

From the Preshower to the New Technologies for Supercolliders edited by Björn H Wiik, Albrecht Wagner and Horst Wenninger, World Scientific. Hardback ISBN 9812381996, £53 (\$78).

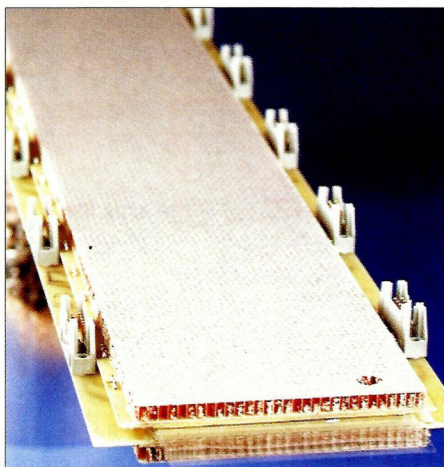
In 2000, the city of Bologna was the European Capital for Culture. To mark the occasion the University of Bologna and its Academy of Sciences published the achievements of their most distinguished members in the field of science and technology. This collection acknowledges the contributions of Antonino Zichichi and his colleagues in the development of experimental techniques that have contributed to the discovery of new particles and phenomena in the field of high-energy physics.

The collection was originally prepared by Björn Wiik, who at the time was director of DESY. After Wiik's untimely death in 1999, Albrecht Wagner, Wiik's successor, continued and completed his work, with the help of Horst Wenninger of CERN.

In his introduction Wiik recalls how in the early 1960s, when the dominant detector was the bubble chamber and the dominating field of interest was the physics of hadrons and neutrinos, Zichichi started to study the unfashionable topic of lepton-pair production in hadronic interactions. During the 1960s and early 1970s, Zichichi and colleagues, mainly working at CERN, developed a number of techniques to help in the problem of particle identification. This foresight was vindicated with the discovery in 1974 of the J/Ψ particle. The "pre shower" technology was essential to this discovery. In fact, this early emphasis on the development of innovative detection techniques continued to be one of Zichichi's main scientific motivations.

The first section of this collection contains the major contributions from Zichichi and his co-workers on the development of three techniques that have come to be widely used in high-energy physics experiments: the "early shower development" method (universally used and now called the "pre shower" method), the study of range curves for high-energy muons in order to discriminate against pion penetration ("muon punch-through method"), and the "lead scintillator sandwich telescope" – the precursor of today's calorimeters.

In the second section there are original papers by Zichichi and colleagues on high-precision time-of-flight (TOF) counters and the neutron missing-mass spectrometer technique.



The ALICE experiment at the LHC will use multigap resistive plate chambers (MRPCs) like this in its time-of-flight (TOF) system. The MRPC is a stack of resistive plates that define a number of independent gas gaps (10 in the case of the ALICE TOF), allowing full detection efficiency and excellent time resolution (< 50 ps). This device was developed by Crispin Williams et al. within the framework of the LAA project detector R&D initiated by Antonino Zichichi.

This section also includes an extract of a paper by Federico Palmonari on the AMS experiment. This experiment uses a TOF system that relies heavily on the early work of Zichichi and his colleagues at Bologna and CERN.

The third part of the collection describes the achievements of the LAA project. This was initiated by Zichichi, funded by the Italian government and implemented at CERN in 1986. The goal of the project was to prove the feasibility of a series of detector technologies that could be used in a future multi-TeV hadron collider. Zichichi had long promoted the construction in his native Sicily of a very high-energy hadron collider, the "Eloisatron", with a collision energy of 200–1000 TeV and luminosities of up to $10^{36} \text{ cm}^{-2} \text{ s}^{-1}$. The machine parameters that served as a basis of the LAA project were those of a 10% model of the Eloisatron, surprisingly close to those of the LHC. The book reproduces the CERN report by Zichichi on the main achievements of the LAA project. All aspects of detector layout were considered in the project and, in view of the demands of the machine, special attention was paid to radiation hardness, rate capability, hermeticity and momentum resolution of the detector assemblies.

From 1990 to 1996 the LAA was transfor-

med into the CERN Detector R&D. The fourth section is a review by Wenninger of the impact of the results from these two programmes on the design of the LHC detectors. Although the solutions adopted for the LHC may differ from those studied at the LAA, Wenninger argues convincingly that the initial work had a great influence and measurable impact on the design of the present LHC detectors.

Through this collection of papers, which touch only on one aspect of his work, Zichichi emerges as a person highly motivated by the development of experimental techniques to meet the challenges of future high-energy particle-physics experiments. The early work carried out directly by Zichichi and colleagues and the later LAA work that he inspired have certainly had a significant and continuing influence on particle detector design.

Mike Price, CERN.

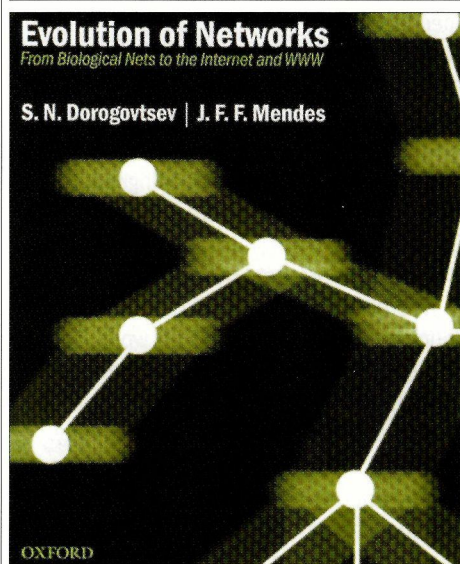
Evolution of Networks: From Biological Nets to the Internet and WWW by

S N Dorogovstev and J F F Mendes, Oxford University Press. Hardback ISBN 0198515901, £49.95 (\$95).

Imagine some collections of diverse objects: autonomous systems on the Internet, pages on the World Wide Web, neurons, genes, proteins, citations of scientific publications, the words in a human language, etc. Is it not fascinating that the graph-based abstractions of these different systems reveal that certain qualitative relationships among the objects remain invariant from one system to another? For instance, it was found that in a graph of the protein interactions of the yeast *S. cerevisiae*, the number of nearest neighbours follows a power-law distribution just as in a graph of the pages on the World Wide Web.

This book is an introduction to the exciting area of networks modelled as random graphs. The authors describe some fundamental structural properties of these graphs, and give a tour through a variety of real-world examples. They explain the underlying mechanisms that drive the evolution of graphs over time, and discuss the impact that a structural property of a graph may have on performance issues such as virus spreading and network connectivity.

As Dorogovstev and Mendes put it, this book was written by physicists but is aimed at a broader audience. The technical developments are kept at a low level, so no particular prerequisites are needed to follow them, and the authors present timely examples that



cover the broad scope of the book.

The first chapter gives definitions of basic metrics that characterize a graph. The next chapter is devoted to exposing the preferential linking, a principle that, for instance, explains the emergence of the power-law distribution of the number of nearest neighbours of a vertex in a graph. The book proceeds with a discussion of a broad set of network examples, including scientific literature, communication systems and biological systems. In the subsequent two chapters, the authors separately cover equilibrium and non-equilibrium networks. The chapter on equilibrium networks analyses the stochastic recursive evolutions that drive a random graph to its steady state (equilibrium). A standard example in this context is the construction of a random graph by Erdos and Renyi. The chapter on non-equilibrium networks focuses on temporal aspects, especially the evolution of some probability measures of a graph over time. The book continues with a chapter on the global properties of graphs and their effect on performance. The authors end with appendices including some mathematical content and a detailed bibliography on the graph literature.

The exposition of the book is very pedagogical. Instead of rushing to examples, the authors first introduce readers to important elementary notions. After motivating the problems through well-chosen examples, they delve into specific subjects in detail, and the fundamental principles are unveiled in a suitable manner. There is, however, a certain imbalance in the lengths of different chapters.

This book should benefit readers who seek to gain an insight into the fundamental principles that underlie the random graphs found in diverse scientific disciplines.

Milan Vojnovic, EPFL.

Weep for ISABELLE – a rhapsody in a minor key by Mel Month, Avant Garde Press. ISBN 1410732533, \$28.95.

This book attempts to unravel a complicated politico-scientific tapestry, but in trying to unpick some tricky knots it creates a few new tangles of its own. In 1982 the US high-energy physics community organized a meeting at Snowmass to look at the future of national high-energy physics. After riding the crest of a wave for 30 years, the community felt in danger of falling into deep water.

Across the Atlantic, CERN's proton-antiproton collider had not yet discovered the W and Z carriers of the weak nuclear force, but the writing on the wall was clear (the crucial discovery came in 1983).

The US community was pushing for an ultra-high-energy proton collider to probe a distant energy frontier and search for the "Higgs mechanism" – which drives the subtle electroweak symmetry breaking and ensures that the weak W and Z carriers are much heavier than the massless photon that mediates electromagnetism. Thus Snowmass helped paint the wagon for the US Superconducting Supercollider (SSC), which was to emerge as the nation's bid to regain particle-physics superiority. But by 1993 the global financial climate had cooled and the SSC was sacrificed, leaving the field clear for CERN's LHC to become the world focus for high-energy physics.

Among those at Snowmass in 1982 was Mel Month of the Brookhaven National Laboratory and founder of the US Particle Accelerator School. One lunchtime, Month blurted out his views on the current US physics scene. These innocent remarks were not meant for general consumption, but bosses have long ears and there was an abrasive run-in. Month's career then became slow-tracked. A heavy chip on the shoulder can be difficult to offload. To help, Month compiled this 600-page book, in which he portrays himself as "Mickey", a highly motivated but politically naive young Brookhaven researcher.

The first half of the book depicts the evolution of particle physics in the second half of the 20th century as seen through Brookhaven eyes. Brookhaven was the site of major post-

war US high-energy machines, which from 1960 to 1975 made many discoveries and reaped an impressive Nobel harvest. But as the US continued to disperse its high-energy physics effort, Brookhaven began to lag behind in this research sector. Its contender, the ISABELLE proton collider, was overshadowed by other US plans and hampered by difficult technology for superconducting magnets to guide its high-energy protons. Eventually ISABELLE had to make way for the new SSC, and Brookhaven looked to have missed the boat. (Ironically, when the SSC was finally cancelled, ISABELLE was reincarnated as the RHIC high-energy nuclear collider now in full swing at Brookhaven.) The laboratory's stock tumbled further in the 1990s with unwarranted scaremongering of a tritium leak from its nuclear reactor.

The evolution of particle physics as seen from Brookhaven is a little like the British view of Europeanism – interesting but distorted because of evolved isolation. Month attributes blame, while his skewed overview brings some fresh insight and provides some vivid quotes: "Always the bridesmaid and never the bride", referring to CERN's early history; and for the SSC, "Like Lady ISABELLE a decade earlier, this dressed-to-kill damsel turned out to be a flash in the pan".

The survey would be more valuable with a detailed index to help track through the intricate history. However, as the book calls itself a "historical novel", none is supplied. The "novel" content is mainly confined to the second half of the book, where Month imagines Mickey interviewing the "Players", the major characters in the book, most of whom are ex-Brookhaven management.

The book is difficult to read without an insider's knowledge of particle physics. In the very first paragraph, BNL (for Brookhaven National Laboratory) appears without explanation, the first of much in-your-face shorthand, not all of which gets sorted out in the glossary. There are also some inaccuracies, such as: "1993 – Rubbia forced to resign as CERN director-general".

In the push and shove of ruthless competition, most people experience at some time the bitterness of career injustice. These unpleasant episodes can be sublimated into fresh motivation, or simply filed. This book looks to have been a catharsis for Month, but does so much subjective detail need to be displayed? *Gordon Fraser, Divonne-les-Bains.*

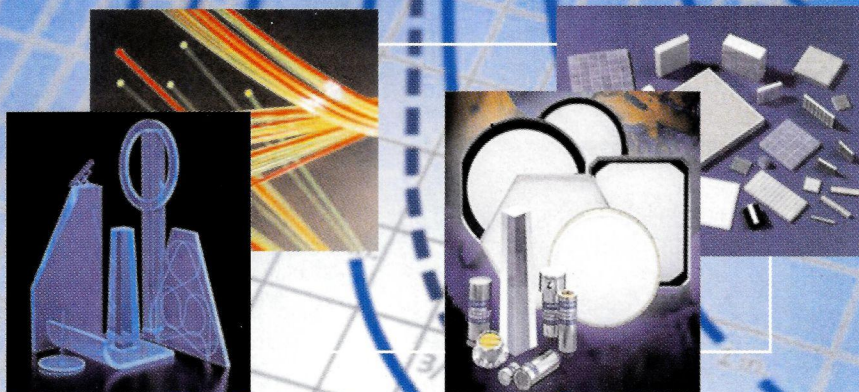
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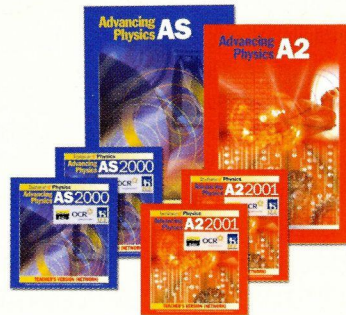
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