

BOOKSHELF

The Global Approach to Quantum Field Theory by Bryce DeWitt, Oxford University Press (vols I and II). Hardback ISBN 0198510934, £115 (\$230).

It is difficult to describe or even summarize the huge amount of information contained in this two-volume set. Quantum field theory (QFT) is the more basic language to express the fundamental laws of nature. It is a difficult language to learn, not only because of its technical intricacies but also because it contains so many conceptual riddles, even more so when the theory is considered in the presence of a gravitational background. The applied field theory techniques to be used in concrete computations of cross-sections and decay rates are scarce in this book, probably because they are adequately explained in many other texts. The driving force of these volumes is to provide, from the beginning, a manifestly relativistic invariant construction of QFT.

Early in the book we come across objects such as Jacobi fields, Peierls brackets (as a replacement of Poisson brackets), the measurement problem, Schwinger's variational principle and the Feynman path integral, which form the basis of many things to come. One advantage of the global approach is that it can be formulated in the presence of gravitational fields. There are various loose ends in regular expositions of QFT that are clearly tied in the book, and one can find plenty of jewels throughout: for instance a thorough analysis of the measurement problem in quantum mechanics and QFT, something that is hard to find elsewhere. The treatment of symmetries is rather unique. DeWitt introduces local (gauge) symmetries early on; global symmetries follow at the end as a residue or bonus. This is a very modern point of view that is spelt out fully in the book. In the Standard Model, for example, the global symmetry (B-L, baryon minus lepton number) appears only after we consider the most general renormalizable Lagrangian consistent with the underlying gauge symmetries. In most modern approaches to the unification of fundamental forces, global symmetries are quite accidental. String theory is an extreme example where all symmetries are related to gauge symmetries.

There are many difficult and elaborate technical areas of QFT that are very well explained in the book, such as heat kernel expansions, quantization of gauge theories, quantization in the presence of gravity and so on. There are also some conceptually difficult and profound questions that DeWitt addresses head on with

authority and clarity, including the measurement problem mentioned previously and the Everett interpretation of quantum mechanics and its implications in quantum cosmology. There is also a cogent and impressive study of QFT in the presence of black holes, their Hawking emission, the final-state problem for quantum black holes and a long etcetera.

The book's presentation is very impressive. Conceptual problems are elegantly exhibited and there is an inner coherent logic of exposition that could only come from someone who had long and deeply reflected on the subject, and made important contributions to it. It should be said, however, that the book is not for the faint hearted. The level is consistently high throughout its 1042 pages. Nonetheless it does provide a deep, uncompromising review of the subject, with both its bright and dark sides clearly exposed. One can read towards the end of the preface: "The book is in no sense a reference book in quantum field theory and its applications to particle physics...". I agree with the second statement but strongly disagree with the first.

Luis Alvarez-Gaume, CERN.

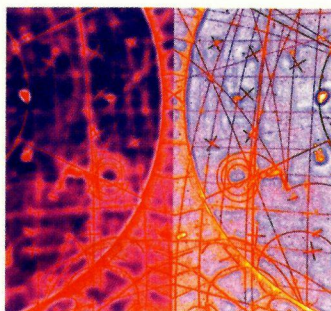
Standard Model. More recently, the beautiful phenomenon of neutrino oscillations has demonstrated that the Standard Model needs to be enlarged to account for neutrino masses. In a nutshell, neutrinos are in the spotlight.

For this reason it is very pleasant to see one of our colleagues undertake to communicate to a broad public his enthusiasm and excitement for these particles that are so hard to detect. The "mirror" through which Vannucci invites us to discover these neutrinos is, in the end, that of his own personality. The reader finds a typically French character, profoundly cultured, who revels in the company of literary quotes that mirror his thoughts and that enrich them with a touch of melancholic beauty. Marcel Proust and Oscar Wilde top his favourite author's list, which extends from Saint Augustine to Daniel Pennac, via Jean-Paul Sartre and the medical dictionary. Sometimes a school-boy's wink, and often a sensuous shiver, express themselves through these quotations, which is testimony to the fact that science speaks not only to the brain but also the heart. I am not sure that I have grasped what these quotations are supposed to explain, but they certainly carry a form of emotion.

The book tells the story of neutrinos, at a level that is meant to be accessible to pupils in the final years of high school (15–18 years old), as well as scientifically cultivated adults. It begins with a discussion of perception and detection, first of ordinary objects and then of particles. Then we arrive at Pauli and his "radioactive ladies and gentlemen", followed immediately by UA1 and the discovery of the W. (Sartre and Le Verrier are quoted...but no word of Carlo Rubbia. This will soothe the feelings of all those who felt they should have appeared.) Then we go back to the experiments to measure the neutrino mass followed by neutrinoless double-beta decay, and the detection of the first neutrino interactions by Fred Reines. As one can see, the experiments that have established the properties of neutrinos are listed thematically and not necessarily historically, something that I appreciated.

With occasional irony towards his colleagues (or himself?), Vannucci takes us around the experiments that made history in neutrino physics; those that were right and those that were wrong, those that made us understand and those that got us confused. This is followed by a discussion on uncertainties and the scientific method. I am not sure I agree fully when what we don't know yet but are striving to know and will hopefully understand ("the big

FRANÇOIS VANNUCCI LE MIROIR AUX NEUTRINOS



Le miroir aux neutrinos (The Neutrino Mirror) by François Vannucci, Odile Jacob. ISBN 2738113311, €23.50.

Neutrinos have excited scientists since 1930 and have allowed some important discoveries: Gargamelle's 1973 observation of neutral currents in fact constituted the first manifestation of the Z boson, and as such marked the experimental foundation of the

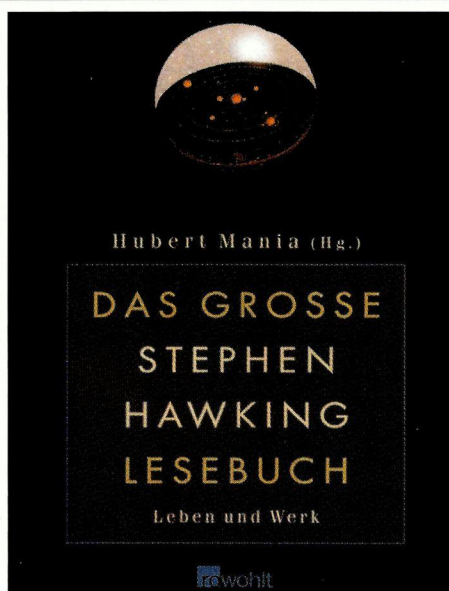
bang cannot be considered a physical event"), is compared with medieval legends ("angels, archangels and cherubim of the middle ages"). However, do read carefully and you will find the definition of the "miroir aux alouettes", which inspired the title of the book and is taken from a quotation in...a dictionary.

It is not obvious for whom this book is best suited. For whom would I buy it? It seems more for our fathers – and mothers – or our colleagues than for teenagers, who may be discouraged by the unlikely mix of literature and science.

Alain Blondel, Geneva University.

Das große Stephen Hawking Lesebuch, Leben und Werk (The Big Stephen Hawking Reader) by Hubert Mania (ed.), Rowohlt Verlag. Hardback ISBN 3498044885, €17.90.

The Big Stephen Hawking Reader includes excerpts from books written by Hawking, as well as information about his life and work. This naturally divides the book into two parts: the first half is a short biography of Hawking interspersed with sections explaining



the basic physics of his work. In this way it not only introduces Hawking himself, but also his thoughts and ideas.

Mania admits in the prologue that he wrote the biography from a "respectful distance",

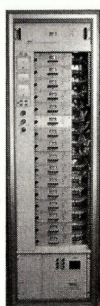
honouring Hawking's wish to be remembered for his work and not his "involuntary presence in the gossip columns". Because of this, Mania sometimes leaves out things that could shed a less favourable light on Hawking. For example, Hawking's treatment of his first wife is only mentioned very briefly. Nevertheless there are some nice anecdotes about Hawking, such as when he was thinking about *A Brief History of Time*. "If he was going to neglect his research to write a popular book, then it should be profitable for him."

The second half of the book is made up of excerpts from *A Short History of Time*, *The Illustrated Short History of Time* and *Einstein's Dream*. The chapters are well chosen and understandable with the help of Mania's comments.

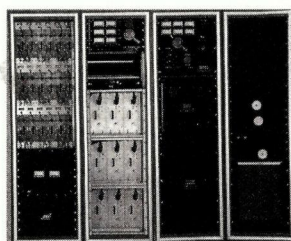
Even if Mania's book is sometimes a little sketchy, I enjoyed reading it and would recommend it to anyone who wants a short introduction to Stephen Hawking's life and work – and it whets the appetite for more books about and by this well known scientist. Hannelore Hammerle, CERN.

RF Amplifiers

QEI Corporation will design and manufacture to your RF Amplifier needs. Our 30 years of experience allows us to work with you to complete your requirements. Whether you require solid state or tube, air or water cooling, CW or pulse, LF to UHF, we can meet your needs. To discuss your project, contact QEI at 800-334-9154 (USA), 1-856-728-2020 (International), or via e-mail at qeisales@qei-broadcast.com.



8KW, 200MHz, CW, Water Cooled, Solid State RF Amp



65KW, 200MHz, CW, Single Tetrode RF Amp



QEI Corporation • One Airport Dr • PO Box 805 • Williamstown, NJ 08094 USA • 800-334-9154 (USA)
1-856-728-2020 (International) • qeisales@qei-broadcast.com (e-mail) • <http://www.qei-broadcast.com>

SUPPLIER INFORMATION



Janis Research Company Inc

Pulse Tube Cooled 4 K Closed Cycle Refrigerator Systems

With a base temperature of <5 K (1.5 K optional) and an ultra-low vibration design, these systems are ideal for samples with low thermal conductivity. The top loading sample chamber is mechanically isolated from the cryocooler cold stages. The sample is in helium gas for fast sample exchange. High temperature options available.

Janis Research Company Inc, 2 Jewel Drive,
PO Box 696, Wilmington, MA 01887-0696, USA
Tel: +1 978 657 8750
Fax: +1 978 658 0349
E-mail: sales@janis.com
Web: www.janis.com

SUPPLIER INFORMATION

- Do you want to promote your latest catalogue?
- Have you recently upgraded your company website/ or do you just want to increase the traffic?
- Have you had a new product launch that you want to continue to promote?

If you have answered YES to one or more of these questions, you should reserve your space on the Supplier Information page.

FOR ONLY £625, 50 WORDS OF TEXT AND AN IMAGE (OF YOUR HOMEPAGE, LATEST CATALOGUE OR NEW PRODUCT) CAN APPEAR ON THE NEXT SUPPLIER INFORMATION PAGE.

Call Jonathan Baron or Edward Jost on +44 (0)117 930 1265 or +44 (0)117 930 1026, respectively, to be included.