

on your phone number when I look it up in the book can we read this in a way that makes sense of Bell's theorem. A less contorted interpretation gives the impression that what is at stake is merely a fussy predilection of Einstein for obscure metaphysical principles of good form, rather than the urgent need not to abandon the search for understanding when faced with correlations that cry out for a deeper explanation than the Copenhagen doctrine allows them to have.

When Bell is quoted, light breaks through the clouds, but when Bernstein's elaborations resume, the clouds close up again. The interplay between the two is reminiscent of the Born-Einstein letters, in which Einstein writes patiently and lucidly to Max Born about why quantum mechanics bothers him, and Born, in a running commentary that utterly misses the point, "explains" what is on Einstein's mind. Sometimes Bernstein points his reader in the wrong direction even before Bell has a chance to finish, as with the bracketed curveball he tosses into "In a theory in which parameters [such as might correspond to new forces] are added to quantum mechanics to determine the results of individual measurements..." Other times he seems not to be listening to his own words: "If one were not worried about locality, one could imagine a mechanism that would reproduce the quantum-mechanical correlations without 'spooky actions at a distance.'" Wolfgang Pauli's remark that one should not "rack one's brain about the problem of whether something one cannot know anything about exists all the same"—refuted, in one of the wonderfully ironic twists of this extraordinary tale, by Bell's proof of the non-existence of something one cannot know anything about—is here presented as the kind of position taken by blasé physicists over the experimental confirmation of that proof.

In short, Bernstein seems to share Born's immunity to the intellectual disease that Bell's theorem finally cured. This is fine for a quantum engineer, but a problem for anyone attempting to convey Bell's accomplishment to a broad audience. The essay is nevertheless redeemed by its mementos of John Bell. His speech to Bernstein on why doing quantum mechanics is like riding a bicycle will delight anyone and deeply move those who miss him so very much.

If Bell raged against the obscurities of the quantum theory, Wheeler glories in them: "'Beautiful' is what I would call it. To me it's the magic way to do it." Wheeler's more sensa-

tional images of the quantum world, such as his "great smokey dragon," are not to be found here. As befits an essay on this splendid *homo copenagensis*, there is no attempt to look for conceptual trouble in the belly of the dragon, and the essay is primarily a straightforward and engaging sketch of Wheeler's life in physics, peppered with entertaining anecdotes, many of them new to me, about the great scientists whose careers intertwined with his own.

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SETI Pioneers: Scientists Talk About Their Search for Extraterrestrial Intelligence

David W. Swift
U. Arizona P., Tucson, Ariz.,
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"Are we alone in the universe, or are other beings out there, somewhere among the stars?" So begins this book—and the search itself. The question is old. Giordano Bruno's greatest heresy was maintaining that a plurality of worlds support life. Gauss suggested cutting messages to extraterrestrials into Siberian forests. But the notion of communicating with stars using radio waves dates only to 1959. In that year, Philip Morrison and Giuseppe Cocconi published their landmark paper suggesting that technology had advanced to a point where communication was feasible. Frank Drake independently arrived at the same conclusion and actually tried to listen in on a few nearby stars.

With barely 30 years having passed, one still has a reasonable hope of conversing with all the leading SETI players. Indeed, Iosef Shklovskii died in 1985; thus David Swift has interviewed 17 SETI pioneers at a propitious time.

Except for exceedingly brief introductory and concluding sections, the book consists solely of transcripts of interviews. There is some small strength here. The voice of each scientist can be clearly heard, as the author has scrupulously remained in the background. Most of the interviews were done in more than one session, and even the repetition within the interview has not been edited. (One pioneer has complained to me that in the book he sounds like a boring old guy who repeats the same stories!) There has been little check-

ing of the accuracy of offhand remarks. Many of the questions are superficial—take, for instance, the question "Where did you live during childhood and when you were growing up?"

Nonetheless some delightful, irrepressible personalities manage to shine through. They sprinkle the book with fun facts and ideas. Drake and Morrison give us an important oral history of "the beginning" of the search. From Freeman Dyson I learned that 10 years ago Kuwait was already the brightest spot on Earth at a wavelength of 2μ . I loved Barney Oliver's stories about Bell Labs, and my interest was piqued by his brief mention of the Sugargrove debacle. Nikolai Kardeshev tells us of the influential work on "extraterrestrial botonics" done by Professor Tihov in Kazakhstan. Ronald Bracewell presents an interesting argument on the pseudoscientific aspects of the Drake equation.

One feature is striking: Nearly all of these pioneers express great current interest in this subject but deny spending time on SETI. The new generation, represented by Jill Tarter and Paul Horowitz, are fortuitous exceptions. The general attitude is that studies of extraterrestrial intelligence should—like my students' computing—only absorb "cycles in background."

Swift did little to compromise the presentation of an unbiased text of interviews. He should have. The addition of a longer overview, with interviews tightly edited to about half of their current length would have made a better book.

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NEW BOOKS

Atomic and Molecular Physics

Atoms. J. Perrin (translated from French by D. L. Hammick). Ox Bow, Woodbridge, Connecticut, 1990 [1913]. 231 pp. price not stated. pb ISBN 0-918024-79-X. Reprint

Atoms in Strong Fields. NATO ASI Series B 212. Proc. Conf., Kos, Greece, October 1988. C. A. Nicolaides, C. W. Clark, M. N. Nayfeh, eds. Plenum, New York, 1990. 540 pp. \$115.00 hc ISBN 0-306-43414-8

Interaction of Atoms and Molecules with Solid Surfaces. *Physics of Solids and Liquids*. V. Bortolani, N. H. March, M. P. Tosi, eds. Plenum, New York, 1990. 679 pp. \$115.00 hc ISBN 0-306-43424-5. Compilation

Intramolecular Motion and Chemical Reaction. Proc. Conf., London, February