their supporters). Knowledge without power generates irony, which has been an important mode of discourse among sociologists. It is relatively rare in the discourse of the powerful and in scientific journals. So that even if the ASA had opted to drive its social reformers and other committed visionaries out of the discipline and even if every sociology student were well-trained in mathematics, in formal hypothetical thinking, and in the design of controlled experiments, sociology might still be an improbable, if not an impossible, science. *The Impossible Science* is well worth the attention of readers of this journal.

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Inflating Universes

Particle Physics and Inflationary Cosmology. ANDREI LINDE. Harwood, New York, 1990. xviii, 362 pp., illus. $60; paper, $29. Contemporary Concepts in Physics, vol. 5. Translated from the Russian by Marc Damashek.

The intellectual merger of particle physics and cosmology has been one of the scientific triumphs of the past decade. The seeds for this merger were planted back in the '70s with the establishment of the big bang model and with the realization that the early universe was sufficiently hot and dense that the physics governing it was dominated by nuclear and elementary particle effects. The recent confirmation of predictions from cosmology about the number of fundamental particles by experimental results from the Large Electron Positron and Stanford Linear Colliders (LEP and SLC) has completed the merger. Intellectually, however, it was probably the idea of inflation that most attracted particle theorists to cosmology. Although others such as Gliner, Kazansas, Sato, and Starobinsky also played with some of the ideas involved, inflationary cosmology really took off in 1980 when Alan Guth showed that the type of fields predicted in grand unified theories could drive a rapid expansion of the early universe. This solved a number of the longstanding initial-condition problems of the standard big bang model and stimulated a real revolution in cosmology. It was immediately recognized that the cosmological initial conditions could be a natural consequence of the unification of the forces, and that one might even use the cosmological consequences of a unified theory to ascertain its validity. However, one important hurdle existed in Guth's original formulation—though he could get the rapid expansion to occur, Guth was not able to get from that phase back into the more slowly expanding universe in which we find ourselves now.

This problem was resolved by Andrei Linde working in Moscow (and independently by Paul Steinhardt and Andreas Albrecht working in the United States). Linde's solution became known as "new inflation," and he went on to show that other formulations of inflation might also work. In fact, he showed that essentially any scalar field existing at early times in the universe could cause inflation, and since all unification models seem to have some sort of scalar field, they all lead naturally to some sort of inflating phase. Linde dubbed the idea that any simple scalar field could cause inflation "chaotic inflation," and the production of multiple inflating epochs by multiple scalar fields has come to be known as "stochastic inflation." When coupled with ideas about quantum gravity, stochastic inflation leads to multiple inflating, causally disconnected universes. Linde's work, along with his dynamic personality, wry sense of humor, and prodigious publication rate, has made him one of the world's leading cosmologists. There is little doubt that Linde, although young, is assuming the mantle of the late Yakov Zel'dovich as the Soviet Union's leading cosmologist, and now that he has accepted a position at Stanford University he is also becoming one of America's leading cosmologists.

Linde's book *Particle Physics and Inflationary Cosmology* clearly and succinctly presents the development of inflationary cosmology in the language of modern quantum theory. (Also recently published, by Academic Press, is a collection of Linde's original papers entitled *Inflation and Quantum Cosmology*). The monograph is written primarily for those approaching the subject from the particle physics rather than the astrophysics side of cosmology and is at a level appropriate for the advanced graduate student. The book has fewer typographic errors and linguistic awkwardnesses than are typical for monographs translated from the Russian, but more than are usually encountered in other works in theoretical physics. The Russian references are particularly complete, which is a boon to those of us less familiar with that literature. This is, however, at the cost of being somewhat less complete with regard to the Western references.

The book focuses on the connection between particle physics and inflation, and the reader will not find other aspects of the particle-cosmology connection, such as dark matter, nucleosynthesis, baryosynthesis, and other more phenomenologically oriented subjects, discussed in any significant way. However, the discussion of inflationary cosmology is extraordinarily thorough. Various potentials and their effects on inflation are treated in great detail. The physics of phase transitions in a hot universe is well described. The derivation of scale-free fluctuation spectra at the end of inflation is made clear. The discussions of both the new and the chaotic inflationary scenarios emerge as natural consequences of the framework developed earlier in the book.

Linde's treatment of inflation in quantum cosmology provides a natural stepping-off point for his recent stochastic inflation. In his last chapter Linde lets his imagination run wild, and it's fun to see where it goes. He claims that the studies of the universe and of consciousness may be intertwined. He even speculates that consciousness, like space-time, may have its own intrinsic degrees of freedom. He draws some interesting parallels between the study of consciousness and the recent interest in the fundamental problems of the origin of space-time and such questions as why it is four-dimensional. He muses that an examination of consciousness, and other fundamental problems such as life and death, from a physics perspective rather than a philosophical or theological one, may be needed, and that perhaps apparently disparate sets of problems are not unrelated. Obviously such speculations as this, and his equating of vacuum energy with life, are not presented with the rigor of the rest of the book, but they do provide a way of ending what is basically a hard-core physics monograph with a truly vast cosmic perspective.

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Paleoecological Troves

Packrat Middens. The Last 40,000 Years of Biotic Change. JULIO L. BETANCOURT, THOMAS R. VAN DEVENDER, and PAUL S. MARTIN, Eds. University of Arizona Press, Tucson, 1990. viii, 469 pp., illus. $55.

"In some circles," write Betancourt, Van Devender, and Martin, "the paleoecologist is considered an unfortunate ecologist, one who has the vantage of time but lacks too many pieces of the puzzle for a coherent view" (p. 435). In this volume, we are challenged to dispute this paradigm and juxtapose the clairvoyance offered by modern ecology against the less focused but broader vision of paleoecology. The result is a fascinating introduction to the world of packrat (*Neotoma* spp.) midden analysis in a series of well-written papers on the ecology of *Neotoma* and the paleoecology of the