millimeter sky.

There is no shortage of fine books about cosmology; my favorite is the paperback by Jim (P. J. E.) Peebles, *Principles of Physical Cosmology* (Princeton U. P., 1993). However, Partridge's book has no competitor in explaining the hazards and joys of the experimental physicist seeking to measure the faint whisper of cosmic noise from the beginning of time. It reviews the physics of the Big Bang, the early predictions by Ralph Alpher, Robert Herman and George Gamow, the physics of radio astronomy and the stories of the initial discovery by Arno Penzias and Robert Wilson, as well as the reasons so many people came so close but missed it. It covers experimental approaches including radio receivers, thermal detectors, spectrometers, calibration, beam switching and error analysis.

The sensitivities of receivers have improved by many orders of magnitude since the original discovery, so the calibration and the modeling of atmospheric and our own Galactic emission are now the limiting factors. The book covers the relevant theory in depth, with some two-thirds of the space devoted to it. If there is any weakness in the book, it is the impossibility of keeping up with the flow of recent papers. Most of the references end in early 1992, but Appendix C summarizes work through early 1994. This period includes the main COBE results and first detections of the acoustic oscillations of the photon–baryon fluid. In short, the book is a well-written and thorough review of a difficult and exciting experimental and theoretical domain.

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The Three Big Bangs: Comet Crashes, Exploding Stars and the Creation of the Universe

Philip M. Dauber
and Richard A. Muller
Addison-Wesley, New York, 1996.
207 pp. $25.00 hc
ISBN 0-201-40752-3

In *The Three Big Bangs*, Philip M. Dauber and Richard A. Muller have written a delightfully readable book about the three singular events—the emergence of the early universe, the supernova synthesis of our elements and the Cretaceous–Tertiary impact of a giant comet or asteroid—that shaped

so much of the prehistory of the human estate. Wonderfully, it is as accessible to the sophisticated layman as to the astrophysical specialist. Thus, because most astrophysicists tend to be knowledgeable in at most two of these three fields, the book's overall synthesis has greater depth than the omissions in one's own field might suggest.

Dauber and Muller observe early in their book how incredible it is that three events, each singularly important as preconditions for mammalian life, should have almost identical—and human—time scales: seconds to minutes rather than eons. True, the universe spans 59 orders of magnitude in time, from Planck time to Hubble time, but the nuclear cadenza in the first few minutes stole the show. As the authors so eloquently emphasize, "The 3-degree temperature today and the extrapolation back to the temperature at which 25% of matter would be converted to helium are the cross check, along with the observed expansion of the galaxies and the near-uniformity of the microwave radiation that constitutes the bedrock upon which rests our reconstruction of the early universe."

The focus of the book is reiterated four times, at the beginning and end of the preface, in chapter 10 and as the book's last line: "The search for our origins continues." In my view it is justifiable to dramatize this most fundamental issue of science by blatantly appealing to our almost universal fascination with explosions—thus the three big bangs. There is more than enough science to justify our equally universal soul searching, driven by the deep recognition of the infinitesimal probabilities of the events leading to us. The time-reversed order of the book—the K–T impact first and the flatness or deceleration of the universe last—is appropriate to the ordering of our abilities to visualize the events, inflation during the first 10^{-32} seconds coming harder to us than the global disaster to reptilian life caused by a vegetation-denuding fireball. Both play their parts in this story of unlikelihood—or inevitability, depending upon the depth of one's own soul.

The chapters dealing with the K–T impact are fascinating to me. I was acutely aware of the drama (and pain) that accompanied the discovery and interpretation of the iridium anomaly. Certainly, it seemed unlikely that a boloid of the right size and timing had collided with the Earth so as to enhance the evolutionary dominance of mammals. The presentation of the theory by Walter and Luis Alvarez, Frank Asorro and Helen Michel in 1980 met with vitriolic rejection by the majority of Earth and life scientists. The condemnation of this reasonable suggestion of a new way to explain so much about life on our planet was incredible to me. I tried to help, but Rich Muller was much closer to Luis than I was and more deeply involved. In a fascinating chapter, the authors generously excuse this early rejection on the basis of the paleontological and geological professions' fight for gradualism against the catastrophe theories of established religions. By contrast, the 50 career-busting years it took for Alfred Wegner's theory of continental drift—even more incredible to me—is mentioned politely.

Also by contrast, the nearly instant recognition and acceptance of my own far-out theory (with Richard White) of neutrino-driven supernova explosions were dramatic and surprising. Almost an industry of graduate students under Willy Fowler and Al Cameron set about making it work. What a difference! And then, 27 years later, came the detection of neutrinos from Supernova 1987A. What elation! Nevertheless, despite these many years of work, a universally accepted solution to the "supernova problem" is still ellusive. A supernova explosion is a highly improbable phenomenon, and relating one to the highly forbidden nickel–cobalt-56 decay is even more unlikely—as is the excited state in carbon-12, that sets the stage for the nuclear synthesis of the heavy elements.

The emerging recognition of the Chicxulub, K–T impact crater in southern Mexico is analogous to the detection of the neutrinos from Supernova 1987A. The difference is that there had been 25 years of cooperative research before the detection of the neutrinos and far less time before the present, emerging acceptance of the implications of the Chicxulub crater. If we as scientists are to reach the goal both of this book and of thinking humans—to understand human origins—we will have to cooperate on a grander scale on all these problems and more, including inflation of the early universe, the deep-Earth biosphere and the evolution of chimpanzee behavior. This book begins to raise the curtain.

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Magnetism in Disorder

Trevor J. Hicks
Oxford U. P., New York, 1995.
147 pp. $85.00 hc ISBN 0-19-851016-0

Magnetism in Disorder by Trevor J. Hicks is a monograph reviewing neutron-scattering studies in magnetically disordered materials. (It is volume 11 in the Oxford Series on Neutron Scattering in Condensed Matter.) The book begins with a chapter on the interactions of thermal neutrons with nuclei and electronic moments in solids. This is followed by chapters on diffuse scattering from dilute and concentrated ferromagnetic alloys, defect scattering from antiferromagnetic alloys, inelastic-scattering studies of magnetic excitations in disordered materials (including a section on critical scattering), spin glasses, and amorphous magnets. Hicks is well qualified to write such a review, since he has played a key role in many neutron scattering studies of magnetic alloys.

Although of modest length, the book contains a wealth of references to experimental studies, along with short presentations of a number of theoretical models that are particularly useful in interpreting the data. Also noteworthy is the material on polarized-neutron experiments. In addition, the book contains interesting sections on neutron-scattering instrumentation at the Atomic Energy Research Establishment, Harwell, England, and at the Institut Laue–Langevin in Grenoble, France. Included in the latter are instruments for the polarization analysis of diffuse scattering and a description of the spin-echo spectrometer.

The book is likely to be most useful to anyone seeking rapid access to the literature on neutron-scattering studies of magnetically disordered solids. A wide-ranging survey, it does not provide in-depth coverage of any of the topics, but by following up on the references one can quickly locate the relevant original papers. For its nontechnical language, this book can be looked upon as the printed version of a World Wide Web site for investigations of disordered magnetic materials.

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MHD Structures, Waves and Turbulence in the Solar Wind: Observations and Theories

Chuan-Yi Tu and Eckart Marsch
Kluwer, Norwell, Mass., 1995.
210 pp. $92.50 hc ISBN
0-7923-3345-4

With their book's title, *MHD Structures, Waves and Turbulence in the Solar Wind: Observations and Theories*, Chuan-Yi Tu and Eckart Marsch capture the central enigma behind