Once upon a universe

***The Left Hand of Creation* (John D. Barrow and Joseph Silk, Basic Books, Inc. 1983, Heinemann, London 1984, pp xi + 256, £9.95)**

IN 1977 Basic Books published *The First Three Minutes* by Steven Weinberg, a book that proved to be very successful in conveying to the lay reader the excitement of researches in the physics of the universe from its birth to an age of three minutes. The book described how light nuclei like helium and deuterium (heavy hydrogen) were made in the *early universe* by fusion of primordial neutrons and protons. It also highlighted the discovery of the cosmic microwave background and its implications for the early history of the universe.

By 1977, however, cosmologists and particle physicists had become considerably bolder partly out of confidence (in the case of the former) and partly out of desperation (in the case of the latter). Confidence, because the successes of understanding the origin of microwave background and primordial nuclear fusion led the cosmologists to probe the state of the universe even closer to its origin in the big bang, to find out how the so-called basic constituents of matter like quarks, electrons, positrons and neutrinos came into existence. Desperation, because the particle physicists in search of the holy grail of a grand unified theory (GUT) realised that no terrestrial acceleration was ever going to produce particles energetic enough to verify their theoretical predictions and to save their theories from being mere speculations they had to take the *very early universe* (VEU) seriously.

The VEU talks about the period from the origin to the time of the order of 10^{-33} second. During this period the crucial decisions about the state of the universe were made. In particular GUTs fixed the ratio of baryons (heavy particles like neutrons and protons) to photons (the particles of light) that has remained essentially unaltered to this day. The expansion mode of the universe was also fixed during this era. The inhomogeneities in matter distribution that eventually became galaxies and clusters of galaxies, the varieties of neutrino species and other exotic particles that make up the "hidden matter" today, the existence or otherwise of magnetic monopoles etc are some more examples of the relics of the VEU. It is through matching theoretical predictions about such relics with the present-day observations that the joint scenario of GUTs and VEU can be confirmed.

It was inevitable that such exciting (and comparatively less costly) frontier area of research should attract a lot of talent both old and young. Since 1977 there have been numerous workshops and conferences in this field and the subject is still in formative stages. Barrow and Silk have attempted to follow Weinberg's first three minutes of the early universe by giving here an account of the present actvity in GUTs and VEU. How far have they been successful in conveying the flavour of the subject to the lay reader?

This reviewer enjoyed reading the book and found most of the major research activities covered adequately. The "left hand" implying the violation of parity in weak interaction does not feature predominantly in the book and was probably chosen to make up an impressive title. The authors have been fair in stating the problems and failures as well as the successes in this area. Unlike the reader of *The First Three Minutes* who comes away with the impression that this is the last undisputed word on creation, the reader of *The Left Hand of Creation* gets the impression that the subject matter is still full of question marks. This is a plus point both for the book and for its authors.

However, a lay reader without a background of some astronomy and particle physics may find the book uneven. There are places where difficult ideas are explained with excellent analogies (e.g. on p. 223) while elsewhere technical jargon appears without any elucidation (e.g. on p. 18). The various sections sometimes give the impression of being too short and disjointed like extracts from a diary. Some topics like the inflationary universe are repeated in different places when they could have been better described coherently in one place.

I would therefore recommend the book strongly to a physics undergraduate but not to an intellectual in humanities. That the account given here is authoritative is beyond doubt, for both the authors are recognised research experts in this area. Their informal approach and involvement in the field have combined to produce, on the whole, a much-needed book on this subject.

Jayant Narlikar

Prof. Narlikar heads the Theretical Physics Group at the Tata Institute of Fundamental Research, Bombay.

***Late Night Thoughts* (Lewis Thomas; Oxford University Press; 1984; pp. 175; £9.95)**

MEN seeking the ultimate experience of "non-duality" traditionally retreat to the forest or desert. The freedom from worldly care is supposed to be conducive to such "unitary" experience. Yet the lack of human ties does not imply selfishness on the part of the seers who are supposed to see "unity in diversity". Indeed, these men have always been depicted as paragons of piety and altruism. In his latest collection of essays, the noted scientist and writer, Lewis Thomas, traces the roots of such altruism to the fundamental unity of the DNA molecule. Says Thomas:

> "If we are to take seriously the notion that the sharing of similar genes imposes a responsibility on the sharers to sustain each other, and if I am right in guessing that even very distant cousins carry at least traces of this responsibility and will act on it whenever they can, then the whole world becomes something to be concerned about on solidly scientific, reductionist, genetic grounds. For we have cousins more than we can count, and they are all over the place, run by genes so similar to ours that the differences are minor technicalities.
>
> "...We have an enormous family to look after, or perhaps that assumes too much, making us sound like official garderners and zookeepers for the planet, responsibilities for which we are not yet grown-up enough.

The trouble is that the men who matter, the generals, politicians, and the boffins, do not share that notion. Therefore the missiles, each of which can vaporise a hundred Hiroshimas in its artificial sun, multiply. Thomas devotes a number of pieces to the predicaments arising from this perversity. Yet the overall result is not pessimistic. For even when he is musing on radioactive mushrooms late at night while listening to Mahler's Ninth Symphony, Thomas is busy devising a novel military exchange between the Russians and Americans to prevent their growth. Then there are pieces that are pure vintage Thomas—On Speaking of Speaking, Seven Wonders, Falsity and Failure, On Smell. One is tempted to list the whole table of contents. For Thomas is surely a writer, to quote *New Scientist*, in the tradition of T. H. Huxley, Faraday, and J. B. S. Haldane.

Vithal C. Nadkarni