

Bookshelf

ing. There, two-photon physics potential includes the production of heavy flavours, violent electron-photon scattering, and jet production. This work has many theoretical implications.

The final part of the meeting was given over to the prospects offered by a future linear electron collider of very high energy (some 500 - 1000 GeV total energy). This type of machine would be used either as such, or after conversion into a photon-photon or a photon-electron collider. Such a conversion would use Compton back-scattering of either or both electron beams on a laser, yielding a photon beam of approximately the same energy and intensity as its "parent" electron beam. Each of these three options has its own physics implications.

With the non-electromagnetic behaviour of the photon still little understood (September 1993, page 22), the meeting showed how increased luminosity from new machines would open up a more systematic study of the interactions of highly virtual photons.

Conceptual Foundations of Modern Particle Physics, by Robert E. Marshak (World Scientific, ISBN 98 102109 81)

Particle physics really began as an independent scientific discipline after the Second World War. Robert Marshak was one of its pioneers on the theoretical front, starting out his career with important contributions on meson theory (together with Hans Bethe). The life of Marshak, who died in December 1992, was intimately interwoven with the post-war development of particle physics. His work on weak interaction theory was an important step towards the formulation of the V-A theory, the main pillar on which the modern electroweak theory rests erected. He is also remembered as the founder of the biennial 'Rochester' conference series (March 1993, page 24).

Just before his death Robert Marshak finished writing his book on the concepts of particle physics. The book starts out with an historical account of the development of the field. He divides it into the startup period (1945-60) - the period of meson physics, the physics of strange particles, parity violation etc; the heroic period (1960-1975) when the Standard Model of the electroweak and strong interactions was developed; and finally the period of consolidation and speculation (since 1975).

Marshak's recollection of the development of particle physics represents a personal view, worth reading by young researchers, although it does not attempt to provide a complete picture.

After the historical chapter Marshak introduces the reader to the basics of quantum field theory (space-time symmetries, global internal symmetries and their breaking, gauge symmetries). Later he turns to a description of QCD and the gauge theory of the electroweak interactions. A whole chapter is devoted to the problems related to anomalies.

In the last part of the book Marshak discusses various hypotheses of unifying the strong and electroweak interactions, especially the various facets of the SO(10) theory, followed by a long discussion of the fermion generation problem and of preon models. The book concludes with an extensive description of topological effects in gauge theories (instantons, solitons, index theorems etc.).

Marshak's book cannot be regarded as a textbook, but rather a personal account of the theory of elementary particles, given by one of its founders. The first part of the book, fairly easy to read, could also be used as an introduction to the theory of elementary particles. On the other



Particle physics pioneers Robert E. Marshak (left, 1916-1992) and Maurice Goldhaber. Marshak completed his book 'Conceptual Foundations of Modern Particle Physics', now available from World Scientific, just before he died.

Leon Van Hove - scientific highlights

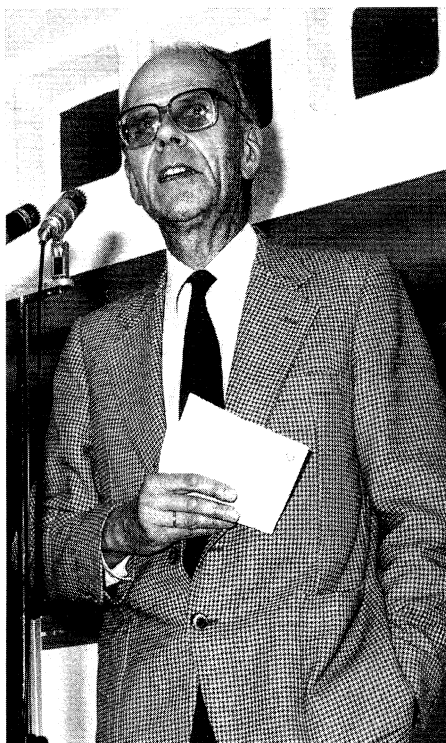
hand the second part is rather specialized and is suitable only for experts in particle theory, searching for theory beyond the Standard Model. It could be that this part constitutes, as T.D. Lee writes in his introduction, "a legacy that will impact on the course of the future development of particle physics".

Harald Fritzsch, University of Munich

Scientific Highlights in Memory of Leon Van Hove, Edited by F. Nicodemi (World Scientific, ISBN 98 102139 99 1)

This book collects the contributions for a meeting in October 1991 in Naples under the auspices of the Istituto Italiano per gli Studi Filosofici to commemorate the life and scientific achievements of Leon Van Hove, distinguished theorist and CERN Research Director General from 1976-80, who died in 1990. The articles span Van Hove's scientific contributions and his involvement in European scientific policy and education.

His early scientific work, with contributions to mathematics, statistical mechanics and neutron physics, is covered by A. Messiah and L. Michel, with an appraisal by A. Martin. Among Van Hove's best known research papers is his analysis of neutron scattering data to explore the structure of dense systems and magnetic materials in terms of pair correlation functions. This and its later applications are reviewed by A. Messiah, who also collects some interesting memorabilia from the years they spent together at Princeton, where Van Hove also had a fruitful collaboration with G. Placzek.



L. Michel undertakes the task of explaining in its full generality the predictions of Van Hove singularities in the phonon dispersion relation for periodic systems. The functional relation between the frequency and wave vector characterizing elastic waves in crystals plays a central role in the explanation of their thermodynamic, acoustic and optical properties. The existence of these singularities was a consequence of applying a beautiful mathematical theory of M. Morse to physics. Van Hove derived his results by showing that they were inevitable consequences of the global topology of the first Brillouin zone of the periodic lattice. This pioneer work used powerful global analysis techniques to unravel concrete physical properties.

For this impressive body of achievement, together with his study of low dimensional phase transitions and

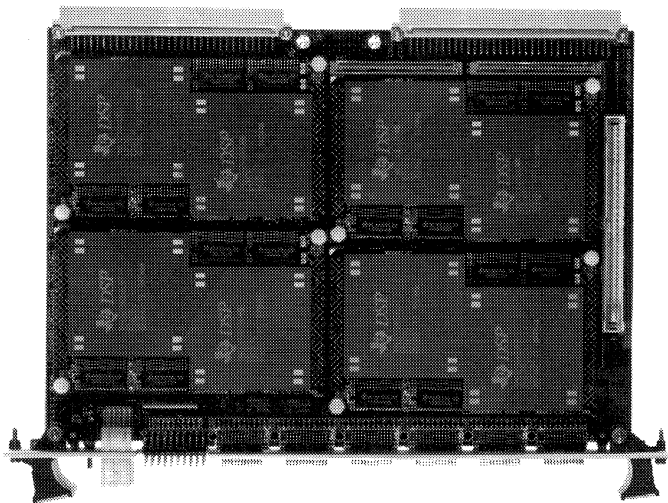
non-equilibrium statistical mechanics, he was awarded the prestigious Danny Heinemann Prize of the American Physical Society.

Although during his years in the US he had already worked on high energy physics themes, on his arrival at CERN he became more concerned with these problems (as A. Martin reminds us): Coulomb effects in pion-nucleon scattering, generalized Pomeranchuk theorems, high energy consequences of the quark model, etc.

In later years he became interested in multiparticle production, multiplicity distributions in hadronic final states, the quark-gluon plasma and the deconfining transition, the negative binomial distribution, simplified parton shower models, etc. These topics, his contributions and consequences are reviewed by A. Giovannini. These subjects were dear to Van Hove, providing in his own words "a meeting ground between particle and statistical physics, a dialogue between theory and experiment."

The purely scientific contributions to this volume also include articles on hierarchical structures (E.R. Caianello), magnetic translation groups (S. Fubini), the fundamental symmetries of string theory (G. Veneziano), and electron holography (by Van Hove's son Michel).

The remaining articles describe Van Hove's impressive contributions to scientific policy. As Research Director General of CERN he played an important, active, and inspiring role in shaping the future of the Laboratory. His interest and contributions to the SPS and LEP programmes are reflected in articles by E. Picasso (LEP: A Big European Project) and F. Bonaudi (The Antiproton Saga at CERN: 1976-1984). These projects, which helped



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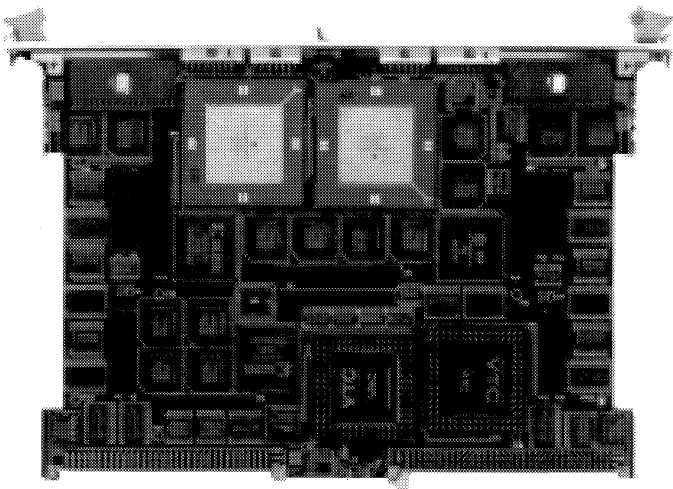
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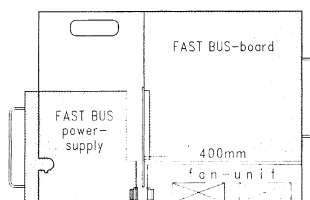
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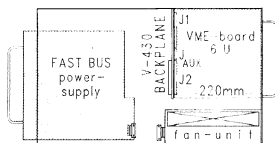
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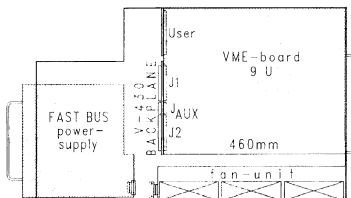
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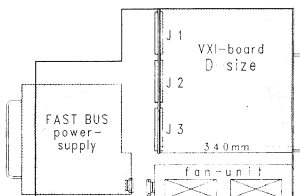
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Around the Laboratories

lead Europe back to world high energy physics supremacy, are among the finest examples of the impact of international cooperation in basic science. The fascinating story of the conception, construction and achievements of these projects are skilfully (and delightfully) told.

We also learn of Van Hove's activities in the European Space Agency (R. Bonnet), the Max Planck Institute (where he was director after Heisenberg retired in 1971), the European Joint Research Centre (J.P. Contzen) and the European Science Foundation (J. Goormaghtigh). These articles portray a man deeply committed to the advancement and teaching of science. He was aware very early of the social accountability of scientists in modern times, and he played an active role in making sure that political decisions regarding the funding of science should be in harmony with the critical judgement of leading scientists. Consensus in the scientific community is a crucial ingredient towards the successful completion of a big project.

Throughout the book we glimpse the strong personality of this remarkable European, with his deep and eclectic knowledge of physics, his social awareness, his high standards as a scientist and as a human being, and his unfailing commitment to fostering science and international relations.

The book ends with the moving words of his wife Jenny, and the complete transcript of an interview with V. de Alfaro in 1989 on the fascinating discussions Van Hove had with Einstein at Princeton. To find out what Einstein told the young Van Hove, read the book.

Luis Alvarez-Gaume, CERN

International collaboration

In the remarrying of particle physics effort and resources in the aftermath of the decision last October to cancel the US Superconducting Supercollider (SSC), CERN's LHC project for a proton-proton collider in the 27-kilometre LEP tunnel continues to provide an international focus.

In the US, the 'Future Vision' subpanel chaired by Sid Drell has had several meetings and continues to receive input. So far, collaboration with CERN in work towards the LHC accelerator and its detectors is seen as providing a window of opportunity for US scientists while capitalizing on the valuable progress made for the SSC. At the same time, adequate funding should be assured so that all current US projects in the pipeline get completed.

On the other side of the world, a major meeting between Indian and CERN scientists took place in Bombay from 7-9 March to discuss in detail Indian participation in LHC. CERN was represented by Research Director Walter Hoogland and Particle Physics Experiments (PPE) Division Leader Jim Allaby, together with several senior scientists from the CMS and ALICE experiment collaborations and from the LHC machine group.

On the Indian side, participants included R. Chidambaram, Chairman of the Atomic Energy Commission, V. Singh, Director of Bombay's Tata Institute of Fundamental Research, A.N. Prasad, Director of the Bhabha Atomic Research Centre, Bombay, D.D. Bhawalkar, Director of the Centre for Advanced Technology, Indore, V.S. Ramamurthy, Director of the Institute of Physics, Bhuban-

eshwar, and Bikash Sinha, Director of the Variable Energy Cyclotron Centre, Calcutta. In all, there were nearly 60 Indian participants.

Several talks covered CERN activities, the physics expected from the CMS and ALICE detectors, various programmes in the framework of the Detector Research and development Committee (DRDC), and the status of the LHC machine. High energy accelerator-based activities in India in electron-positron, proton-antiproton and heavy-ion interactions were summarized by Indian scientists, as were developments in accelerator technology at the Centre for Advanced Technology and the Bhabha Atomic Research Centre.

The discussions revealed great enthusiasm and interest of the Indian high energy physics community in contributing significantly to all facets of CERN's LHC programme.

A cooperation agreement between CERN and India's Department of Atomic Energy (DAE), encompassing scientific and technical cooperation in CERN research projects was signed in 1991. The aim of the recent meeting was to extend this cooperation to include Indian participation in LHC and the necessary protocol is being prepared.

CERN LEP from one year to the next

In the cold light of January and the traditional winter machine shutdown, CERN's LEP electron-positron collider team traditionally reviews the