiments”, the authors deal with decays, i.e. the directly observable phenomena. This starts with details of the phenomenology related to kaons and the latest experimental results. It leads, via a history of the Standard Model, to the Kobayashi-Maskawa ansatz and the need for at least three families. It is here, in chapter 10, that the forecasts of the first



edition are shown to materialize, with the experimental opportunities offered by B physics. The late 1990s saw the construction of the asymmetric B factories and finally in 2001 the demonstration of CP violation, with a multi-standard-deviation effect, for the first time outside the kaon domain, in four decay channels.

A glimpse beyond the Standard Model forms the content of Part 3, starting with a quest for CP violation in the neutrino sector and possible corrections to the current paradigms. It then leads on to top quarks and charged leptons, supersymmetry, minimal flavour-violation and extra dimensions, and baryogenesis in the universe.

Part 4 consists of only one chapter. Here, in their dashing style at its best, the authors recall that CP violation represents “a profound intellectual insight” that also has “many and far-reaching concrete consequences”. Although the three-family Standard Model can implement CP violation through the KM mechanism, we have not yet reached an understanding of it, for we are left with the mysteries related to the quark mass matrices. After looking back to the successes of the past, the authors advance an “Agenda for the future”. Happily (from the point of view of an experimentalist) this agenda covers many different experimental fields, so there will be no shortage of work.

The cut of the book is theoretical but is suitable and stimulating for an

experimentalist, showing rigour and insight. The authors concede that it does not make easy reading and more than one reading may be necessary. Sometimes other sources (quoted as references) may also be needed. Some lack of precision in the historical details could have been avoided, and the bibliography would gain from a less casual presentation. The tone is friendly, however, even if the jocular comments are occasionally puzzling. The reader is shown how to see the CP "wood" among the "trees" of phenomenological details, without missing anything of importance.

Maria Fidecaro, CERN.

Books received

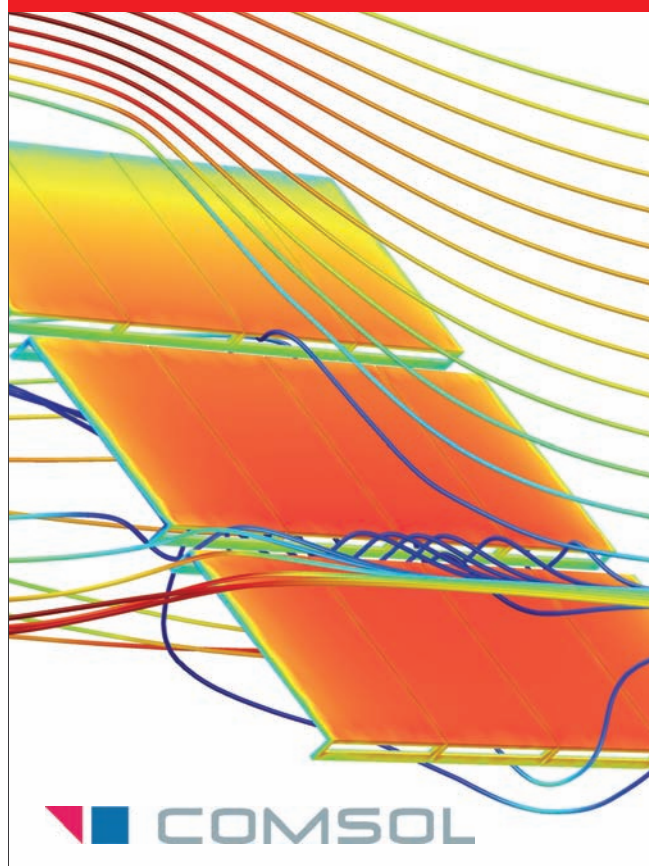
Principles of Radiation Interaction in Matter and Detection (2nd edition) by Claude Leroy and Pier-Giorgio Rancoita, World Scientific. Hardback ISBN 9789812818270, £112 (\$191). Paperback ISBN 9789812818287, £61 (\$104).

This book addresses the fundamental

principles of interactions between radiation and matter and the principle of particle detectors in a range of fields, from low to high energy, including space physics and the medical environment. It provides abundant information about the processes of electromagnetic and hadronic energy deposition in matter, detecting systems, and the performance and optimization of detectors. In this second edition, new sections dedicated to the following topics are included: space and the high-energy physics radiation environment, non-ionizing energy loss, displacement damage in silicon devices and detectors, single-event effects, detection of slow and fast neutrons with silicon detectors, solar cells and pixel detectors. This book will be of use to students as a reference for courses in particle, astroparticle and space physics and instrumentation, as well as researchers dealing with instrumentation in particle physics. Part of it is directed toward courses in medical physics.

Of Matter and Spirit: Selected Essays by Charles P Enz, World Scientific. Hardback ISBN 9789812819000, £48 (\$83).

The essays selected for this book comprise ideas presented in oral or written form between the years 1972 and 2000, some of which were originally given in French or German. They are preceded by a biographical and topical introduction. As the title suggests, one major theme of the essays collected here is the material world, which is viewed in its extreme spatial extensions of the universe and of the elementary particles. In particular, the fascinating notion of the void and its fluctuating energy is the subject of various discussions, as is the subdivision of material bodies and its limits. The latter, as well as the limit of gravitational stability, are depicted in a diagram leading to the ultimate point of the Planck mass and length. The other topic of the title is the spiritual realm and here the book's content is based on reflections and quotations from various religious texts.



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