

Explaining the Universe. John M. Charap, Universities Press (India) Pvt Ltd, 3-5-819, Hyderguda, Hyderabad 500 029. 2004. 226 pp. Price: Rs 315.

In this fascinating and engaging book, John Charap takes us through a grand tour of the physics of the Universe and its evolution in the preceding century. He wonderfully develops from the classical Newtonian world to the Einsteinian and quantum world in a manner that the basic thread of argument and motivation is comfortably accessible to the intended, interested wider audience. I would say without hesitation that he has succeeded pretty well in this.

The author weaves the motivational arguments quite convincingly and insightfully in developing from the classical Newtonian framework to the modern relativistic and quantum framework. It is a marvellous treat, which I am sure every reader will find entertaining and enjoyable. Apart from the masterly discussion of intricate and complex issues of theories of relativity, quantum theory, chaos and string theory, there is a good discussion on critical astronomical observations and the big-bang origin of the Universe.

I should, however, say that everyone has his own way of developing the edifice. To me, the most compelling argument that takes one from Newton to Einstein is the inclusion of light (zero mass particle) in the framework. Since it moves with a constant universal speed, which is untenable in Newtonian mechanics, we need a new mechanics of special relativity. Further, its interaction with gravity would require that gravity must bend space. Thus gravitation could truthfully be described only by the curvature of space-time. Now the dynamics of gravity has to be fully determined by the space-time curvature and the remarkable feature of this line of approach is that the so-called cosmological constant appears as naturally in the equation as the matter stress energy tensor. It is truly a new constant of space-time which needs to be fixed by experiment.

It is interesting that the author not only builds up the story of the working of the Universe in an exciting and educative manner, he does not shy away from making bold predictions for the developments to come by. He pronounces that by 2020 all the big puzzles of high energy physics, including for instance, Higgs particles, WIMPs, string theory, etc. would have been resolved. This is certainly a big claim, which

is perhaps indicative of the mood of our times, where it takes little to be bold, and bold outrageously. Gone are the days of Lorentz and Poincare, who were robbed of their due credit for discovering special relativity, simply because they were not bold enough to pronounce that velocity of light is constant. Curiously, what seems much more on the cards – the detection of gravitational waves by man-made detectors – escapes his spree of predictions. He does, however, keep the healthy opening for surprises, and nothing could be a surer prediction than that there would be surprises.

It is really an interesting and remarkably well-written book which should be read by the lay audience as well as the experts alike with equal interest. I would strongly recommend it to one and all.

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Finite Element Analysis Procedures in Engineering. H. V. Lakshminarayana. The Universities Press (India) Pvt Ltd, 3-5-819 Hyderguda, Hyderabad 500 029. 2004. 347 pp. Price: Rs 150.

The author has presented yet another textbook on Finite Element Analysis, which he has claimed is primarily intended for the novice in the subject to understand and use FEM as a numerical tool for solving complex structural mechanics problems. He has tried quite hard to cover all aspects of this vast subject in just 250 pages. In the process, he has done little justice to most of the contents in the book. The author throws up words like variational methods, functional, weighted residual techniques, etc. which, in my opinion, will be difficult to handle for a novice without a chapter on energy methods. Also, the assumption that the target audience for this book to have some basic knowledge on Theory of Elasticity, which forms the backbone of FEM, is quite unreasonable. The concept of weak and strong form of the governing differential equation, which forms the foun-

ation for the FEM, is not properly introduced in the book. It is quite well known that C^1 continuous formulation for conforming plate finite elements is quite difficult to formulate and hence there is a tendency to always use C^0 Mindlin formulations. Although both these formulations are given, a need for such C^0 formulations in the light of difficulties experienced by the C^1 formulation is not highlighted which, in my opinion, is paramount in understanding the plate finite element formulation. Some of the positive aspects of the book are the excellent treatment of 3-D beam formulation, and the inclusion of patch test in the chapter on plate finite elements. Inclusion of some practical problems at the end of each chapter will be of immense benefit to practising engineers. The book gives the complete details of how a finite element computer code should look like, which would be of great help to those who are into writing FE software. Also, a thorough review of all the commercially available finite element software and its various capabilities will be of great use to the practising engineer, for whom the book is meant. In summary, the author has tried very hard to cover this vast subject under 250 pages by taking into consideration the needs of a fresh undergraduate or engineer without FE background and in the process he is forced to leave out details of many important aspects of the subject.

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Ethical and Regulatory Aspects of Clinical Research. E. J. Emanuel *et al.* (eds). The Johns Hopkins University Press. 2715 North Charles Street, Baltimore, Maryland 21218-4363, USA. 2003. 490 pp. Price: US \$39.95.

The irony was delicious – and that was why I accepted the invitation from the editor of *Current Science* to review the book. This is a Johns Hopkins Press publication and it was, of course, a Johns Hopkins researcher who collaborated in

performing dubious clinical trials at the Regional Cancer Centre at Thiruvananthapuram, Kerala in 2001. While sadly, as expected, no positive fallout appears to have come of that episode, it appears now that India will soon be a major scene of international action on clinical trials. It would be interesting from the point of view of an Indian physician, to see Western viewpoints on this often grey area – ethical and regulatory aspects of clinical research. One word will suffice to describe the book – outstanding.

The volume consists of extracts and readings on the subject over the years. The book arose out of an attempt to create a comprehensive textbook of classic writings on the topic for a course on ethics of clinical research for the National Institutes of Health, USA. Almost all the articles are from American journals, but the sources are as diverse as *Science*, *New England Journal of Medicine* and *Hastings Center Report*. Even given that Americans usually quote their own sources, I find it difficult to accept that the editors found no useful articles from *The Lancet* or the *British Medical Journal*.

The book begins with a historical section which recalls Tuskegee and many other trials that serve to illustrate man's inhumanity to man. Randomized controlled trials, the ethics of placebo, genetics research, informed consent, human embryo and stem-cell research ethics and more have been covered. I learnt to my surprise from the chapter 'Wanted: single white male for medical research', that most research on human beings had been performed on white men so as to maintain uniformity and reduce variables in subject selection rather than take a general population and 'complicate' the results. [Of course, this could also be used as specious justification to the question 'why are Western researchers now looking towards India for subjects for clinical trials?']. The editors are not afraid to choose controversial topics – for instance, Carl Cohen argues that the belief that use of prisoners as research subjects is unethical on grounds that consent is not free and is due to coercion, does not hold.

There is no mention, as the editors state in the foreword, of the ethics of emergency research or on compensation for research mishaps. Understandably, many of the articles have been edited and all the footnotes and references have been deleted in an attempt to keep the book to a manageable size and price. However, this can be

frustrating for most of us in India. For instance, where will I ever get access to the journal *Social Science and Medicine* for the entire article 'Ethics are local'?

Who should read this book? Certainly, all researchers should; however, I believe that bureaucrats and those in the health industry and the Health Ministry should also study this volume. Even those physicians who practice only clinical medicine, but do not engage in formal research should read it, as the book is a reminder of the many grey areas of medicine and the one underlying principle, *Primum non nocere* (First, do no harm).

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Energy at the Crossroads: Global Perspectives and Uncertainties. Vaclav Smil. The MIT (Massachusetts Institute of Technology) Press, Cambridge, Massachusetts, USA. November 2003. xvi + 427 pages. US \$33.05. ISBN 0262194929.

'The most fundamental attribute of modern society,' writes Vaclav Smil, 'is simply this: ours is a high-energy civilization based largely on combustion of fossil fuels'. It goes without saying that 'energy literacy' and sound energy policies are a must for any society pursuing economic development, industrialization, and higher standards of life. Technical publications on energy, important as they may be, are rarely read by the general public. Vaclav Smil is among a few energy experts who have made a bridge between energy science and the general public. This is his 18th book on energy.

Energy at Crossroads is divided into six lengthy chapters: Long-term trends and achievements (chapter 1); Energy linkages (chapter 2); Against forecasting (chapter 3); Fossil fuel futures (chapter 4); Non-fossil energies (chapter 5); and Possible futures (chapter 6). These titles demonstrate the comprehensiveness of the book on the current situation and future perspectives of energy resources, production, and consumption.

What separates modern countries from traditional and pre-industrial societies is a sharp increase in per capita energy consumption, and this has happened in our lifetime although with varying rates in different countries. Smil chronicles the development of modern energy systems and explains how the 20th century emerged as a century of petroleum and electricity. This trend has continued to the present century. Fossil fuels (coal, oil and natural gas) account for nearly 90 per cent of world's energy consumption. The relative significance of coal, oil and natural gas has changed rapidly. Coal, which dominated the 19th century and early decades of the 20th century, gave way to oil. It is likely that natural gas will play a prominent role in the near future.

Energy means so many things to many people mainly because it is linked to various aspects of our life, work, economy, politics and civilization. Smil explores the linkages between energy and economic development of nations, life standards of individuals, environmental problems facing the world (notably, the impact of fossil fuels on the atmosphere), and war. Smil formulates 'energy intensity', that is the primary energy consumption per dollar of gross domestic product (GDP) in a given country, and shows how it is related to other social indicators such as infant mortality and political freedom index among various nations. Access to energy resources has been a cause of many wars in human history. A remarkable feature of modern wars, however, is that they utilize highly energy-incentive technologies.

Understanding the future of energy, especially oil, is of paramount value to policy makers, industrialists, and business managers, and to the whole humanity. Smil argues against quantitative forecasts of energy futures because the history of such forecasts is mostly a history of failure. There are so many factors and uncertainties that rigid quantitative forecasts are often wrong. Instead, Smil favours normative scenarios, that is, building flexi-