And what viewpoints! As any student of comets knows, the subject is replete with exciting anecdotes and a long list of characters. The author does an excellent job of putting the ancient events in a temporal context to which the reader can relate, while covering the multitude of events with which comets have been associated in the public mind in the last decade. These events range from the origin of Earth and the creation of its oceans to the death of the dinosaurs and observations of comets by the ancient Chinese and Greeks, the Norman invasion, the cosmologies of Isaac Newton and Edmund Halley, Comet Bennett and the 1973 Yom Kippur War, Comet Shoemaker–Levy 9 and its impact on Jupiter, Comet Hale–Bopp and the Heaven's Gate cult and last year's spate of Hollywood impact–disaster movies.

Levy has been in the thick of these events, having discovered a good number of comets himself and worked closely with others studying minor planets in our Solar System. He describes well what it is like to be a comet hunter (the average hunter spends 400 hours watching the skies before finding a comet) and he invites the readers to go outside and stargaze themselves, following a series of easy steps that he lays out.

The book reads like a series of essays loosely tied together by the overarching theme of cometary impacts on planetary bodies. Discussions include comets and the formation of the planets, a wonderful comparison of Venus, Earth and Mars (and why humans are a very lucky species) and the existence of extraterrestrial life and the need for Jupiters to protect inner, life-bearing planets from impacts. I particularly like his description of what it would be like to live near an impact site. (I remember thinking similar thoughts while being shown through Meteor Crater, Arizona, by Eugene Shoemaker, the father of the study of terrestrial impact features. At the bottom of this approximately 2 km wide and 300 m deep crater, we were invited to look up and around and view the consequences of a 10-megaton explosion; this was very sobering for any contemplation of nuclear war. It occurred to me at the time that, at a relative collision speed of ~50 km/s, the average being at the site would have only enough time to look up and think "Oh—.") Levy points out that while the impact was large, if any people had been living in what is now Flagstaff, Arizona (50 km away) at the time of the impact 50 000 years ago, they would have felt nothing more than strong ground tremors and heard a huge boom.

The one criticism I have of the book is that, while the individual chapters or essays read very well and are informative and thought-provoking, (à la the ruminations of Lewis Thomas on biology), the overall theme of impacts is returned to only in a somewhat haphazard way, making the book more experiential than tutorial I wish Levy had both broadened and refined his focus a bit more. It is clear that he has a lot to say and teach about astronomy as we currently know it, and has clearly used the long hours he has spent hunting comets to think hard about the subject.

I heartily recommend this book to anyone interested in learning about the study of comets and what is being done today to understand them and catalog their dangers to life on Earth. I then recommend that the reader pick up Fred Whipple's *The Mystery of Comets* (Smithsonian, 1980), another wonderful book by a master cometologist, to see how far we have come in the last 20 years of cometary study—and how far we still have to go.

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Basic Calculus: From Archimedes to Newton to its Role in Science

Alexander J. Hahn
Springer-Verlag, New York, 1998. 545 pp. $59.95 hc ISBN 0-387-94606-3

Alexander J. Hahn's *Basic Calculus* is not a clone of the traditional calculus text. Its development is entirely historical, with many references to and quotes from sources that are, if not original, at least authoritative. Vast numbers of applications, in fields including astronomy, biology, engineering, economics and physics, permeate and surround a solid core of the elements of calculus. A truly modest sampling of topics includes: The potassium–argon clock, OPEC and the price of oil, the Springfield rifle, Hubble's law, the orbit of the Moon, sliding ice cubes, quantitative analysis of lenses, experimenting with *E. coli*, interior ballistics, free fall with air resistance, the internal combustion engine, the sliding chain, fermentation processes, supply and demand in a market and the rocket equation.

The seven chapters of part I ("From Archimedes to Newton") form the mathematical core. The first four of these chapters cover science and mathematics from Pythagoras to Kepler. Calculus first appears in chapters 5 ("The Calculus of Leibniz") and 6 ("The Calculus of Newton"). In chapter 7 ("The *Principia*"), the author takes us through Newton's geometric proof of equal areas in equal times. He then provides a commentary on Newton's proof that seems more resonant to a modern ear. Every serious physics student should dip into the *Principia* at least once. Part II ("Calculus and the Sciences") makes up about 60% of the book and, in its seven chapters, not only stresses applications to the sciences but also introduces new mathematics.

The author, a professor of mathematics at the University of Notre Dame, has used this book in a two-semester calculus sequence "for arts and letters honors students" and a one-semester course of "elementary applications of the calculus for regular arts and letters students and architecture majors." It seems to me that the book is very suitable for such courses. It is perhaps less suitable for a course in which the aim is to learn calculus as a tool and the desire is "to get on with it," without exploring historical byways. Several of its chapters would be appropriate for a course on the history of physics.

There is an abundance of worked examples and an average of about 60 problems at the end of each chapter, many of which could well be borrowed for assignment in an introductory physics course. The author's Web site, http://www.nd.edu/~hahn/ (the URL cited in the book seems to be incorrect) provides excellent support. Here, one can learn much about the mathematicians and physicists whose work the book describes. By judicious clicking one can generate planetary orbits, view a page from the *Conics* of Apollonius or the notebooks of Galileo, study a fascinating gallery of famous curves (from the Astroid to the Witch of Agnesi) or be connected to the US Census Bureau's home page. This is a well-written and interesting book, well suited to its stated purposes.

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Looking for Earths: The Race to Find New Solar Systems

Alan Boss
Wiley, New York, 1998. 256 pp. $27.95 hc ISBN 0-471-18421-7

"There are three topics in your field that we try to keep up with," a *New York Times* reporter told an audience of astronomers recently: "the accelerating universe, dark matter, and, of course, planets of other stars." For astronomers too, extrasolar planets are one of the hottest topics of the 1990s. So it's not surprising that a half-dozen books on the subject have been published in the past few years, with more in the works. Among these now available: Alan Boss's *Looking for Earths* stands out as the work of an accomplished participant in the field. Boss is not a planet hunter, but he is a noted theorist who deals with the way solar systems form.

The book is a narrative about scientists in search of planets and the means they use to find those planets. Boss takes us along on the endless academic circuit of conferences, committee meetings, and lectures that consume the time and energy of many experts-in-demand. The reader shares his enthusiasm at milestone announcements of planetary discoveries—and the occasional disappointment when a discovery is later disproved or withdrawn. Where most books on this subject focus on the observational findings, our theorist-guide also recounts the developments within his small circle of specialists on where and how planets form.

Memories are vivid. Boss knows where he was when he heard about 51 Pegasi B, the first accepted extrasolar planet of a Sun-like star, and how he felt when he showed a plot of the latest theoretical computations to a senior colleague. He explains why the manuscript of what is arguably the most important paper in the history of the field, delivered to him by messenger from the offices of *Nature* to be refereed, sat unread for a day or two, despite breathless anticipation. He also details the repeated and finally successful efforts to find brown dwarfs. These are objects with masses below the critical value needed for the onset of sustained nuclear fusion, as in a true star, but otherwise distinguished from planets, although by criteria not yet universally accepted. Boss's tale is personal, one of the relatively rare but welcome accounts in which a scientist shares with the reader the feelings he experienced as, together with colleagues and competitors, he helped lay the groundwork for a new science.

It's the insider's view of committees and advisory panels in *Looking for Earths* that historians of the space program will find most interesting. Boss and friends traveled a long road in their efforts to get the search for Earth-like planets included in the Federal budget. The names of proposed projects and the panels that evaluate them are constantly changing as the tale unfolds, like billboards advertising local attractions on a long highway trip. Fortunately, there's a glossary, so that a reader can distinguish programs such as ASEPS, ExNPS, FRESIP, OSI, POINTS, and SIM from consulting groups that include COMPLEX, PSSWG, SIMSWG, SISWG, and TOPSSWG (I'm not making any of these up). The author is not shy about sharing his impressions of management decisions at NASA and the Jet Propulsion Laboratory or the supposed perfidy of a few insiders, and he doesn't hesitate to label one colleague who emerges victorious from certain program reviews as "fast-talking." Other witnesses, of course, should be heard from.

Anyone who writes his own book is entitled to emphasize his own views. By the start of 1999, there were 17 known planets of Sun-like stars beyond our Solar System. All are at least as massive as Jupiter, yet several reside in very close circular orbits, their periods measured in days rather than years. Such objects were not generally expected. Others, about half of the extra-Solar planets, revolve in notably elliptical orbits having semi-major axes of about 0.2 astronomical unit or larger. Boss terms the latter objects brown dwarfs, with no hint to the reader that most of us call them planets. As brown dwarfs, they fit his formation theories. But as planets, they probably are telling us that more work is needed.

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Scientific Instruments 1500–1900: An Introduction

Gerard L'E Turner
U. Calif. P., Berkeley, Calif., 1998. 144 pp. $40.00 hc ISBN 0-520-21728-4

Advertised as "a must-have book for the active collector," this thin volume, by Gerard L'E Turner, offers beautiful photographs and brief descriptions of the sort of instruments that one might find in an antique shop or on the auction block. As an introduction to the field, it can't be beat. Collectors with a little experience, however, would do well to consult the more detailed books listed in the bibliography.

Turner adopts the definition of "scientific instrument" that has guided public and private collections for years, placing much more emphasis on instruments designed for practical purposes than on those designed for scientific investigation or demonstration. Accordingly, the bulk of the text pertains to horology, navigation, surveying, drawing, and calculating, weighing and measuring. One short chapter concerns optical instruments (such as microscopes and telescopes), and another concerns instruments used for natural philosophy (what is now known as physics).

Turner, of Imperial College, University of London, writes for an English audience and gives primacy of place to English examples. Since London was the center of the instrument trade in the 18th century, some of this Anglo focus is warranted. For the 19th century, however, it obscures the important work done by instrument makers in other lands. Turner mentions, for instance, J. J. Lister's invention of achromatic objectives for microscopes, but he ignores the immersion lenses, which originated on the Continent and which British microscopists were slow to adopt. Turner's few references to American instruments indicate an ignorance of recent scholarship in this field.

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New Books

Particle Physics

Electromagnetic Processes at High Energies in Oriented Single Crystals. V. N. Baier, V. M. Katkov, V. M. Strakhovenko. World Scientific, River Edge, N.J., 1998. 554 pp. $113.00 *hc* ISBN 981-02-1603-3

Heavy Flavours II. *Advanced Series on Directions in High Energy Physics 15*. A. J. Buras, M. Lindner, eds. World Scientific, River Edge, N.J., 1998. 828 pp. $98.00 *hc* ISBN 981-02-2215-7

Modulation Spectrometry of Neutrons with Diffractometry Applications. *Series on Neutron Techniques and Applications 1*. P. Hiismäki. World Scientific, River Edge, N.J., 1997. 177 pp. $48.00 *hc* ISBN 981-02-2746-9, *Diskette*

Physical Electronics

High Speed Diode Lasers. *Selected Topics in Electronics and Systems 11*. S. A. Gurevich, ed. World Scientific, River Edge, N.J., 1998. 198 pp. $48.00 *hc* ISBN 981-02-3237-3

Plasmas and Fusion

Electron Kinetics and Applications of Glow Discharges. *NATO ASI Series B, Physics 367*. U. Kortshagen, L. D. Tsendin, eds. Plenum, New York, 1998. 557 pp. $155.00 *hc* ISBN 0-306-45822-5

Instabilities in a Confined Plasma. *Plasma Physics Series*. A. B. Mikhailovskii. IOP, Philadelphia, 1998. 462 pp. $250.00 *hc* ISBN 0-7503-0532-0

Popularizations

Annals of the Former World. J. McPhee. Farrar, Straus and Giroux, New York, 1998. 696 pp. $35.00 *hc* ISBN 0-374-10520-0

Before the Beginning: Our Universe