

Bookshelf

The Story of Spin, by Sin-itiro Tomonaga, translated by Takeshi Oka, University of Chicago Press, ISBN 0 226 80793 2, \$50

Spin has always been a physics enigma. Emerging ghostlike from the fog of atomic spectroscopy in the early 20th century, it found its explanation ('acrobatically', according to Pauli) in Dirac's monumental formulation of relativistic quantum mechanics.

However even the name 'spin' is a misnomer. As Landau and Lifshitz point out in their standard quantum mechanics textbook - 'this property of elementary particles is peculiar to quantum theory and therefore has in principle no classical interpretation. It would be wholly meaningless to imagine the "intrinsic" angular momentum of an elementary particle as being the result of rotation around its own axis.'

To compound the spin enigma, the deceptively simple relation between spin and quantum statistics which emerges from the intricacies of relativistic quantum mechanics still awaits a simple explanation.

This delightful book, originally published in Japanese in 1974 (Tomonaga died in 1979), is, with some justification, claimed to be the most complete and accessible treatment of spin. Presented as a series of lectures, it begins with the efforts of Sommerfeld, Landé and Pauli to disentangle the details of atomic spectroscopy, and goes on to cover the emergence of the quantum mechanical explanation of electron spin, first by Pauli and then by Dirac, the discovery of proton spin, the relation between spin and quantum statistics, and the emergence of



isospin in nuclear physics. Lovingly translated, the incisive formalism is interspersed with anecdotes, and the book's evocative final chapter abandons formalism to survey Japanese physics from 1925-40, where the figure of Yukawa looms large.

Tomonaga's personality is evident despite the physics rigour. A classmate of Yukawa at Kyoto, he settled at Tokyo after initial spells at the RIKEN research centre and two years with Heisenberg at Leipzig. In 1947 he independently developed a modern form of quantum electrodynamics in complete ignorance of the measurement of the Lamb shift which stimulated Schwinger and Feynman in the US. For their quantum electrodynamics work, Feynman, Schwinger and Tomonaga shared the 1965 Nobel prize.

As the book originally appeared some time ago, there is nothing on quark/gluon spins and the new enigma of how constituents carry the spin of the proton. Spin continues to be enigmatic.

Homage to Tomonaga. Last year was the 50th anniversary of the renormalization procedure which opened the route to modern quantum electrodynamics and led to the 1965 Nobel prize for Richard Feynman, Julian Schwinger and Sin-itiro Tomonaga for their independent contributions. In Japan this anniversary was marked by a special meeting at the Tanashi branch of the KEK Laboratory (formerly Tokyo University Institute for Nuclear Study), where the speakers included Tomonaga collaborators Gyo Takeda (left) and Daisuke Ito. Tomonaga, who died in 1979, proposed his new approach to electrodynamics during his regular Friday Tokyo seminars.



Paul Dirac: The Man and his Work, by Abraham Pais, Maurice Jacob, David I. Olive and Michael F. Atiyah, edited by Peter Goddard, Cambridge University Press, ISBN 0 521 58382 9 (hbk £12.95/\$19.950)

On 13 November 1995, a plaque in London's Westminster Abbey was dedicated to the memory of Paul Dirac. This slim (120-page) volume contains four lectures on Dirac's life and work given at London's Royal Society prior to the ceremonies in the Abbey, together with an introduction by Stephen Hawking.

Despite his legendary taciturnity and reticence, Dirac was an avid traveller and a frequent visitor to scientific meetings, drawing on this contact, Pais summarizes Dirac's personal qualities and their impact on his approach to physics. Maurice Jacob of CERN describes Dirac's classic work on antimatter and its implications for modern physics and cosmology.

One of Dirac's special preoccupations was magnetic



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