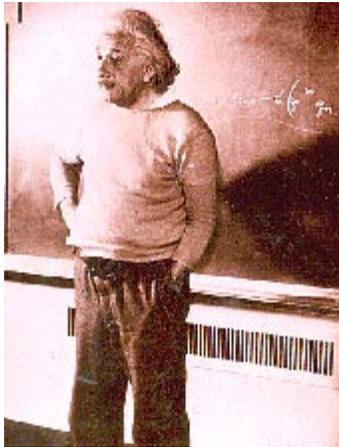


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## THE QUESTION OF ANSWERS



**Einstein's struggle with Quantum Theory: A Reappraisal** By Dipankar Home and Andrew Whitaker, *Springer*, \$149

Albert Einstein didn't own a car. In the latter part of his life, when he was the prize possession of the newly set up Institute for Advanced Study in Princeton, he traded this luxury for the joy of the long walks between his residence and workplace. Of Kurt Goedel, famous logician and colleague of his, he would say that he used to go to the institute only to have the pleasure of walking back home with Goedel, discussing physics. Abraham Pais, author of Einstein's two-volume biography, was another colleague who occasionally gave him company during those strolls. As Pais wrote in *Subtle is the Lord: The Science and the Life of Albert Einstein*, one day, on his way back home, the father of relativity suddenly stopped, turned to him, and asked, "Do you really believe that the moon exists only when you look at it?"

Stand vindicated

In science, it is said, it's more important to ask the right questions than to find out the answers to them, and Einstein's query has been bequeathed to latter-day physicists as if engraved on a stone tablet. The poser pertains to quantum mechanics, a theory — an ensemble of theories, to be precise — without which physicists don't understand a thing of what's going on within an atom. If you think theories are there to make sense of weird phenomena — for example, an apple's predilection for the ground rather than the sky when flying off a tree — quantum mechanics isn't your cup of tea. By no stretch of imagination can you subscribe to its tenets. Here are some of them for the uninitiated: a subatomic particle like an electron is both a point-like object and a wave, and reveals either of those incarnations depending on which one you want to observe; at any instant of time the electron does have neither a definite position, nor a precise velocity. If you aren't already shocked by such lunatic behavioural traits, here's one more of them: the electron isn't there at all unless it's detected by an apparatus. No wonder the physicist, Daniel Greenberger, once called quantum mechanics "nothing but magic".

Troubled as he was by the travesty of logic in the subatomic realm, Einstein's revulsion against the last bit prompted him to pose that famous question to Pais, who, incidentally, was a staunch adherent of quantum mechanics. If the electron isn't there when no apparatus detects it, shouldn't the moon, too, vanish as soon as we turn our gaze away from it? The issue was Einstein's life-long vexation; even two decades before he met Pais in Princeton, he debated it with Rabindranath Tagore when the latter called on him at Kaputh, Germany, in 1930.

Einstein's dogged opposition to the so-called quantum revolution, despite sowing some seeds of it himself, has gained the status of a legend which, sadly, casts him not only as a loner but as a loser too. Justly held equal to Isaac Newton for what he did before 1925, he is often criticized for wasting the last 30 years of this life, which, his detractors say, could have been better spent had he gone fishing instead. But hang on, that verdict may have been issued in a hurry.

Well, that's the opinion of Dipankar Home of the Bose Institute, Calcutta, and of Andrew Whitaker, belonging to the Queen's University, Belfast. These quantum physicists have painstakingly chronicled cutting-edge experiments conducted over the last 50 years to put the record straight. According to them, Niels Bohr, along with his followers, like Werner Heisenberg, Max Born and Wolfgang Pauli, brushed aside Einstein's attempts to poke holes in their arguments building the new theory as if those didn't matter. They were quite content at providing explanations for experimental results at hand, while Einstein kept insisting that they were missing the bigger picture of reality by not pondering the logical foundations of their ideas deeply enough. The wheel has turned a full circle, and Home and Whitaker write that "now it has become acceptable to question Bohr's views, even to criticize them".

The authors dedicate their book to the memory of David Bohm and John Stewart Bell, the two physicists who refused to be swayed by the mainstream and undertook experiments to assess Einstein's views. Thanks to their enthusiasm, a new era of research began, which convinced physicists that attempts to interpret quantum mechanics were not merely matters of philosophy. What's more striking is that it is these experiments that are going to yield some spinoffs of immense commercial potential — for example, ultra-secret message transfer or the last-generation computer.

While going through Home and Whitaker's description of Bohm's strenuous attempts at theorizing to prove Einstein right, I was intrigued by the factoid that Einstein himself was critical of his self-declared disciple's views at the outset. Can you believe this? Possibly this is what makes science so exciting. You never know who's right, and when.

Home and Whitaker's desire to make the book accessible to "a wide range of readers" (one cannot but notice their struggle to keep complex mathematical formulae at a bare minimum level) is laudable. But I have my doubts *vis-à-vis* their claim that "anybody with an interest in Einstein and quantum theory should be able to understand" its arguments. Neither the price tag, nor the level of discussion hints at that clientele. In writing the book they may have been guided by Einstein's dictum that in science things can be made simple up to a point, but not simpler. Or maybe they didn't have to deal with an editor like the one who famously warned Stephen Hawking that each equation in a science title targeted for lay readers halves its sale.

True, the issue at stake — the ultimate nature of reality — cannot be fully appreciated without mathematics, which happens to be the *lingua franca* of physics. But that can't be held against sincere attempts to make it understandable to a vast section of readers. In personal communication with this reviewer, one of the authors (Home) has revealed that they have a much more popular version of this title in mind. It's high time the promise is kept. The fruits borne by Einstein's critique of quantum mechanics are too spectacular to be left for the admiration of the experts alone.

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