books

The cosmos from a different point of view

Endless Universe
Beyond the Big Bang

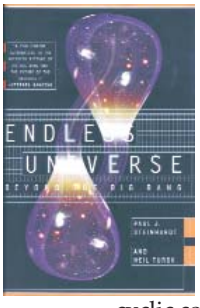
Paul J. Steinhardt and Neil Turok
Doubleday, New York, 2007. $24.95 (284 pp.). ISBN 978-0-385-50964-0

Reviewed by Glenn D. Starkman

Should scientists write popular books about their alternative theories even when they have admitted that the ideas are controversial? Many of us in science would instinctively answer that the proper—nay, the only—place for discussions of such theories is in the peer-reviewed literature. And yet there are historical examples of controversial science that first gained traction from public dissemination. Charles Darwin's *On the Origin of Species*, published in 1859, and Rachel Carson's *Silent Spring* (Houghton Mifflin, 1962) come to mind. Such works should make one pause before denigrating the public presentation of alternative theories.

But do those lessons apply to a technical field such as string cosmology, in which almost none of the target audience has the tools or the knowledge to critically assess the science? And if the audience is unequipped to evaluate the authors' claims, are those authors obligated to be particularly clear that their theory is not widely viewed as a compelling alternative and that some of their fundamental claims have been challenged in the scientific literature?

Readers should keep those questions in mind as they delve into Paul Steinhardt and Neil Turok's *Endless Universe: Beyond the Big Bang*. The book is first and foremost a popular exposition of their cyclic theory of the universe, in which the universe goes through cycles of apparent growth and contraction, heating and cooling. The cycling is driven in part by the interactions between our three-dimensional universe and another parallel universe that is our close neighbor, but is off in a direction perpendicular to the three with which we are familiar. The book also positions the cyclic universe as an alternative to the widely revered and accepted concordance model, which posits that the universe initially underwent a period of inflationary growth and is presently dominated by dark energy and cold dark matter.



To present their story, the authors, who are both theoretical physicists, use biographical vignettes that focus on personal scientific developments, especially as they relate to the emergence of the cyclic and inflationary models. Thus readers learn that Steinhardt, Albert Einstein Professor in Science at Princeton University, was one of the early and principal developers of the inflationary model while Turok, chair of mathematical physics at Cambridge University, was an early and influential investigator of alternatives to inflationary theory.

Despite its ambitious agenda, the book is eminently readable and refreshingly brief. It should be widely enjoyed by nonexperts for its lucid descriptions of both the inflationary model and the cyclic alternative. Vested experts will quibble over particular descriptions and challenge certain historical narratives. Others will suggest, either because they disagree with Steinhardt and Turok's calculations or because many of the observational results predate the cyclic model, that the cyclic universe's consistency with cosmological observations is significantly less persuasive than inflation's. I would have preferred a more critical examination of the evidence for both theories. The authors are far from unique in feeling "a growing concern with the conventional picture." Nor are they alone in believing that science benefits when the canonical theory is challenged by alternatives, just as the cyclic theory and its ekpyrotic predecessor, proposed by Justin Khoury, Burt Ovrut, Steinhardt, and Turok, challenge the worldview of the inflationary paradigm.

Still, I strongly believe that Steinhardt and Turok were capable of creating not just a readable book but a truly compelling one. Instead, their weaving of autobiographical interludes into *Endless Universe* seems too short on deep insights and on details of their intellectual processes, and thus too much of a deliberate hook, to be compelling. The authors might have seized the opportunity, and the space, to promote not just the particular cyclic concept that they profess such enthusiasm for but also the more general value of alternative theories to science. Steinhardt and Turok could have far more clearly opened up to the public the process by which scientific theories are developed, debated, challenged, and defended. That book is one I would want not just to read but to recommend whole-heartedly.

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Solid-State Physics
Introduction to the Theory

James D. Patterson and Bernard C. Bailey
Springer, New York, 2007. $99.00 (717 pp.). ISBN 978-3-540-24115-7

How does one choose a text when teaching a graduate course in condensed-matter physics? Certainly for an undergraduate course, Charles Kittel's *Introduction to Solid State Physics* (Wiley, 1953), whose eighth edition was published in 2005, comes immediately to mind. The many tables presented in the book were an indispensable resource to me, at least before the advent of Google. Neil Ashcroft and N. David Mermin's *Solid State Physics* (Holt, Rinehart and Winston, 1976), which makes for more comfortable and leisurely reading than Kittel's text, is an alternative. Neither text, however, would seem to have the depth needed for a graduate course. The remarkable early texts *The Theory of the Properties of Metals and Alloys* (Clarendon Press, 1936), by Nevill Mott and Harry Jones, and *The Modern Theory of Solids* (McGraw-Hill, 1940), by Frederick Seitz, are at a more appropriate level for a graduate course, but too much has happened in the past 70 years for either to serve as a modern text.

In the 1960s and 1970s, a flood of