

BOOKSHELF

Hidden Worlds: Hunting for Quarks in Ordinary Matter

by Timothy Paul Smith,
Princeton University Press.
ISBN 0691057737, £17.95 (\$24.95).

The world of subatomic particle physics is often portrayed to the non-specialist as solely the business of large "atom smashing" particle accelerators. But the mysterious quarks are very much the basis of familiar matter in the world about us, as Timothy Paul Smith explains in his book *Hidden Worlds*.

Smith, a research scientist at the Massachusetts Institute of Technology Bates Linear Accelerator Center and research professor at Dartmouth College, has produced a clear and concise journey through the wonders of subatomic physics for the student. His background as a teacher is soon apparent, as he uses common experiences to help relate the physical scale, details and concepts he wishes to convey. This skill makes the story and its comprehension easy for the lay reader.

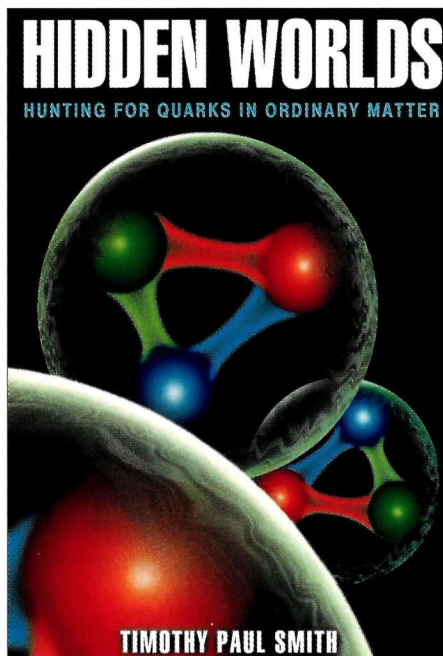
Smith quickly introduces his target area and focuses on his quark story. The early pages lead us through the requirement for high-energy accelerators and for their ever-increasing power to explore smaller and smaller particles as the atom, nucleus and nucleons are unwrapped.

The regular comparison and relation of physics concepts to chemistry provides an additional base for the reader's understanding. The use of quick resumés at the start of each chapter also enables the reader to progress through the book with some certainty – and is helpful for those who cannot complete the book in one go.

Smith uses his own experiences at research laboratories to describe both the scientific method and research team challenge in technical and organizational arenas. His obvious excitement and dedication to the research challenge are very clear, and no high-school student should miss such an invitation to a career.

The book should give the reader confidence in the use of the concepts of – among others – the nucleus, nucleon, charge, spin, color, quark, antiquark and gluon. Smith's good use of analogies using everyday systems also means that the reader can quickly become confident with the constituent quark and quantum chromodynamics. However, this should not be misinterpreted as gaining a full understanding; this is a small book covering a wide subject area and simply gives an overview in preparation for more advanced work.

The chapter "Particle Taxonomy and Quark



Soup" brings us into the Greek alphabet soup, which usually sinks lone attempts at the quark world. Smith's attitude appears to be that the reader should be exposed to this, but not overwhelmed. Patterns and overview are extracted and we proceed to further discoveries without exhaustion. However, Smith should have expanded more here, as this is the area in which readers are likely to be short of knowledge.

Next, Smith delves into the quark/gluon world, where there is a good use of clear text and diagrams. Having reviewed the quark's history and the current theories, Smith completes his story with some outstanding questions and current research proposals.

For those of you who flip through a book looking at the ratio of diagrams to text, Smith certainly passes the test, including Feynman diagrams, scale charts, quark and nucleon diagrams, accelerator exploded views and ample graphical charts. A glossary that gives an adequate description of technical terms is also provided, enabling easy reference without having to search through previous chapters.

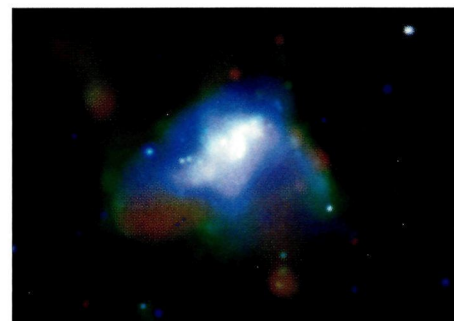
In all, *Hidden Worlds* provides a short introduction and overview of the subject area. Students should use it as such and expect to follow up with a more rigorous technical book. It is written in an attractive and easy to read style, which gives the reader the confidence to attack this difficult subject. In my opinion, a copy should be placed in every public library. *John Cuckney, Oxford University Summer School for Adults.*

Element Genesis, solving the mystery

a video release by the RIKEN Institute, Japan. English version ¥3000 NTSC format, ¥4000 PAL/SECAM format.

A flapping butterfly, the songs of birds, the colours of flowers, mountains and oceans – all are relics of the stars, for the ashes of stars are the building blocks of all we can see and touch. On Earth, the ashes must have been recycled, because we can find nearly all the elements present. It is only half a century since we began to understand that the genesis of the elements lies in the stars. They are the factories and, depending on their fuel, mass and age, they produce their specific elements.

RIKEN, the Institute of Physical and Chemical Research in Japan, has taken the initiative to produce a video of the processes involved in the synthesis of elements in the stars. The film begins with a gentle introduction, but soon the audience must be alert as they will be informed about the basics of radioactivity and the structure of atomic nuclei, in subtle detail. The video continues with the synthesis of elements, first in a star like the Sun, then during the Big Bang,



Element factory: NGC 1569, a dwarf galaxy 7 million light-years from Earth, is pictured in X-rays by the Chandra Observatory, which found evidence for elements such as oxygen, neon, magnesium and silicon – the recycled "ashes" of dead stars. (NASA/CXC/UCSB/C Martin et al.)

and then in massive stars, and ends with the production of thorium and uranium in a supernova explosion. Back on Earth, RIKEN argues that its research using radioactive ion beams is important for unravelling the mysteries of element synthesis, with supporting statements from scientists from other countries.

The video lasts for 35 minutes and is a complete lesson in nuclear synthesis. It is excellent material for high-school and university students who already have a background knowledge of this subject matter. Despite the long duration ▶

of the film, it can be used to support lessons on this topic. However, there are also some cautionary remarks. As mentioned before, the information given within the first six minutes about the basics of radioactivity and the structure of atomic nuclei is so compact and detailed that even the most attentive students will be exhausted, especially as the information comes both from a voice-over and simultaneously from three or four different places in an animation. This could be simply avoided.

Fortunately, the movie then slows down and the alternation of the narrator with comments from Japanese scientists works very well. If the "man in the street" understands that thermal motion of two hydrogen nuclei by quantum-electrotunnelling through the barrier created by electric repulsion leads to fusion into deuterium, a positron and a neutrino, then the video would also be suitable for the general public. Otherwise, it would probably be better to make a special, more simplified version, which could give an overview of the birth and death of the (massive) stars that 5 billion years

ago resulted in the birth of our solar system.

In summary, this is an attractive and interesting video on nuclear synthesis and nuclear structure, and could be useful for supporting lectures and classes. For further information on the video and its distribution, please see <http://www.image-science.co.jp/element>. Jacques Visser, *Public Relations, NIKHEF*.

Books received

Introduction to Numerical Analysis by Michelle Schatzman, Oxford University Press. Paperback ISBN 0198508522, £24.95; hardback ISBN 0198502796, £49.95.

Written for advanced undergraduate mathematics students who are interested in the "spice and spirit" of numerical analysis, this is an English translation of an updated version of Schatzman's book, which first appeared in French in 1991.

Nonrelativistic Quantum Mechanics

World Scientific. Paperback ISBN 981024651X, £33 (\$48); hardback ISBN

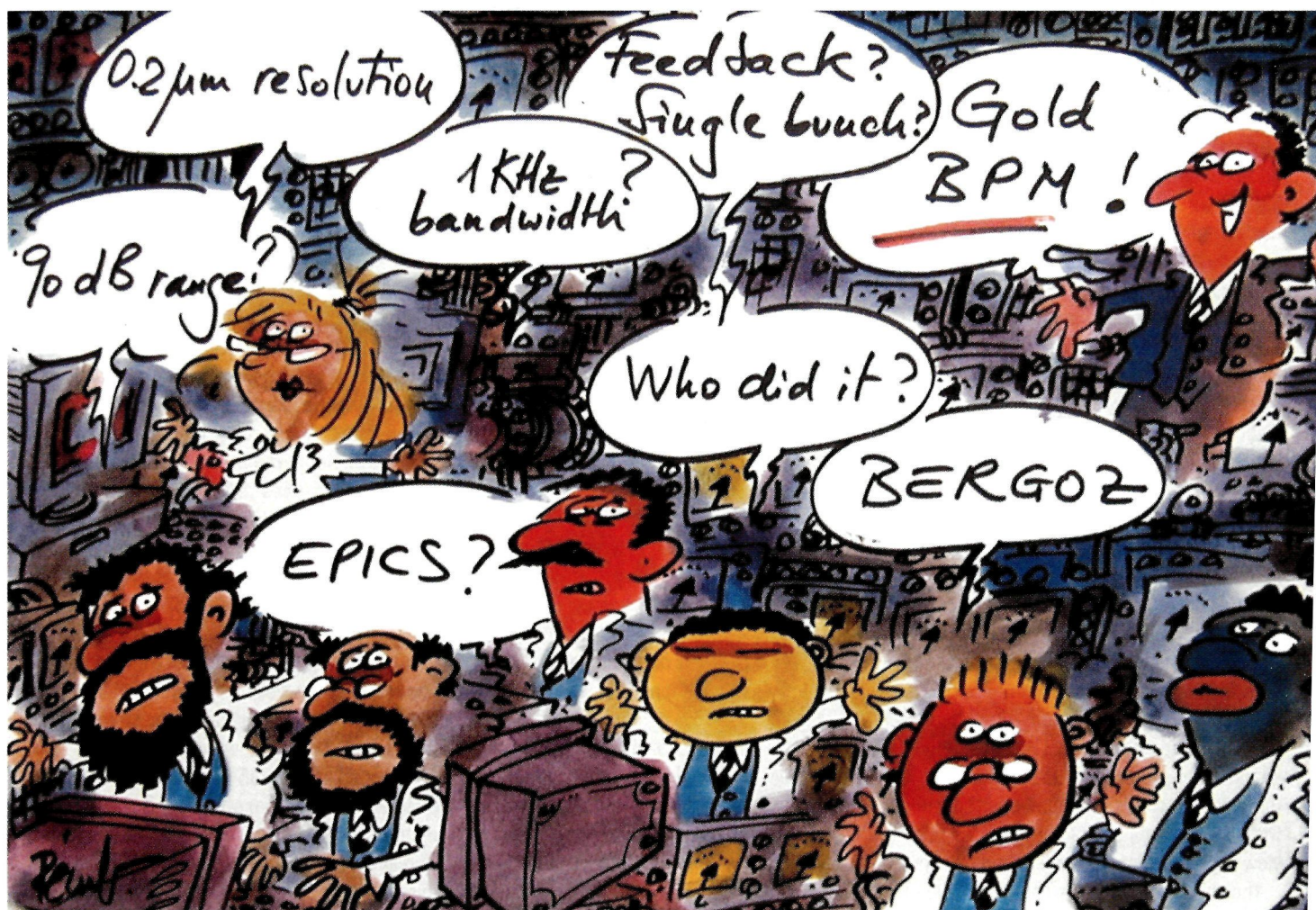
981024634X, £53 (\$78) and

Problems & Solution in Nonrelativistic Quantum Mechanics by Anton Z Capri, World Scientific. Paperback ISBN 9810246501, £33 (\$48); hardback ISBN 9810246331, £58 (\$86).

Now in its third edition, Capri's textbook is suitable for advanced undergraduate students as well as graduate students. The new study guide, in its first edition, has grown out of popular demand. The problems, most of which have been tested on the author's students, vary in difficulty from very simple to research level.

Chaos and Time-Series Analysis by Julien Clinton Sprott, Oxford University Press. Paperback ISBN 0198508409, £24.95; hardback ISBN 0198508395, £49.95.

Aimed at students, scientists or engineers who want to use the ideas in a practical setting, this book introduces new developments in chaos and related topics in nonlinear dynamics. The emphasis is on physical concepts and useful results.

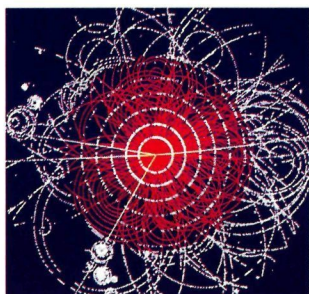




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Image shows a simulation by the ATLAS experiment of the
decay of a Higgs boson into four muons (yellow tracks).



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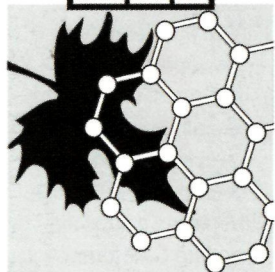
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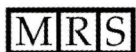
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MEETING ACTIVITIES

Symposium Tutorial Program

Available only to meeting registrants, the symposium tutorials will concentrate on new, rapidly breaking areas of research.

Exhibit and Research Tools Seminars

A major exhibit encompassing the full spectrum of equipment, instrumentation, products, software, publications, and services is scheduled for December 2-4 in the Hynes Convention Center, convenient to the technical session rooms. Research Tools Seminars, an educational seminar series that focuses on the scientific basis and practical application of commercially available, state-of-the-art tools, will be held again this fall.

Publications Desk

A full display of over 775 books, plus videotapes and electronic databases, will be available at the MRS Publications Desk.

Symposium Assistant Opportunities

Graduate students planning to attend the 2003 MRS Fall Meeting are encouraged to apply for a Symposium Assistant (audio-visual assistant) position.

Career Center

A Career Center for MRS meeting attendees will be open Tuesday through Thursday.

The 2003 MRS Fall Meeting will serve as a key forum for discussion of interdisciplinary leading-edge materials research from around the world. Various meeting formats—oral, poster, round-table, forum and workshop sessions—are offered to maximize participation.