

cannot be explained by some mathematical structure, algebraic, topologic or otherwise.

References

1. E. P. Wigner, *Commun. Pure Appl. Math.* **13** (1), 1 (1960).
2. A. Einstein, *On the Method of Theoretical Physics*, Clarendon Press, Oxford, UK (1933).
3. Quoted in Fritz Rohrlich's obituary of Jauch, *PHYSICS TODAY*, December 1974, p. 70.

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A Spacetime Note, with Strings Attached

In his excellent review article, "Reflections on the Fate of Spacetime" (April, page 24), Edward Witten paints an intuitive picture of where string theory may be headed. I would like to add a footnote on the implications for cosmology.

Assume a stringy cosmos ($\alpha' \neq 0$) that is gravitationally closed. Then, as the cosmos begins to contract, there is a finite limit, $\sqrt{\alpha'}$, to how small its radius can become. After this limit is reached, momentum and wrapping states are exchanged and the cosmos again expands in a different "direction." In other words, just as replacing worldlines with world-tubes eliminates the singularities from Feynman diagrams, $\alpha' \neq 0$ eliminates the singularity of the Big Bang's initial state. Of course, so does $\hbar \neq 0$. However, $\alpha' \neq 0$ also explains why a closed cosmos will oscillate. Indeed, because string theory predicts gravity, in the sense noted by Witten, a stringy cosmos requires only sufficient mass to create the Big Bang.

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Clarification on De Vaucouleurs Obit

In our obituary of Gérard de Vaucouleurs (April, page 76) the late Antoinette de Vaucouleurs should have been identified as his first wife. De Vaucouleurs' second wife, Elysa-beth, survives him.

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Author Disputes Review of Richard Feynman Biography

I take strong exception to Silvan S. Schweber's review (October 1995, page 64) of my book *The Beat of a Different Drum: The Life and Science of Richard Feynman*. I find it to be intemperate and patronizing.

Much of his tract is devoted to faulting me for having failed to make use of or acknowledge the efforts of other scholars. He begins by declaring that it is "somewhat difficult to comprehend" how one can write about Feynman without mentioning James Gleick's *Genius: The Life and Science of Richard Feynman* (Pantheon, 1992). I seriously disagree. (I also wonder how Schweber could praise Gleick's book as a "superb prior biography" without mentioning the fact that one of the two people acknowledged by Gleick for their "patient guidance and sharp insights in matters of physics" is Schweber himself.)

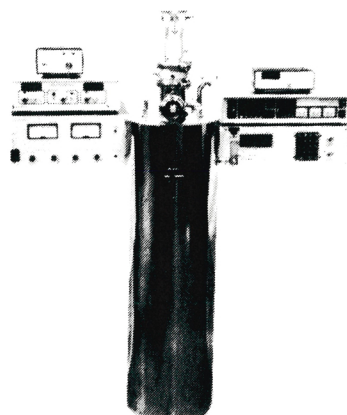
My biography and Gleick's were written independently during the same period, 1988–92. Upon Feynman's death on 15 February 1988, Gleick wrote an obituary published in the *New York Times*, and on 24 February I gave an invited memorial talk at Cornell University on "My Last Encounter with Richard Feynman." On that occasion, I also interviewed Hans Bethe about Feynman. A few weeks later, Bethe notified me that Gleick intended to write a biography of Feynman and that, if I heard from Gleick, I should give him whatever assistance I could. I sent Gleick a copy of my Cornell talk on Feynman and telephoned him to discuss our respective projects. Although most of my scientific/historical writing to date had been quite technical, I had intended to write a more popular scientific book for the general reader. However, upon learning about Gleick's plan to write a popular biography, I decided to write about Feynman's work in rigorous scientific terms, albeit in a deeply human context, primarily for the scientific community.

Because of protracted illness, I did not submit the manuscript to my publisher until the end of September 1992, several weeks before Gleick's biography was published. My publisher decided to let Gleick's book have its play before issuing mine, and to proceed with the production phase of my book at a leisurely pace. I took advantage of the delay to send my manuscript to Bethe and Willis E. Lamb Jr, among others, for their

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