

---

**The Big and the Small: Journey into the Microcosm – The Story of Elementary Particles.** G. Venkataraman. Universities Press (India) Ltd, 3-5-819 Hyderguda, Hyderabad 500 029. 2001. vol. 1, 276 pp. Price: Rs 200.

---

Elementary particle physics, which deals with the behaviour of the smallest entities mankind has probed, has attained a stage where there is a 'standard model' – a God of small things, so to speak – in excellent agreement with experiments, so much so that any tiny deviation, for example, a small non-zero neutrino mass, is considered a major breakthrough. There is no competing alternative theory on the offer. An introduction to the subject addressed to the young and the curious is therefore very timely. But this is a daunting task as many sophisticated concepts of physics have to be dealt with, along with the associated mathematics. Not many particle physicists have come forward to take up this challenge. Instead, they have made it more difficult by introducing quirky terminology and often confusing jargon.

G. Venkataraman is well known for science popularization through his earlier writings. In this book, he writes with panache and consummate skill, bringing in, when useful, appropriate analogies from other areas of physics and extracting the maximum from well-chosen diagrams. His style is chatty rather than pontificating, and is interspersed with warning signs, apologies and assurances when the going gets a shade heavy. In places, he gently guides the reader through difficult, new ideas while in some parts (e.g. the formulation of the  $(V-A)$  theory of weak interactions by E. C. G. Sudarshan and others, or the discovery of the  $J/\psi$  particles) the book achieves the racy style of a mystery novel. I was in two minds when reading the book. On the one hand, it was a fascinating read and hard to put down. On the other, I did not want to rush through and miss any of the details. Venkataraman shows how a theory is gradually woven from strands based on empirical evidence, brilliant insights and heroic collaborative ventures. He deftly captures the excitement of frontline research. The book should spur some to choose science as an exciting career option.

'Volume I' sounds a shade forbidding for a paperback of less than 300 pages addressed to non-experts. This is no tome. Venkataraman traces the historical development of the subject through the discovery of the pions, muons and the 'strange' particles, the overthrow of parity, the introduction of SU(3) and quarks, the parton model and on to gauge theories. He does an excellent job in discussing the standard model of particle physics, going into concepts like spontaneous symmetry breaking and non-abelian gauge theories with illuminating examples. Interspersed in the text, as side attractions, are thumbnail sketches of the people and personalities involved in the game. Topics which do not find mention include string theory, supersymmetry,  $b$ -quark physics and neutrino physics. Their mention, even sketchily, would have made the book really up-to-date. It is possible that some of these topics are slated to appear on stage in the promised second volume.

A jarring note is sounded by the large number of misprints and errors. As a few random samples: Table 2.A1.4 (p. 15):  $M_W, M_Z$  are about 80 and 91 GeV (not MeV), 'Donald Glazer' for 'Glasher' (p. 123) – the inventor of the bubble chamber, etc. There are also a few serious physics flaws: e.g. Parity conservation implies that  $P_{\text{initial}} = P_{\text{final}}$  and not ' $P_{\text{initial}} = P_{\text{final}}$ ' (p. 33);  $\Delta^{++} \rightarrow pp$  (p. 133) is not permitted (by baryon conservation). In Table 8.2 (p. 142) pions are suddenly denoted as  $p^{+,0,-}$ ,  $K^{\pm}$  are assigned the same strangeness, and the  $\rho$  meson listed as an isospin singlet! In the Higgs mechanism, the erstwhile Goldstone bosons become the longitudinal modes of massive gauge bosons, as correctly explained. But to say that the Goldstones leave behind ghosts (p. 208) is a trifle unfortunate, since the term 'ghosts' is used for other quantum fields which appear in the quantization of gauge theories. These examples are only indicative and certainly not exhaustive. There are quite a few more. Perhaps, they can be corrected in future editions and more care will be taken in subsequent additions to this series.

Who, other than practising physicists, will enjoy the book? Scientists from other disciplines will surely find it of interest. For even the brighter high-schooler, stuff like the Euler-Lagrange

equation, group theory, etc. I daresay, will put the book beyond range. But smart physics (and allied subjects) undergraduates will surely lap it up. I also feel that postgraduate students will love this book.

Venkataraman and the Universities Press are to be commended for this addition to the now widely known, low-priced, excellent *Vignettes in Physics* series. The book leaves the readers eagerly looking towards the forthcoming second volume which bears the sub-title 'From the Microcosm to the Macrocosm – The Fascinating Link between Particle Physics and Cosmology'.

AMITAVA RAYCHAUDHURI

*Department of Physics,  
University of Calcutta,  
Kolkata 700 009, India  
e-mail: amitava@cubmb.ernet.in*

---



---

**The Handicap Principle: A Missing Piece of Darwin's Puzzle.** Amotz Zahavi and Avishag Zahavi. 1997. Oxford University Press, New York. 286 pp. US \$30.

---

The works of immense proportions and great importance in art and music are often conceived as small, simple ideas; later to attain their magnificence. The main theme in Beethoven's glorious Symphony No. 3 – the 'Eroica' – began as a small piece in a ballroom, was later modified for a ballet, evolved as a piano piece, and finally achieved its grandeur in the Finale of the Symphony. Do scientific theories develop like this? Do the theories of evolution themselves evolve from their apparent initial insignificance to all the later importance? At least one biological theory stands in good stead as illustration of this: Amotz Zahavi's theory of signal selection. In 1975 Zahavi gave birth to 'handicap principle', which appeared as a short paper in *Journal of Theoretical Biology*<sup>1</sup>. It is now an all-inclusive, all-pervasive theory of signal selection, best explained and elevated to a new height in a book by Amotz Zahavi and his wife Avishag Zahavi.

We owe the theory of sexual selection to Darwin, who argued that traits such