Theory and Phenomenology of Sparticles, An Account of Four-dimensional $N = 1$ Supersymmetry in High Energy Physics. Manuel Drees, Rohini M. Godbole and Probir Roy. World Scientific Publishing Co., Singapore. 2005. 584 pp. Price: $108.

Supersymmetry is an elegant proposed symmetry between bosons and fermions. Experimental studies of elementary particles are consistent with the possibility that this symmetry is present in nature in an approximate, or broken, form, but have not provided any specific encouragement to believe this is the case. Nevertheless, supersymmetry and its experimental verification is among the most exciting frontier areas in the physics of elementary particles and fundamental interactions, and with good reason. The encouragement to believe in it arises from theoretical considerations of elegance and beauty, as well as (more compellingly) the ability of supersymmetry to address a theoretical puzzle, the 'hierarchy problem' raised by the existence of widely disparate energy scales in nature.

There are already several textbooks on the subject, starting from the early 1980s. An amazon.com search for the keyword 'supersymmetry' yields 1100 hits, which seems rather astonishing at first. But the list spans conference proceedings, reprint volumes, non-technical expositions, personal theories of cranks, alien-encounter stories, and the occasional mainstream novel where the hero or heroine brings up the topic to create an impression! Limiting the search to books with the word 'supersymmetry' actually in the title brings the number down to 125, and the number of genuine textbooks in the area is probably more like three dozen.

Of these, some are comprehensive expositions of the formalism, spanning space-time dimensions and incorporating different realizations of this symmetry ($N = 1, 2, 4, 8$ depending on the number of independent symmetry generators). Others, like the early *1001 Lessons in Supersymmetry* by Gates *et al.*, now available for free online, and the slimmer *Supersymmetry and Supergravity* by Wess and Bagger, limit themselves to $N = 1$ supersymmetry in 4 spacetime dimensions, the case most relevant to experiments at present-day energies. These are useful and even classic textbooks, but are limited almost exclusively to formalism, with some connections to phenomenology and experiment briefly appearing towards the end.

The volume under review is of a different type altogether. It seeks to be the complete primer on supersymmetry for the theorist, phenomenologist and experimentalist, with an eye directly on the large Hadron Collider due to start running at Geneva in a couple of years and widely expected to be the first place where supersymmetric particles are observed. Actually this book is not the first one on supersymmetry to have a strong connection to observable signatures and future experiments. Mohapatra's 1986 book, recently revised, attempts to cover similar terrain, but is far less comprehensive and also gives considerable emphasis to Grand Unification, a related but logically independent topic. Many lecture-note volumes also cover bits and pieces of the same ground, but they are all briefer and less comprehensive.

More serious competition to this book would be provided by the forthcoming *Supersymmetry* by Binetruy, and *Weak Scale Supersymmetry: From Superfields to Scattering Events* by Baer and Tata. Both books appear to cover much the same ground as the book under review. Unfortunately for their authors, these books are yet to see the light of day, the former being due in January and the latter in March 2006. Thus Drees, Godbole and Roy are off to a one-year head start over their competitors.

After a short introductory chapter, the book splits into two parts, with Part One, 'Supersymmetry formalism' being just 140-pages long. The rest of the book (some 340 pages) is devoted to Part Two, 'Supersymmetry phenomenology'. The Formalism section is well organized, starting with the supersymmetric harmonic oscillator and going on to develop the supersymmetry algebra, superfields, their interactions, and superspace perturbation theory. At this stage the key 'nonrenormalization theorems' are stated and derived. The formalism part then closes with a survey of the various field-theoretic mechanisms of supersymmetry breaking. The presentation is lucid throughout and the notation well-chosen. If the text occasionally seems rather heavy with equations, there are also many interjected explanations in words and, quite helpfully, bold-face and/or italicized phrases to emphasize the key points to a student.

A notable omission in the Formalism part of the book is supergravity. This arises when we consider space-time dependent supersymmetry transformations, and therefore also gravitation, and such theories are typically much more complicated than the simpler 'global' supersymmetric field theories. On the other hand, aspects of supergravity are central to some phenomenological scenarios. The authors have taken a practical approach to the problem, placing supergravity in the Phenomenology part of the book. After several chapters in this part covering the Minimal Supersymmetric Standard Model (MSSM), they return to supersymmetry breaking in a more phenomenological context, and it is here that supergravity makes its first appearance. The heavy-duty equations are relegated to what the authors quaintly call an 'Annex' in Chapter 12, leaving the bulk of the chapter free to continue with the flow and address the super-Higgs effect and gravity-mediated supersymmetry breaking. All in all, a reasonable compromise given that a more thorough introduction to supergravity formalism could have added a hundred pages to the book and delayed the advent of the Phenomenology part that is the authors' key focus.

The last three chapters are the most forward-looking and ambitious. A chapter titled 'Beyond the MSSM' covers generalizations of the minimal supersymmetric standard model to incorporate extra-Higgs particles, or to break a discrete symmetry called R-parity. It also addresses the small observed neutrino masses and how they could arise in supersymmetric theories. This is followed by 'Supersymmetry at colliders', a rather long and comprehensive survey of the key experimental signatures of supersymmetric particles. This is nicely organized into separate sections for slepton searches and searches for the squarks and gluinos that will also experience strong interactions. In each section, the typical signals at various present and projected accelerators are discussed in some detail. The final chapter of this trio is on 'Supersymmetric cosmology', where the Big Bang scenario is reviewed briefly and then its features in a supersymmetric theory are discussed: dark matter, the role of the gravitation in cosmology and the process of baryogenesis. This part of the book is highly recommended reading for any particle physicist, indeed for any physicist who has studied quantum field theory and the barest outlines of supersymmetry. The topical and speculative nature of the material means it may have a shorter shelf life than the rest of the book, but that is an inevitable risk for any textbook on a subject whose experimental foundations are not yet laid at the time of writing.

In short, this is a highly recommended book for the student of particle physics who has studied the basics of quantum field theory and the phenomenology of the known elementary particles. In addition, it is a handy source of information (and more valuably, explanations) for senior students and practising physicists in other areas, who will increasingly feel the need to know about the area of fundamental science most finely poised today for a dramatic experimental breakthrough.

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Annual Review of Earth and Planetary Science 2005. Raymond Jeanloz, Ardan L. Albee and Kevin C. Burke (eds). Annual Reviews Inc., 4139 El Camino Way, Palo Alto, CA 94306, USA. 710 pp. Vol. 33. Price not mentioned.

The editors of this volume under review open their preface with statements that *'Earth and planetary sciences have experienced a remarkable blossoming over the past decades. The research disciplines have a broader range of social and political impact than ever before, from addressing resource and security needs to mitigating natural hazards, remediating environmental impact, and documenting global climate change'*. The pace of growth of new knowledge in the area of earth and planetary sciences has increased enormously; as a consequence, the *Annual Review of Earth and Planetary Sciences* continues to serve as a useful resource for capturing the breadth of new developments in this area of knowledge.

The volume deals with several interesting aspects of the subject. These include the early history of atmospheric oxygen, the famous 1200-km-long dextral strike–slip fault zone of northern Turkey (the North Anatolian Fault); processes of orogenic collapse with reference to the Alps; early crustal evolution of Mars; representation of model uncertainty in weather and climate prediction; real-time seismology and earthquake damage mitigation; lakes beneath the Antarctic ice-sheet; subglacial processes that include aspects of subglacial hydrology, subglacial mechanics, sliding, sediment deformation and glacial landforms; feathered dinosaurs, molecular approaches to marine microbial ecology and the marine nitrogen cycle; earthquake triggering; evolution of the continental lithosphere; ichthyosaurian evolution; Ediacaran biotas; mathematical modelling of whole landscape evolution; volcanic seismology; models and outstanding questions of the interiors of giant planets; the Hf-W isotopic system and the origin of the Earth and Moon; planetary seismology; atmospheric moist convection; and orographic precipitation. A survey of some of these topics clearly points towards a continuing interest amongst earth and planetary scientists on questions related to the origin of the planets, the earth and the Moon; issues related to planetary seismology and real-time seismology for earthquake damage mitigation; questions related to climatic and tectonic aspects of orogens; issues related to continental ice-sheets; and evolutionary aspects of fish-shaped reptiles, feathered dinosaurs, and Ediacaran biotas. Such is the spread of earth and planetary sciences, knitted together with the threads of geologic time.

Much of the material is of considerable interest to earth scientists in India. Given the active tectonic environments of India, the reviews related to (a) the seismically hazardous Anatolian fault, (b) methods for predictions of subsequent ground motions from initial earthquake displacements, (c) processes of orogenic collapse that involve transfer of gravitational potential energy by extension in the core of the orogen and synchronous shortening in the foreland regions, are of strong relevance to Indian earth scientists.

India is bestowed with extensive Archaean and Proterozoic geological records; it is in this context that the review on the early history of atmospheric oxygen is of special significance. The evolution of oxygen concentrations in the Precambrian is incompletely understood. More needs to be known on the timing of cyanobacterial evolution, evolution of ocean chemistry, nature of carbon cycling and the influence of nutrient limitation on primary production to be able to understand the early history of atmospheric oxygen.

Another aspect of significance in the Indian context is the subject of orographic precipitation. It will always remain our aim to predict orographic precipitation in future climates. We live in the shadow of the Himalaya, and an 'understanding of the probability distribution of orographic precipitation events in the current climate, as well as the mechanisms responsible, will be useful in evaluating how changes in that probability distribution would lead to different precipitation rates'. The volume also contains an article on Antarctic subglacial lakes – lakes several kilometers beneath the ice sheet. This subject should be of interest to our Antarctic research programmes.

This review has attempted to provide a flavour of the rich content of the volume – this is a volume which is worth exploring both by the specialists and the generalists as it provides a broad view of the advances being made globally in earth and planetary sciences, both in the context of basic and applied aspects. Many of the subjects covered in the volume have a strong societal relevance and should therefore be of interest to a broad spectrum of science managers who deal with earth resources, disaster management and mitigation, and climate change issues.

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Last Frontiers of the Mind – Challenges of the Digital Age. A. Mohandas Moses, Prentice-Hall, New Delhi. 2005. 440 pp. Price: Rs 395.

The book 'Last Frontiers of the Mind' deals with two distinct, though related issues: (i) the relation between body–mind and consciousness (ii) the prospects of the computer-based Artificial Intelligence dominating over human intelligence and eventually assuming the role of the master that will dictate the future of humanity.

On the first topic, Mohandas Moses starts appropriately with a reference to Hippocrates of 5th Century BC; Hippocrates is regarded as the father of scientific medicine (most of us are familiar with the Hippocrates Oath which is a guide to medical ethics and practice). He was the first to recognize that the seat of consciousness is not in the diaphragm of the heart but in the brain. Hippocrates asserted: 'Some people say that the heart is the organ with which we think and that it feels anxiety. But it is not so. Men ought to know that from the brain and from the brain only arise our pleasures, joys, laughter and tears. Through it in particular we