

Remembering Rabi: A challenge and a ghost story

Congratulations to PHYSICS TODAY for publishing the fascinating lecture by I. I. Rabi, "Stories from the Early Days of Quantum Mechanics" (August 2006, page 36). I was particularly interested in Rabi's statement, "During the first period of its existence, quantum mechanics didn't predict anything that wasn't also predicted before. . . . The results that came out of quantum mechanics had to a large degree been previously anticipated." This goes directly against the view, frequently expressed in later years, that quantum mechanics was accepted because all of its predictions were confirmed. Presumably that means predictions in advance: deducing results that were not known before quantum mechanics was proposed in 1925–26. (Physicists and other scientists sometimes use the word "predict" to mean "deduce" a known fact, so the phrase "in advance" is needed to exclude that situation.)

But perhaps Rabi was right. After all, quantum mechanics was accepted by 1928, so there wasn't much time to carry out and publish new experimental tests of its predictions. My impression from Rabi's lecture and other sources is that quantum mechanics was quickly accepted by physicists primarily because it allowed one to derive in a very direct way, from a small number of postulates, all the correct results of the old quantum theory. Getting both the discrete (negative energy) and continuous (positive energy) states of the hydrogen atom from the same equation was especially impressive. The old theory could yield those results, but sometimes only by using an inconsistent collection of ad hoc assumptions—for example, the anomalous Zeeman effect. In addition, quantum mechanics gave cor-

rect results for phenomena—notably the spectrum and ionization potential of neutral helium—that had completely stumped practitioners of the old quantum theory.

Quantum mechanics did of course produce many "predictions in advance." My question is, did their confirmation have any significant role in persuading physicists to accept the theory by 1928?

A possible candidate for a confirmed prediction is electron diffraction: The Davisson–Germer and G. P. Thomson experiments of 1927 are often cited as confirmations of Louis de Broglie's wave theory. But there is some doubt about whether those experiments revealed a completely new phenomenon, theoretically predicted in advance. In any case, quantum mechanics went far beyond de Broglie's theory in its range of applications and philosophical consequences. So I propose a challenge to readers of PHYSICS TODAY: Find evidence that the confirmation of *any* prediction in advance, other than electron diffraction, led *any* physicist to accept quantum mechanics before 1928.

Rabi also said in his lecture that John Van Vleck was "very unfortunate" in publishing a book on the old quantum theory just before it became obsolete. I don't think we should feel too sorry for Van Vleck. His expertise in the old quantum theory helped him become, very quickly, a first-rate practitioner and expositor of the new theory. His review, "The New Quantum Mechanics," published in *Chemical Reviews* in 1928, is an excellent resource for anyone who wants to know what achievements helped persuade scientists to accept quantum mechanics at that time. And he did, after all, eventually win the 1977 Nobel Prize for his research.

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I enjoyed reading I. I. Rabi's "Stories from the Early Days of Quantum Mechanics." Graduate students particularly need to read stories like these to help them over the bumps they invariably encounter in their careers. With respect to the "Pauli effect," I have a more

recent story suggesting that the effect persisted even after his death! At a 1961 meeting of the American Physical Society at the New Yorker Hotel in New York City, Richard Feynman gave a talk to a packed conference hall on the quantization of the gravitational field. He started out in typical Feynman fashion by saying, or actually shouting, "Pretend Einstein never existed!" At this point, those of us in the hall heard a noise coming from the ceiling: A loudspeaker had come loose, dangled for a moment from attached wires, and then finally plunged to the floor. No one was injured, and amidst laughter after the shock wore off, Feynman continued. Victor Weisskopf, who had also been a student of Pauli's, was heard to remark, "That was Pauli's poltergeist." Feynman later elaborated on his talk to a huge audience at Columbia University, but as far as I know, no further Pauli poltergeist activity was reported.

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Coordination, research needed in weather science

At the onset of another hurricane season, Gavin Schmidt's Quick Study piece on "The Physics of Climate Modeling" (PHYSICS TODAY, January 2007, page 72) could not be more timely nor on a topic of greater importance. It follows one by Kerry Emanuel in the August 2006 issue (page 74) on thermal aspects of greenhouse gases contributing to hurricane genesis. And in the November 2006 item "Science Board Recommends Major Hurricane Research Program" (page 30), Jim Dawson directed attention both to the devastation wreaked by Hurricane Katrina and to a National Science Board panel convened to investigate the root causes of severe, damaging storms and ways to ameliorate their effects. We're among the concerned scientists and engineers who have written letters in support of the NSB effort, and we now provide additional information on the topic.

Letters and opinions are encouraged and should be sent to Letters, PHYSICS TODAY, American Center for Physics, One Physics Ellipse, College Park, MD 20740-3842 or by e-mail to ptletters@aip.org (using your surname as "Subject"). Please include your affiliation, mailing address, and daytime phone number. We reserve the right to edit submissions.