Q & A with FRANK WILCZEK,
Author of THE LIGHTNESS OF BEING: Mass, Ether, and the Unification of Forces
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Your book is called THE LIGHTNESS OF BEING. How did you come to that title?

It plays on *The Unbearable Lightness of Being*, Milan Kundera's famous novel, which also got made into a very sexy movie. In modern physics we've discovered that the division of the world into light and matter is superficial; there's only one thing, and it's more like the traditional idea of light than the traditional idea of matter. That's the Lightness of Being.

Also, I believe (and my book tries to show this) that when you really engage with the physical world you find deep structure that's surprising, fantastically rich and strangely beautiful. Then Being becomes enchanted, and not just bearable but enchanting.

Richard Feynman appears several times in your book. Can you tell us something about your interactions with Feynman?

I had a very interesting conversation with Feynman, in which he told me that his most famous work was a big disappointment to him.

You say that recently the laws of physics have changed, not just in detail but in kind. What do you mean by that?

Prior to the twentieth century, physics tried to explain how Nature works. Over the twentieth century, and especially in the last half, we got much more ambitious - now we're uncovering what Nature is.

And what is it?

The foundation is an entity I call the Grid. The Grid fills space, and is full of spontaneous activity. In some ways it resembles the old idea of "ether". But the Grid is highly evolved ether, ether on steroids if you like, with many new features.

Is physics finished?

Far from it. As we learn more, we learn to ask better questions. The laws we have are very powerful and accurate, but they aren't as pretty as they should be, and some important items are left out.

What's missing?

Most of the Universe! Just as we were perfecting our theories of normal matter - the stuff we've been studying for two millennia, and that we're made out of - the astronomers discovered that 95% of the mass of the Universe is something entirely different and mysterious stuff, the so-called dark matter and dark energy.

What's next?

We have some wonderful ideas waiting to be tested. There are good reasons to think that the Universe is a multilayered multicolored superconductor; that all four known forces can be brought together in a unified theory; that seemingly hopelessly different kinds of matter are just different aspects of one all-embracing stuff. I anticipate that the next few years will be a new Golden Age in fundamental physics.

Why now? What's going to initiate that Golden Age?

We've had those wonderful ideas, but not adequate tools to test them. Now at the CERN laboratory, near Geneva, a great project is coming to fruition: a twenty-seven kilometer long accelerator, the Large Hadron Collider (LHC), that will finally give us a clear look at the basics. It's our civilization's answer to the Pyramids of ancient Egypt, in scale; but much better, because it's curiosity-driven and intelligent.

What are you hoping for?

As I mentioned earlier, there are good reasons to think that the Universe is a multilayered multicolored superconductor, that all four known forces can be brought together in a unified theory, and that seemingly hopelessly different kinds of matter are just different aspects of one all-embracing stuff. If that's all true, the main evidence will be that new kinds of particles and interactions get observed at the LHC. These have names like "Higgs particle" and "Supersymmetry". One of the new particles could supply the astronomers' dark matter.

Could the LHC destroy the world?

No. There've been some scary-sounding speculations about producing mini-black holes or strangelets or alternative vacuums that gobble up Earth or even the whole Universe. But Nature has been experimenting with LHC-type collisions throughout the Universe for a very long time, using very, very energetic cosmic rays. As for those speculations, I got involved back in 1999 with a different but equally fake earth-destruction scenario. As penance I've had to serve on official panels assessing all possible dangers. Not just once, but a bunch of times. The thing is safe. So if the LHC destroys the world I'll be not just surprised, but very embarrassed.

How did you learn you'd won the Nobel Prize?

I was in the shower at 5:11 AM when my wife brought me our mobile phone and said "There's a lady with a beautiful Swedish accent that wants to talk to you."

What did you get the prize for?

There are four basic forces of Nature. I figured out the equations for one of them.

What was it like to get the prize?

They sure know how to throw a party.

What's next for you?

I'll be watching to see how my ideas about unification and the dark matter stack up against observations, at the LHC and also in other experiments. That's going to be exciting. If the ideas continue to look good, I'll want to build on them.

Besides trying to find new laws, I'm also working on making creative new use of the laws we have. I think we're at a very early stage in exploiting the possibilities of quantum mechanics. We can take the science formerly known as electronics to new places, maybe eventually enabling quantum computers or better devices for capturing solar energy.

Over the longer term I'd like to return to my first love, which is trying to understand how minds work. That's what I intended to study when I went to college; but I got diverted.

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