

A HIGH-LEVEL POPULARIZATION OF HIGH-ENERGY PHYSICS THEORY

The Tenth Dimension: An Informal History of High Energy Physics

Jeremy Bernstein
McGraw-Hill,
New York, 1989. 164 pp.
\$9.95 pb ISBN 0-07-005017-1

Reviewed by Robert March

The Tenth Dimension is an excellent book, with a somewhat misleading title and subtitle.

First, it would be more appropriate to call this book a history of high-energy theory. Though the worth of any experiment in a fundamental field is quite properly judged by how much it advances our theoretical understanding, experimental programs at accelerator laboratories are driven in large measure by technical rather than theoretical considerations. Any history organized around the advance of theory will necessarily give a distorted view of the experimental side.

The word "informal" in the subtitle might also prove deceptive. On the one hand, it may be taken as the antonym of "scholarly," since the book is devoid of footnoted references. But it is certainly not a synonym for "popular," except in a sense broad enough to encompass *Scientific American*. Although with its prodigious display of Feynman diagrams *The Tenth Dimension* is at a somewhat higher technical level than that publication, it remains quite easy to read.

It is important to make this clear so that those familiar with the works of Jeremy Bernstein will not be misled. He is celebrated as a gifted popularizer of physics, having honed his art for

more than two decades on a highly literate but mostly scientifically untrained audience, the readers of *The New Yorker*. *The Tenth Dimension* is for a different sort of audience. It will appeal mainly to physicists and other professional scientists, though it should be accessible to the very astute lay reader who follows the field with some care.

A third possible deception lurks in the title itself, which clearly derives from superstring theory. That theory receives only a brief and sketchy mention, in the closing pages of the book. Bernstein's principal focus is on the solidly established body of theoretical concepts that has come to be known as the "standard model"—the quark model with electroweak unification, quark-lepton symmetry and quantum chromodynamics.

The book is organized by topics, rather than in a linear chronology. It opens with a "teaser," the story of the discovery of supernova 1987a and the detection of its neutrinos in two large proton-decay Čerenkov detectors. It then moves in turn to weak and strong interactions, parity and CP violation, symmetry groups and the quark model, quantum chromodynamics, electroweak unification and the implications of all of the aforementioned for cosmology and higher unifications. As a result, Ernest Rutherford bows in only midway through the narrative, when he is needed to provide a context for the tale of the struggle to understand how neutrons and protons might be shown to have parts when those parts stubbornly refused to appear in the free state. This choice of organization is one of the factors that will make this book difficult for anyone totally new to the subject; at times it is hard to see where Bernstein is going unless you know the rest of the story. On the other hand, this approach does permit a more coherent development of the theory than a strict chronology would allow.

This said, it must be emphasized

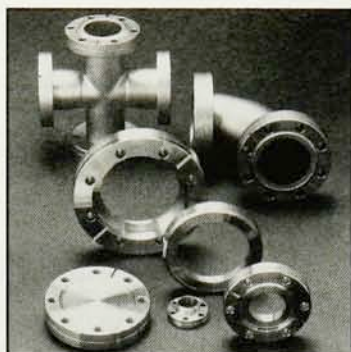
that this is a superbly informative history. One gets a vivid image of the confusion, misinterpretation and occasional despair that accompanied the fitful and uneven progress toward a final understanding. Bernstein makes no attempt to tidy things up. He lets us know of loose ends like the Cabibbo angle, which served its purpose in advancing electroweak unification, but which still retains some mystery even after the triumph of that theory. For anyone who wants to know how science really advances, in contrast to the neat picture promulgated in most textbooks, this is the book to read.

Though the exposition of experiment is largely slaved to theory, a few often-neglected achievements are put in their proper place. Gerald O'Neill and Bruno Touschek get due recognition as the true pioneers of colliding beams, though by the time their efforts came to triumphal fruition in the "November Revolution" of 1974, O'Neill was pursuing a different vision, the colonization of space. Only an accident of fate—that the mass of the J/ψ lay slightly above rather than below the design energy of the ADONE storage ring—deprived Touschek of the discovery of that particle. Martin Perl is lauded for the discovery of the third generation of fermions, a long and lonely feat of data analysis carried through in the face of skepticism and even derision.

Theorists may also need rehabilitation, especially those who were ahead of their time. Everyone knows that Yoichiro Nambu is an important figure in particle theory, but Bernstein makes clear the crucial turn he took on the path to unified gauge theories. Many who admire Gerardus 't Hooft's proof of renormalizability are unaware that he was simply carrying forward a long and arduous program conceived and developed by his teacher, Martinus Veltman. Bernstein also gives Minoru Kobayashi and Toshihide Maskawa the recognition they deserve, but rarely get,

Robert March is a professor of physics and liberal studies at the University of Wisconsin, Madison. His research interests include particle physics and high-energy astrophysics. He is the author of *Physics for Poets* (McGraw-Hill, New York, 1978; second edition).

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for anticipating the discovery of the third generation in their model of CP violation.

Though it can be read in an evening, this slim volume does manage to teach a great deal of physical theory. More important, it gives a useful perspective on the tangled history of a central subdiscipline of modern physics. It is recommended reading for anyone with an abiding interest in that field.

Instruments and Experiences: Papers on Measurement and Instrument Design

R. V. Jones

Wiley, New York, 1988. 485 pp.
\$79.95 hc ISBN 0-471-91763-X

There are at least two things notable about this book. The first is that it represents the initial volume in the Wiley Series in Measurement Science and Technology. The chief editor of the new series, Peter H. Sydenham, has convinced the publisher, quite correctly in my opinion, that instrument and measurement science deserves recognition as a field with its own scholarship, techniques and skilled practitioners.

The book is a compendium of one man's work, including some of his original papers, along with his own up-to-date commentaries introducing each of the ten chapters. An enterprise of this kind usually works best when the author is highly distinguished and respected. R. V. Jones, the author of *Instruments and Experiences*, is such a man; it is he who represents the book's second point of distinction. Jones is noteworthy not only for his mastery of the field—as demonstrated by his research papers—but also for his contributions to education, his work in scientific intelligence during the Second World War and his authorship of the international best-seller *The Wizard War* (published in 1978 in London as *Most Secret War*), which describes Jones's experiences in scientific intelligence during World War II.

Twenty-six of Jones's papers are distributed among the first eight chapters; together these papers form a representative sample of his contributions to instrument design. The first of these papers, "Infrared Detection in British Air Defence, 1935-38" appeared in 1961 in the very first volume of the journal *Infrared Physics*. The delay in its publication was due to security reasons.

From that work on copper-constant-