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June 6, 1982

Heinz R. Pagels  
author of The Cosmic Code  
c/o Simon and Schuster  
1230 Avenue of the Americas  
New York, N.Y. 10020

Dear Dr. Pagels,

I just finished reading your book The Cosmic Code, and I felt I had to write and tell you what a magnificent accomplishment it is.

I have been fascinated by the new physics for years but have never gotten more than a chapter or two into any of the scores of popularizations that the publishing industry frequently, if randomly, emits. I never felt that this was my fault, though, since I have spent the last ten years as a software engineer (albeit in an insurance company) and am considered reasonably talented in my field. Now you have restored my confidence in myself because I can see that all it really takes is for some physicist who knows what he's talking about to sit down and take the time to translate the major aspects of the new theories into plain English. I've always felt that physicists who have children probably do very well at giving their kids an idea of how to think about the new theories, but that when it comes time to write books some different sort of mood overtakes them and the goal of gently leading by the hand becomes tainted by the more competitive (and secretive) relationships they probably have with other adults. Thank you for addressing the child in me.

Your clarity is dramatic when compared with, for example, Steven Weinberg's The First Three Minutes. Although I did make it through the very last chapter when it first came out, I find it curious that now I can't seem to

remember any of it. I'm sure he was well-intentioned, but I just felt defeated by that book. And again, now that I have seen your work, I know that it's not simply my fault.

So the first question I have is: What should I read next? Have you written other books or articles, or is there something in the works I can look forward to? Right now I am mostly interested in "quantum wierdness", which I would like to be able to define a little more precisely to myself, and "gauge theory", which eludes me somewhat. I would also be tremendously grateful if you could recommend a clear introduction to Ilya Prigogine's theory of dissipative processes as being a chemical model of what we ordinarily call life, for which work I understand he copped a recent Nobel. I read K. G. Denbigh's An Inventive Universe, but the impact was felt, like the Weinberg book, only for the first three minutes. It seemed like a private aside to fellow academic flapjaws rather than an attempt to share with the public genuinely verified discoveries.

I realize that in the last part of your book you had to allude to several gargantuan and partly contradictory lines of research, but could you tell me if exchange forces are real forces like gravity/electromagnetic/weak/strong, and if the Higgs particle is reducible to quarks, leptons and/or gluons? I wasn't sure how speculative these lines of thought were.

Also, since I plan to be talking about your book with my friends for the next few years, could you tell me how to pronounce your last name?

A few random compliments\*: 1) You have a great knack (if knacks can evince greatness) for using erudition without parading it. The scores of germaine quotes from physicists prove it, but what really impressed me were the deft references to existential and psychiatric semantics on page 209. Since I know somewhat more about these fields than I do of physics, I admired the naked charm with which you demonstrated your knowledge of subjects which physicists are not supposed to be conversant with. I also agreed with what you said. 2) You dismiss with a contemptuous wave of your hand the currently chic pseudo-correlations between the new physics and oriental mysticism. About time, I say. 3) You gently expose the shallowness of supposed wise men like Isaac Singer who imagines a Bulova on a beach to constitute a valid thought-experiment to prove the existence of gods. As Carl Sagan (who I hate) points out, now you have to go on and ask who put the gods on the beach, so just what have you clarified? 4) You are not personally anxiety-ridden about a possible implosion of the universe

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\* "Who ordered that?" -- I. I. Rabi



zillions of years from now. I have a nutty friend who "feels" that the Big Bang and the Ghab Gib are equally "repugnant to reason" because they imply that it doesn't really, cosmically speaking, matter if we don't get up and go to work in the morning. As I explained to one of my less nutty friends, and later wrote in my diary, "Just a billion years ago we were just some cells swimming in the ocean, and if it takes just a billion years to create all the rich sense of human purpose and magnificence we see today, what will happen in the next 100 billion years the universe probably has left will completely transform, metamorphosize, superseed and utterly replace what we call purpose with something for which a forced termination may be utterly insignificant."

Can there be any clearer proof of the existence of a God that likes practical jokes than the fact that the entire scheme of quarks, leptons and gluons was erected purely to lead earthling physicists to devote their lives in the latter fifth of the twentieth century to the search for NAKED BOTTOM?

Last fall at your Academy of Sciences I attended a remarkable lecture by Ilya Prigogine at which, due to the tardy delinquency of a friend, we were seated in an ante-chamber from which we could neither see the slides nor make out much of what was said. Rather than punch my friend in the eye I decided to sit back, close my eyes and pretend I was listening to a poem in a foreign language. What was unmistakeably communicated through all this static was a tremendous sense of excitement about being in the forefront of physical science. Although I made no sense whatever of a score of references to semi-groups, what excited me was the idea that physical laws bore a definite relationship to the macroworld of human society in terms of entropy. He said at one point, "... and so history will never end." Well, I'm very interested in questions like that, and I've been looking for months for books that will explain what he must have been talking about, in vain. He also mentioned a recent French experiment which had something to do with disproving local causality, although after reading your book I realize I probably misinterpreted what he said. After the lecture I crowded around the podium to gape at him, and took the opportunity to point out to him that his briefcase was open. (I always summarize this lecture to my friends by saying it was the first time I'd had to correct a Nobel prize winner.) Since there's a good chance that you too attended this lecture, can you tell me how I can go about learning what he was talking about? What are semi-groups, what about the French experiment, what books should I read, and will history end before I've gotten half-started?

4.

Thank you again for a wonderful two-week long stretch of enlightenment. I really do hope you write some more for the layman. Have you ever thought of giving a series of lectures at, say, the NYU School of Continuing Education? If not, do you imagine there's any way a resourceful and surreptitious person could sneak into any of your lectures at Rockefeller University?

Sincerely,

*Dean Hammett*





Division of Natural Sciences—II

Santa Cruz, California 95064

July 1, 1982

Dear Mr. Hanneke,

I was delighted by your long and inquisitive letter regarding The Cosmic Code. You expressed frustration about finding intelligible science books. Indeed there are few. They either are written by shallow popularizers or by members of the science tribe talking to themselves. The books by the inventors of quantum theory — Max Born, Heisenberg, Schrodinger are good — they have all written books for the public. In what follows I will try to answer some of the questions you asked in your letter.

The Higgs may be elementary like the quarks and leptons seem to be or it can be composite — built up out of quarks and leptons. We won't know until we actually detect a Higgs and even then it may be difficult to settle the question.

Exchange forces are purely statistical in character — they are not mediated by any gluon as are the other



forces

My name is pronounced Pay-gels. My ancestry is German and in German the name is pronounced Pā-gels.

In my opinion the awarding of a Nobel Prize to Ilya Prigogine is a travesty. It just shows how hand up the Noble committee must be to find people in chemistry (a dying field) to give it to him. My opinion is shared by a vast number of my colleagues and is not peculiar to me. Prigogine has made minimal solid contributions to thermodynamics - he is a great showman however.

The Frisch experiment is one by Aspect. The experiment has been done and it is in conformity with the predictions of quantum mechanics. To call this a verification of the



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absence of "local causality" in quantum mechanics  
is a gross misunderstanding of the meaning of  
"local causality" as I tried to explain in my  
book.

Most of my own lectures tend to be rather  
technical. From time to time I give a popular lecture  
but that is becoming - regrettably - a rare occasion.

I hope my comments are of help to you.  
I very much enjoyed your letter.

Sincerely,

Heinz Pagels