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**Einstein and the Ether** by Ludwik Kostro. Apeiron, 2000. 242 pp. \$25.00 (paper). ISBN 0-968-368-948 (Apeiron: 4405, rue St-Dominique, Montreal, Quebec H2W 2B2 Canada; <http://redshift.vif.com>).

A century after Einstein first published on Special Relativity, there remains a surprisingly vigorous opposition to his theories despite their overwhelming acceptance by most working physicists. In this centenary year, one might suppose that an even-handed review of the relativistic hegemony and the beleaguered minority of antirelativists, summarizing the arguments of both camps and the evidence each can muster, would be a valuable resource.

Unfortunately, *Einstein and the Ether* by Ludwik Kostro is not that book, despite its promising title. Kostro, a historian of science, has instead assembled what may be even more surprising: a thorough examination of Einstein's writings on the subject of the ether, over the decades after one might imagine relativistic physics had abolished the subject.

Anyone who has been through a modern education in physics can be pardoned for thinking that the ether resides, like phlogiston and caloric, in the neverland of long-abandoned, misleading, and useless physical concepts. The conventional wisdom is that Einstein's theory provided a conceptual underpinning for the baffling results of experiments that persistently refused to show an "ether wind" that revealed Earth's velocity relative to the absolute reference of the cosmic

ether. With the choice between increasingly baroque ether theories put forward to accommodate the awkward experimental facts, versus an ontologically cleaner relativity theory that accepted the same experiments as simple confirmations of an axiomatic assumption, physicists over the course of a few decades flocked to the banner of relativity and discarded the concept of the ether.

This, it turns out, is an oversimplification. Einstein himself only abandoned the ether notion for the relatively brief time between his enunciation of Special Relativity and his completion of General Relativity. With the realization that, in the full theory of relativity that included accelerating frames of reference, spacetime itself had become a dynamical agent with measurable physical properties, Einstein began once again to speak of a physical ether. This was a very different ether from what nineteenth-century physics called by the same name, to be sure; Einstein's ether was a fully relativistic entity. If one thinks of it as a physical substance, it is a bizarre one indeed by everyday standards. Rather than defining a universal standard of absolute rest, as Newtonian physics would have it, Einstein's ether has no specific state of motion at all; no observer can have a velocity relative to it, not even a velocity of zero. The active spacetime of general relativity allows the identification of absolute accelerations, but not of absolute velocities.

Of course, this led to no small degree of confusion, since Einstein began talking about a relativistic or "new" ether (using the term synonymously, and interchangeably, with such phrases as "physical space", "space in itself", or the "total field") at the same time that outraged defenders of the traditional ether were launching their most vigorous polemics against relativity. Although the debates between relativists and antirelativists in the 1910's and 1920's seemed innately geared to generate more heat than light, the fact that the two sides were using the same word with opposite connotations only made matters worse.

While Einstein himself apparently never abandoned the notion that "ether" was an appropriate term for the physically active substrate of all dynamical processes, he appears to have gradually phased out its use in favor of the various synonyms above, over the course of a couple of decades. Nonetheless, he appears to have maintained the permanent opinion that "empty" space, rather than a vacuum, was instead properly described as a plenum: filled with—or in a sense, constructed by—fields which carried energy and therefore had mass, possessing a kind of unique materiality of its own which both measurably affects and is measurably affected by the more conventional matter that occupies it.

Modern-day antirelativists will not find aid and comfort in Kostro's book; insofar as he takes any stand he seems to be solidly on Einstein's side (this is probably inevitable for a historian of science who does not wish to launch a second career as a fantasist). While Kostro does not harp upon the fact, neither does he sugarcoat the uncomfortable history that the most energetic antirelativists of the early days tended to associate themselves with Nazism

in their efforts to rescue pure "German physics" from the contamination of Einstein's "Jewish science".

An unusual feature of *Einstein and the Ether* is a particularly lavish use of quotations, with all quoted material being presented both in English translation (usually Kostro's own) in the main text, and in the original (usually German) in a special section of endnotes. My spot-checking of the German leads me to the opinion that Kostro's translations, while quite free, are true to the intended meaning and even to the style of the original author. With the masses of quoted material it becomes quite impossible to believe that Kostro is misrepresenting the ideas of any of the principals involved.

The quotations also point up one of the book's shortcomings, a genuinely shoddy job of proofreading. Quotes "f13" and "f14" quietly disappear from the endnotes, having apparently fallen off the bottom of page 223 without quite making it to the top of page 224. In the running text there are repeated infelicities of missing, duplicated, or substituted words, with perhaps the most egregious case being the use of "quantitative" in a context where "qualitative" is surely meant. I suspect that Apeiron, the publisher, places excessive reliance on automatic tools rather than human proofreaders.

"Einstein and the Ether" will not resolve any of the current debates in physics, but it does present a readable and edifying excursion through the thoughts and career of one of the dominant figures of modern science.

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**The New Paradigm: A Confrontation Between Physics and the Paranormal Phenomena** by John O'M Bockris. Normangee, Texas: D&M Enterprises Publisher, 2004. 504 pp. \$34.95 (paper). ISBN 0-97-67444-06.

Is the current scientific paradigm outdated and harmful for the survival of our species? The author, Dr. John O'M Bockris, believes it is, and he tells us why, discusses the impediments for change, and suggests the elements for a New Paradigm. Dr. Bockris is a highly qualified scientist. His principal work has been in the fields of physical electrochemistry, energy, and environmental chemistry. He founded the International Society for Electrochemistry. He was a full professor at the University of Pennsylvania and at Texas A&M University. He has received numerous awards and has published 704 papers and 22 books, yet he has always remained a maverick unafraid to venture into new, controversial and cutting-edge areas like the hydrogen economy and cold fusion. I found the author