

# Scientific Theories

*[On January 2, 2009, my friend Rosie, who is a member of a science book discussion group that I am also part of, sent out a letter to various people raising some questions about physics and the philosophy of physics. This is her letter and my response. –S.H.]*

----- Original message -----

From: Rosie

Milliard (et. al.),

Milliard, I finally got a copy of "The Field" by Lynne McTaggart as you have been suggesting I do for so long. So far I have read 55 of the 227 pages of my copy. This is an interim reaction/report.

While I marked several of her definitions of other people's theories in the early pages as "unfair characterization of this theory" ..... once I got into her explanation of the development of, people involved in, experiments done, correlations found, possible ramifications of the idea of "the field" as she explains it, I have been very impressed. This book has given me the first reasonable answers to two questions which have rambled in my mind for over 30 years:

1. Why can't I put my hand thru the top of a table if it is made up mostly of empty space?
2. Why does the equation  $E = mc^2$  occur to me over and over again .... and what could it really mean?

--Rosie

I am cc'g several people who might be interested in this book and a discussion about it. Anyone who cares to join in is welcome to do so. I am also suggesting it for our Science Book Club. My only request is that any comments be specific and not in the nature of "well he's crazy because he is an \_\_\_\_\_ist." Labels always muddy discussions.

--Rosie

**[Scott's response:]**

Hi Rosie and other science fans,

I don't know what the book in question says about your two questions, or what others might say, but just for the Halibut (otherwise known as the "Hell-of-it") here are the answers I'd give:

- > 1. Why can't I put my hand thru the top of a table if it is made up
- > mostly of empty space?
- >

The statement that the table is made up of “mostly empty space” is highly misleading. In the obvious, everyday sense it is clearly *not* true—and *that* is why you can't put your hand through it! On the other hand, as a brief way of talking about what hard material things (which you can't put your hand through) are actually like on the submicroscopic level and from a physics perspective, the statement is true and useful. It allows you to understand the varying composition of this material object: here atoms with their electrons, there just “empty space”.

Alternatively, we could say that the electromagnetic force is such that it works over some distance, and even exists in what could *otherwise* be viewed as “empty space”. Thus, because of the electromagnetic force, this assemblage of quintillions of particles of minute matter (molecules/atoms/electrons or whatever), which make up the table, acts in such a way that you cannot push through it with your hand. In other words, what you may really be trying to better understand is how the electromagnetic force field acts on other matter and *its* electromagnetic force field. Perhaps a textbook on quantum electrodynamics is in order! My suspicion, however, is that nobody can yet give a really good answer to your question, in a way that would satisfy you! Physics mostly *describes* such force fields and how they affect other matter and other fields—but is not yet very developed when it comes to explaining *why* they work the way they do.

- > 2. Why does the equation  $E = mc^2$  = thought occur to me
- > over and over again .... and what could it really mean?
- >

Insofar as this is an introspective question about your own psychology, I can't say why this connection between a physics equation and human thought continually occurs to you. It seems to suggest some mystical notion on your part, however.

But if treated as an hypothesis, such as that there might somehow be a connection between matter, energy and thought, then the question is more tractable. While *most* matter and energy in the universe is totally unconnected with thoughts or thinking, we can also inquire into the material basis for thoughts and thinking where they do occur.

Thoughts, science now knows, are the result of the functioning of specific neural networks in the brain. The functioning of these neural networks, like all physical matter in motion, operates according to the laws of physics, and—once again—specifically the laws of quantum electrodynamics as far as we know. (And this is almost certainly the only physics involved here; quarks, for example, are irrelevant at this level of physical organization.)

Thus the physical basis for any given thought in any given brain is a set of electrochemical operations within that brain. But instead of talking about neurotransmitters, neurons, electrochemical impulses, or even the specific structure of that sub-network of the brain, let alone the organization of the entire brain,

we talk about the issue at a much more abstract level—at the level of specific thoughts in a specific mind, and their origin and connection to other thoughts in that or other minds.

Once we have basic understandings of the nature of matter-energy, on the one hand, and of mental phenomena like thoughts or memories, on the other hand, I think there is no longer any reason for puzzlement of the sort you raised. And the fact that matter and energy can be converted into each other under certain conditions seems to have no connection whatsoever to the nature of thought or its physical basis.

\* \* \*

Finally, with regard to the comment:

- > ... "well he's crazy because he is an \_\_\_\_\_ist." Labels always
- > muddy discussions.
- >

First, I wonder just *who* you might have had in mind here, and just what “ism”!

I would disagree, though, that “labels always muddy discussions”. Categorization (“labeling”) is a necessary part of thinking. “Ah, this is an apple, despite its strange shape and color....”

It is very helpful in understanding what I have to say to know that I am a philosophical materialist, for example. That is putting a label on me, but one that helps clarify what I am saying—providing that the person understands what a philosophical materialist actually is!

But you were likely alluding to labels like “Marxist”. The same goes here. The label “Marxist” helps others understand what I am saying provided they actually understand what a Marxist is (or at least my flavor). Unfortunately Marxists and non-Marxists generally have totally different conceptions of what that particular label actually refers to.

You are surely right, therefore, that it is better to avoid focusing on “labels” (or categories) which have no clear or agreed on definition among all those in the conversation. *That* truly does serve to muddy the waters.

Scott