

cussion, the reader understands how the pyramids at Saqqara and Giza are "monuments of hope . . . not abstract curiosities." The same might be said of all those structures that Kostof locates in their physical and human environments.

Science & Technology

PERFECT SYMMETRY:
The Search for the
Beginning of Time
 by Heinz R. Pagels
 Simon & Schuster, 1985
 390 pp. \$18.95

THE HIDDEN UNIVERSE
 by Michael Disney
 Macmillan, 1985
 257 pp. \$17.95

In our beginning *may* be our end—or so suggest these two books about the workings of the universe. Pagels, a physicist and executive director of the New York Academy of Sciences, finds an awesome unity at the heart of modern astronomy and cosmology. The laws that govern infinitesimal subatomic particles (quarks, leptons, gluons) also govern the design and movements of the largest features of the universe, molecular cloud clusters. Pagels believes the "Big Bang" explanation of the origin of the cosmos to be the most consistent with observation and reason. According to this theory, some 11 billion years ago a gas of quantum particles exploded, creating nuclei and the lightest elements (hydrogen, helium, and lithium) from which all others are constructed. Thus were born over a 100 billion galaxies, their stars, planets, and more curious features—black holes, neutron stars, and quasars. The holy grail of today's physicists is a grand unified theory (GUT) describing the universe in the first nanosecond after the bang. Pagels himself is confident that scientists are close to discovering a single physical law from which gravity, electromagnetism, and other forces that rule micro- and macrocosmic events derive.

Physicists have not yet been able to fit gravity into a GUT, but Disney, an astronomer at the University of Cardiff, Wales, thinks that gravity may provide the key to the fate of the universe. The study of the attraction between heavenly bodies has led scientists to posit a "missing mass"—invisible material (possibly neutrinos, black holes, or intergalactic gas) that may constitute as much as 90 percent of the universe's total mass. Determining the

density of this mass is crucial, because such knowledge will allow scientists to calculate the average mass density (Omega) of the universe. If it turns out that Omega is greater than one hydrogen atom per cubic meter of all matter, then, explains Disney, the universe is finite (or closed); if it is less than or equal to one (the average density of all *visible* material is about .01), then the universe is infinite (or open). According to known laws, a closed universe will, billions of years from now, stop expanding and begin to collapse back into itself, either bursting into a fiery inferno or perhaps returning to the primordial gaseous state of pre-bang days. An open cosmos, however, will expand indefinitely, becoming colder and darker, though life may continue in altered forms. Disney explains various approaches to studying the missing mass: Measuring relative galactic speeds or establishing the amount of deuterium in space are two. None is without flaws. Nevertheless, Disney believes that the best current calculations put Omega somewhere just short of one—in which case we humans have ice, not fire, to look forward to.

**INTO THE HEART
OF BORNEO**

by Redmond O'Hanlon
Random, 1985
192 pp. \$16.95

Located in the South China Sea southeast of the Malay peninsula, Borneo is the world's third largest island. It is also a naturalist's paradise, home to more than 800 kinds of trees, 25,000 species of flowering plants (compared to Europe's 6,000), the orang-utan (the "great man-like ape" whose presence on the island led many 19th-century scientists to believe that Borneo was the birthplace of mankind), and assorted fish, flesh, and fowl. Among the great scientists who have trudged through its forests are Alfred Wallace and Charles Darwin. Indeed, this account of the author's 1983 journey into the island's center often reads like a running commentary on the works of earlier travelers. (Fittingly, O'Hanlon is the natural science reviewer of the [London] *Times Literary Supplement*.) But the author also tells a good story, beginning with his account of a British Special Operations