

IF THE HIGGS IS THE ANSWER, WILL THERE BE NO MORE QUESTIONS?

The God Particle

Leon Lederman
with Dick Teresi

Houghton Mifflin, New York,
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Reviewed by Donald H. Perkins

Progress in the study of the fundamental particles of matter and the interactions between them depends largely on the provision of ever bigger and better accelerators. Undoubtedly the biggest and best (and the dearest, at around \$8 billion) so far is the Superconducting Super Collider under construction at Waxahachie, Texas, near Dallas. Leon Lederman's book *The God Particle* is primarily about the 2000-year-old search to understand the development of the universe, its basic constituents and the forces that shape it (in fact the book's subtitle is *If the Universe Is the Answer, What Is the Question?*). The book is also an explanation to the layman of the need for the SSC as the next logical step in the search, hopefully to discover the "God particle"—known to physicists as the Higgs boson. Steven Weinberg's recent book *Dreams of a Final Theory* has a similar theme, although it is written by a theorist and in a quite different style. Perhaps we should sit up and take notice when two Nobel laureates, both strong proponents of the SSC, almost simultaneously produce popular scientific texts on virtually the same topic.

Lederman has impressive credentials for his task. He shared the Nobel Prize for the discovery in 1962 that the electron-type neutrino (accompanying electrons in nuclear beta

decay) is distinct from the muon-type neutrino (accompanying the muon or "heavy electron" in pion decay). He also discovered the upsilon meson (signaling a fifth type of quark, the b quark), the long-lived neutral kaon and parity violation in muon decay. He was director of Fermilab for 10 years, and he has made notable contributions in education and in the public's appreciation of science.

Lederman, working here with Dick Teresi, also clearly has considerable gifts as a writer: He tells his story with panache, wit and humor (even if the gags and one-liners tend to grate at times). The book starts off with an imaginary conversation with Democritus, the first person to postulate the existence of the atom. The historical thread is traced through the work of Galileo, Newton, Faraday, Planck, Einstein and others up to modern times. Most people will be familiar with the ideas and the contributions of these early practitioners: The fascination and value of Lederman's text is in bringing out, in terms understandable to the layman, the crucial issues and the "Eureka moments" when the big breakthroughs occurred. He is especially good in detailing the incredible ingenuity and foresight of the early experimenters. The story is also made more vivid by the inclusion of personal details on the great figures of the past. We learn, for example, that the young Faraday once had to survive for a week on a loaf of bread and that Schrödinger produced his celebrated wave equation during an illicit weekend in the Alps!

All this is in preparation for the Higgs boson, the postulated scalar particle whose interactions are supposedly responsible for the creation of mass and for spontaneous symmetry breaking in the electroweak sector—the fact that the weak interactions at low energy are much more feeble than the electromagnetic. The Higgs particle is also postulated to resolve many difficulties in cosmology, by, for example, providing a mechanism to

account for the observed matter-antimatter asymmetry, as well as by seeding the inflationary stage of the Big Bang and solving the flatness problem, the absence of magnetic monopoles and so on. We can see why Lederman calls it the God particle.

Would the detection of the God particle at the SSC solve all our problems? Unfortunately, no. It would be a tremendous step forward, but Lederman makes no pretense that discovering this particular Higgs—that associated with electroweak interactions—is the final key to the secrets of the universe. It will be but one more step along the way. There are presumably other Higgs particles on even larger energy scales. He ends his account with an impassioned plea for the support of basic, curiosity-oriented research, which has led to practically all our major advances in technology. This investment, he points out, at far less than 1% of the gross national product, has consistently outperformed the Dow Jones average.

Science with a Vengeance: How the Military Created the US Space Sciences After World War II

David H. DeVorkin

Springer-Verlag, New York,
1992. 404 pp. \$69.00 hc
ISBN 0-387-97770-8

In an earlier book, *Race to the Stratosphere: Manned Scientific Ballooning in America* (Springer-Verlag, New York, 1989), David H. DeVorkin linked scientific ballooning to a broad set of cultural and political forces that helped shape its use as a research method. In *Science with a Vengeance*, DeVorkin tells the story of another scientific vehicle: the research rocket. Focusing primarily on the use of captured German V-2 rockets to carry instruments into the upper atmo-

Donald Perkins is a professor of elementary particle physics at Oxford University, a Fellow of the Royal Society of London and a member of the Scientific Policy Committee advising the SSC Laboratory Directorate.