# High lights

*Mark Saunders*

**Physics of Space Plasmas: An Introduction.** By George K. Parks. *Addison-Wesley: 1991. Pp.560. £40.45, $48.50.*

FEW natural spectacles can match the transient glory of the Sun's corona at solar eclipse, the sight of a bright comet plasma tail or the shimmering lights in a colourful auroral display. These vivid examples illustrate just some of the countless plasma phenomena within the Solar System that are included in the new field of space plasma physics. Fundamental to the subject's existence is the solar wind, a tenuous, fast-flowing, highly electrically conducting plasma blowing continuously out from the Sun. The solar wind gusts through the whole Solar System; its subtle interplay with planetary magnetic fields and planetary plasmas forms the basis for space plasma physics. Despite the need for further exploration, with exciting prospects ahead, space plasma physics has, after more than 30 years, now reached a mature and sophisticated level. With this maturity the time is ripe for the subject to become available as part of a science undergraduate's basic training.

*Physics of Space Plasmas: An Introduction* by George K. Parks is the most worthwhile attempt yet to provide a textbook aimed at this audience, and as such it provides a timely and welcome addition to the literature. The textbook is attractively produced, adequately illustrated and is written in a fairly readable style, the only marring of this good standard of production being an unfortunate page numbering error in the contents section after page 307. The book's primary focus is the theoretical concepts and techniques used for describing plasma processes in space, the latter including currents, boundaries, waves, shocks and instabilities. In each case, reference is given to experimental observations, although these form only a minor part of the book's scope. As befits a theoretical physics textbook, mathematics is widely used, though at times its level seems more appropriate to advanced post-graduates or to research workers. Indeed, considering the book's perhaps excessive length it may have been advisable to omit some of the more specialized theory and mathematics. Problems given after most chapters form an important and useful feature of the book.

Criticizing a book is never easy, especially when the overall standard is good, and when different readers will doubtless have their own favourite topics that they wish to see emphasized. But in my opinion the textbook suffers, as is often the case, by reflecting the special interests of the author instead of providing a coherent coverage of the whole subject. In particular, minimal coverage is given to planetary magnetospheres, comets and to solar plasma physics, all of which now arguably come under the remit of space plasma physics. Furthermore, a more thorough discussion of the application of every process described would have been welcome through the inclusion of more experimental data. Two surprising omissions include the lack of coverage given to magnetic reconnection and to Birkeland (magnetic field-aligned) currents, surely processes fundamental for driving plasma transport within the Earth's magnetosphere and in coupling solar wind momentum down to the ionosphere. More significantly, however, the textbook seems outdated, for it fails to convey either the true scope or the excitement of present-day research. Indeed one might argue that the same textbook could have been written almost a decade ago.

*Physics of Space Plasmas* is an attractive and worthwhile publication providing a timely, though far from exhaustive survey of a subject which must surely grow in importance during the 1990s. I recommend the book as the best textbook currently available for an undergraduate course and to all research groups interested in space plasma physics. But there remains a pressing need for an up-to-date scholarly text covering the whole of Solar System plasma physics, in which theory and observation are carefully balanced. □

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The diamond ring effect — a solar eclipse.

# Modelling the mind

*L. H. Shaffer*

**Foundations of Cognitive Science.** Edited by Michael Posner. *MIT: 1990. Pp.888. $50, £44.95.*

COGNITIVE science has come into prominence in recent years as an innovative discipline for studying the human mind. Its central idea is that cognition is a species of computing and hence that the brain is a kind of computer. The requirements of a task and the mental processes in its performance are to be stated in computational terms. The computational description of a task, such as playing chess, carrying out medical diagnosis, or understanding speech, allows us to consider the class of possible minds that can perform it; whereas data from human performance allow us to converge on the biological mind within this class. Whether a model of mind, real or possible, is adequate for a given task can be tested by simulating it on a digital computer.

In different chapters of *Foundations of Cognitive Science* edited by Michael Posner, Zenon Pylyshyn discusses the computational concept of mind, whereas Allen Newell *et al.* and David Rumelhart discuss radically different architectures for the mental computer.

The aim of making the models of mental function explicit enough to be testable formally or by using computer simulation introduces a level of stringency lacking in the earlier theories of mind. The challenge of this stringency has already had remarkable results, rendering obsolete many of the traditional concepts inherited from philosophy, psychology and biology. Not the least benefit of the new science is that it exposes very clearly how far short the models still fall in accounting for human performance, sometimes providing clues of what is needed to improve them. This point tends to escape the critics of cognitive science, who seem to prefer the woolly comfort of bland generalization.

Posner is to be congratulated on having brought together so many distinguished authors, each contributing a tutorial chapter on their particular branch of the science. The best of these are exemplary and few of them fall below a high standard. The coverage of the science, even in a book this size, is by no means comprehensive, and that was not intended: there is enough to give the reader the flavour and some of the substance of the research, and each chapter contains a wealth of reference.

The chapters are organized in three sections: foundations, domains and assessment. But the two chapters in the last section, on philosophy of mind and cultural taxonomies, could well fit in the first, whereas the chapters on grammar and semantics in the first



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