D. VAN RAVENSWAAY/SPL

Did 'bubble' universes form during the Big Bang when a false vacuum sped up the expansion of matter?

The importance of nothing

The Void
by Frank Close
Oxford University Press: 2007. 176 pp.
$19.50, £9.99

Lawrence Rudnick

In nothing, there is the potential for everything, from the blank canvas of the artist, to the creation myths of the world's religions, to the richness of the quantum vacuum. The contemplation of nothing can lead to paralysing circularity — is 'no dogs' the same as 'no cats'? It has also led science popularizer Frank Close to create *The Void* as a guidebook through nothing for the general reader.

Close begins with a charming section that relates the questions of his youth, such as the reality of the world before one's own birth. Here he waxes poetic, describing our physical bodies: "We have not been created out of nothing, but from a primeval 'ur-matter', atoms formed billions of years ago that have for a brief while been gathered into collections that think they are us." Sadly, such beautiful language is sparse in the rest of the book.

To the physical scientist, the vacuum is a fecund state; in some ways we parallel the struggles of the ancient Greeks who pondered the reality of space without matter. Although they flirted with the ideas of basic building blocks — atoms — between which empty space could exist, the aristotelian abhorrence of the vacuum dominated thinking for 2,000 years until the birth of experimental science. From his experiments on motion, Galileo inferred the pure motion of an object *in vacuo*, even though he couldn't produce one. The barometer of Torricelli, the Magdeburg spheres of von Guericke, and the wine-and-water theatrics of Pascal led us to the mechanistic view of the vacuum: there was now a truly empty space whose properties could be measured — for example, the ability to transmit light but not sound.

Today's void is much more complicated, and Close guides the reader on the perilous journey past the battles over the existence of the ether, through Einstein's space-time and into the paradoxical world of the quantum vacuum. We sail the infinite sea of Dirac's antimatter states waiting to be excited into existence, to the Higgs vacuum from which all particles gain their mass, to the dark energy that accelerates the expansion of the Universe. And finally, to the origins of the Universe, where Close toys with Hawking's and Hartle's notions of imaginary time. It is an exhausting journey through the now-vital emptiness.

In the end, *The Void* is good for nothing — not great, but good. It covers very complicated concepts in a mostly accessible way, but lacks the graceful prose of either J. Barrow's *The Book of Nothing* or K. C. Cole's *The Hole in the Universe*. Often, Close struggles to make things understandable to the lay reader.

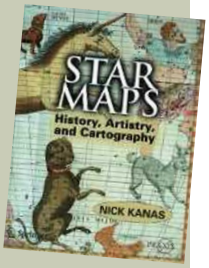
Cole, by contrast, simply reminds us of the alignment of iron filings around a magnet. For this journey, I would start with one of the earlier books, then try *The Void* for another perspective on the endlessly fascinating topic of nothing. ■

Lawrence Rudnick is distinguished teaching professor of astronomy at the University of Minnesota, Minneapolis, Minnesota 55455, USA.

EARTH OBSERVATION

A fresh perspective

Earth From Space (A&C Black, 2007) by Andrew K. Johnston offers a view of the world from above, with more than 300 satellite photographs of Earth. Some are instantly identifiable as rivers, roads and cities; others, like fields in Garden City, Kansas, look like abstract art. Infrared shots of the Iraq–Iran border and radar images of Belgrade reveal the effects of war, environmental disaster and agriculture. The book covers the evolution of our attempts observe the Earth, from Wilbur Wright's plane-mounted camera to today's remote sensors. A chapter called 'Tools of the Trade' explains the technology used to take the photographs, leading in to chapters, such as 'Structure of the Land and Human Presence', that explore the forces that shape the world.



Nick Kanas's *Star Maps: History, Artistry, and Cartography* (Springer, 2007) adopts the opposite perspective — looking up at the sky. It chronicles attempts to chart the stars from ancient times to today. Alongside the familiar terrain of classical Western astronomy are star charts from China, Egypt and Mesopotamia. As well as explore the changing equipment in astronomy and cartography, the book covers the philosophies and personalities that saw star charts develop from images of gods and animals into the more scientific (although less beautiful) maps in use today.

Spies in the Sky (Praxis, 2007) by Pat Norris argues that reconnaissance satellites helped prevent outright conflict during the cold war era. It charts the development of satellite technology and the effect this had on international relations from the 1950s to the present day, before going on to speculate on how satellites might be used in future conflicts. The cold war sparked the demand for accurate, timely images of human activity across Earth that eventually led to the kind of equipment responsible for the book's stunning images.
Jennifer Meyer