ness. The main thrust of this discussion is that this model for river basin evolution produces network structures with fractal characteristics that resemble those of real basins, as obtained from high-resolution digitized satellite images. Additional elements, such as the dynamic interplay of fluvial (flow-dominated) and hill slope (diffusion-dominated) processes and the signature of climatic and geological conditions, are also nicely incorporated into this general framework.

Despite a slight tendency towards information overkill, the book is written in a clear and fluent manner and should render the topic accessible not only to members of the two research communities addressed—hydrologists and physicists—but also to graduate students intending to work in this field. It may also be useful as a source of introductory material and examples for a rather specialized course on complex systems. Physicists working on such phenomena, or wishing to enter the field, will find this book interesting and useful.

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Computational Physics: Problem Solving with Computers

Rubin H. Landau
and Manuel J. Páez Mejía
Wiley, New York, 1997. 520 pp.
$49.95 hc ISBN 0-471-11590-8
Includes diskette

Come, let us parse together and consider that deceptively simple noun phrase "computational physics." Adjective specializing the noun, it ought to mean something like "a subfield of physics based on, or heavily utilizing, computation." Indeed, at the graduate and professional levels, this is exactly what it does mean. It is a lively field of science, whose practitioners are typically the high priests of large, sophisticated numerical codes for use in hydrodynamics, plasma dynamics, gravitational N-body, lattice quantum chromodynamics and so forth. Professional computational physicists might engage in a nitty-gritty discussion on some fine point of parallel hardware memory caching or a heated debate on high-performance FORTRAN versus message passing interface.

In undergraduate teaching, however, computational physics has come to mean something different. Physicists are by nature problem solvers, and we have never been shy about using any available tool—paper and pencil, slide rule, Large Hadron Collider and, yes, the computer. Increasingly since 1990 or so, many physics departments have devised courses whose content is really something like "general, exploratory, quantitative problem solving." Computers figure prominently in these courses, since the computer is an exploratory tool without peer. But the best of these courses feature equally vital doses of analytic methods, order-of-magnitude estimation (reducing a problem to dimensionless form is often the first step in good computation), statistics (often connected to Monte Carlo methods) and just plain logical thinking.

Do these courses teach something valuable? Absolutely! Arguably, they teach precisely what physics departments have to offer as their best defense against new charges of irrelevancy. If we have something to teach biologists as they enter "their" 21st century (as the 20th century was "ours"), this may be it.

Rubin Landau and Manuel Páez Mejía's *Computational Physics* is one of a spate of recently published texts for this kind of useful course. Others include Nicholas Giordano's *Computational Physics* (Prentice Hall, 1997) and Tao Pang's *An Introduction to Computational Physics* (Cambridge U. P., 1997). (To find a dozen more titles, going back to Steven Koonin and Dawn Meredith's *Computational Physics* (Addison-Wesley, 1990), search the Website http://www.amazon.com for the joint subject fields "physics" AND "data processing.")

The present book, developed for a course at Oregon State University, is distinguished by the breadth of material that it contains. This is not, however, always a good thing, since the coherence of the book as a systematic text suffers. Think of this as a good source book for instructors rather than as a text for students. The book is divided into a large number (something like 300) of very short sections. The authors categorize these as theory, method, exploration, problem (meaning a statement of a topic), assessment (meaning an exercise for the student), implementation (meaning a computer program supplied on the book's accompanying diskette) and so on, but this classification scheme breaks down.

There are a lot of good things in the inchoate mass, however: discussion of computer programming languages and methods, error analysis, numerical methods (including differential equations and Fourier methods), data fitting, Monte Carlo methods, summary and assessment of public domain software, a bit on parallel computing and on and on. Among the sampled topics of physics are quantum eigenproblems, bound states and scattering; anharmonic oscillations, nonlinear dynamics and chaos; the Ising model; fractals and pattern formation; and solitons.

Students in a course like this can learn a lot of physics. One might worry, however, that it is a kind of disorganized and opportunistic physics—the "best bits." That's not a sin in the context of a comprehensive undergraduate physics curriculum. But precisely because a course like this is so useful as a general problem-solving course and is thus potentially so useful to students majoring in other areas of science, the individual instructor has to make a tough choice: Do you want to teach physics, or do you want to use physics to teach broad-based computer and analytic problem-solving skills? This book can be useful either way.

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Hunting Down the Universe: The Missing Mass, Primordial Black Holes, and Other Dark Matters

Michael Hawkins
Helix Books (Addison-Wesley), Reading, Mass., 1997. 240 pp. $24.00 hc ISBN 0-201-15698-9

Hunting Down the Universe is in part about the author's role in elucidating the composition of the cosmic dark matter. This is surely one of the most important scientific questions facing science as our century draws to a close, and Michael Hawkins has made a very interesting, if somewhat controversial, contribution to its resolution: He has detected long-term variations in quasar light, which he attributes plausibly to gravitational microlensing by intervening compact objects. If one accepts this interpretation, one then must agree with Hawkins that most of the material in the universe comprises objects of Jupiter's mass. Hawkins further argues that these are primordial black holes. This is remarkable stuff! If it is confirmed, he will have made one of the discoveries of the century.

I approached the book enthusiastically. This is "my" area of research (I work on gravitational microlensing as part of the MACHO—Massive Compact Halo Objects—Project), and I have read Hawkins's research papers with great interest. I was hoping to read the adventure story behind his publications.

The story of Hawkins's own work, and the more general discussion of the cosmic dark matter, takes up less than half the book. The larger portion concerns so-called "other dark matters" and is a peculiar mixture of philosophy of science (with quotes from Ludwig Wittgenstein and Steven Weinberg, among others, used to launch the author's opinionated discussion of the meanings of scientific work), history of science (in particular, astronomy and cosmology) and sociology of science. Much of the early part of this text is wound around Hawkins's highly personal view of Fred Hoyle, his contributions, his controversies and why he "was held up to ridicule and antipathy as the enemy of scientific truth" by the British astronomy establishment.

It is difficult to profit from this material. It reads much like a newspaper op-ed article that has grown much too long: dominated by the opinions of the writer, without adequate support to allow the reader to determine the difference between opinion and fact or between what is controversial and what is widely accepted. I found it a frustrating read.

Towards the end of the book, Hawkins introduces the modern science of dark matter, and the role he has played. This is refreshing after the earlier chapters, and here I was constantly wishing for more. The text would have been immensely improved by the addition of figures (photographs, cartoons and graphs all could support his words). I think the book would have read better if he had expanded the personal elements of the story, because it is certainly an interesting one.

There is a blunder: Hawkins states that the microlensing surveys conducted towards the Large Magellanic Cloud (he mentions MACHO; EROS—Expérience de Recherche d'Objets Sombres—has also reported significant results) have no sensitivity to objects of Jupiter's mass. This is not the case. Both MACHO and EROS have demonstrated that objects with masses between that of Earth and a tenth of a solar mass do not make up a large fraction of the dark matter in the halo of the Milky Way. This result does not directly contradict Hawkins's interpretation of his data, since most of the objects he posits must not belong to galactic halos. It would be surprising, however, if it turned out that the universe is awash in primordial black holes that somehow are excluded from galactic halos. Hawkins should have addressed this; his error allows him to avoid the issue.

The book ends with some discussion of what should be done next. His proposals are entirely reasonable, but I wonder who Hawkins had in mind as he wrote. This discussion is fine for the professional astronomer, but the explanations are brief and would not benefit the nonspecialist. The nonscientist will be lost much of the time.

Some day there will be a terrific book about the cosmic dark matter. It is probably premature to hope for it now. *Hunting Down the Universe* is not the book I hoped it would be when I picked it up.

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NEW BOOKS

Acoustics

Acoustical Imaging, Vol. 23. Proc. Symp., Boston, Mass., Apr. 1997. S. Lees, L. A. Ferrari, eds. Plenum, New York, 1997. 653 pp. $165.00 *hc* ISBN 0-306-45768-7

Statistical Methods for Speech Recognition. *Language, Speech, and Communication.* F. Jelinek. MIT Press, Cambridge,