

BOOKS

Revisiting Tomonaga— And a Lot of Physics

The Story of Spin

Sin-itiro Tomonaga
Translated by Takeshi Oka
U. Chicago P., Chicago, 1997.
272 pp. \$50.00 hc
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Reviewed by Fritz Rohrlich

Of the three theoretical physicists who shared the Nobel prize for the development of quantum electrodynamics in the mid-1940s, both Richard Feynman and Julian Schwinger are well known to physicists in this country, while Sin-itiro Tomonaga is hardly known at all. I myself knew Tomonaga only from his scientific papers, which, typically, are very impersonal. It was therefore a great pleasure for me to read *The Story of Spin*. Contrary to the ordinarily dry and formal style of scientific papers, this book of informal lectures reveals the author's warm and attractive personality. He writes in the epilogue: "As I was reading many of the old papers, I often remembered the old days when I first read them, and I could not resist the temptation to relive how I felt." This captures exactly what comes through in these lectures and what makes reading them an engaging and exciting adventure.

Tomonaga talks about the history of the discovery of spin and the development of its theory from about 1920 to 1940. He experienced much of that history (he was born in 1906), and he makes the subject come alive by leading the reader through the thought processes behind the original literature. The latter makes up most of the references. We become witness to the many great successes as well as frustrating failures of those brilliant but groping leaders who led the revolution into quantum mechanics and later into nuclear physics. And he provides photographs of many of the people who contributed to the various periods, such as Arnold Sommerfeld, Alfred Lande and Fried-

erick Hund, Werner Heisenberg, P. A. M. Dirac and Wolfgang Pauli, James Chadwick, Enrico Fermi and Hideki Yukawa, and quite a few others.

The book was published in Japanese in 1974, only five years before Tomonaga's death. It has now been translated into English by Takeshi Oka, to whom we must all be grateful. He has succeeded well in conveying the informal style and humor Tomonaga intended.

The book contains twelve lectures. The first ten recall the history of the theory of spin from the spin-statistics theorem to the development of isospin. The last lecture is a collection of anecdotal material that Tomonaga either experienced or learned from others; it provides an additional human touch to the preceding story. Lecture 11 is a little out of keeping with the rest. It explains somewhat laboriously (because he uses only elementary notions) the mathematics that leads to the Thomas precession for the anomalous magnetic moment.

The book contains many highlights that are not generally known. Examples are Pauli's deep insight, as early as 1924 (which he expressed privately but not in print), that the failure to explain the doublet structure of the alkali spectra is due to "a classically indescribable two-valuedness" of the electron; the sad story of Ralph de Laer Kronig, who suggested in 1926 that the electron has a spin of $\frac{1}{2}$ and a g-factor of 2, only to be discouraged from publication by Pauli, who found it to be "*ein ganz witziger Einfall*" (a quite humorous idea) but showed no interest in it until half a year later, when George Uhlenbeck and Sam Goudsmit published their paper suggesting the electron spin; and the view expressed by both Niels Bohr and Heisenberg (but not by Fermi and Pauli) that quantum mechanics is probably not valid inside the atomic nucleus and that even energy conservation might be violated there.

I cannot help but mention a few of my quibbles: I do not concur that second quantization fulfills Erwin Schrödinger's wish to give the wavefunction a meaning as a matter wave in ordinary three-dimensional space

(page 105). And I believe that the book would have profited greatly from a name index.

But such gripes do not detract from the considerable value of this book. There is nothing in the literature quite like it. The lectures can be understood by an advanced undergraduate who has had introductory courses in quantum mechanics and atomic and nuclear physics. This piece of the history of physics will provide excellent and exciting reading material complementary to such courses. It also provides the personal touch of an expert in the field that is so often lacking in the physics literature. I recommend it very highly.

The Quark Machines: How Europe Fought the Particle Physics War

Gordon Fraser
IOP, Philadelphia, 1997. 210 pp.
\$20.00 pb ISBN 0-7503-0447-2

Gordon Fraser's *The Quark Machines* is an accurate and rather complete historical record of the evolution of elementary-particle physics from the theoretical speculations of Hideki Yukawa in 1935 and the discovery of cosmic-ray mu mesons in 1937 to the present. The book was written by the editor of the CERN *Courier* and, despite its accuracy, I have trouble with the author's judgment and with the book's tone. The subtitle says the book describes the "war," presumably between Europe and the US, over particle physics. News to me! Yes, I knew about a friendly competition, sometimes even intense competition, that was beneficial to both sides (in correcting false measurements, enhancing theoretical effort and even stimulating governments to spend on high-energy physics). But this is the first I have heard of a "war."

The text, by way of historical background, describes the efforts to develop radar and the atomic bomb. In these areas, about which a great deal has been written and some controversy generated over the historical record, the book is remarkably accurate.

FRITZ ROHRLICH, of Syracuse University, wrote (with Josef M. Jauch) the first book on the Dyson-Feynman-Schwinger-Tomonaga quantum electrodynamics in 1955 (second edition 1976) and has been working in this and related fields ever since.