

# The Un-Common Language of Science

*Does  
particle physics  
need to find  
new ways of  
describing itself?*

by John Womersley  
DZero Co-spokesperson

I recently attended a conference with a significant number of cosmologists, dark matter experimentalists and so on—people we don't normally talk to very much.

I gave a typical talk about the Higgs search at the Tevatron. Afterwards, during the coffee break, one of the cosmologists came up to me and started asking questions. It took half an hour of the two of us standing at a whiteboard, re-interpreting my talk, before we both understood, in a common language, why what I had just described mattered to him.

This conversation brought home to me one of our problems in particle physics. Often we like to focus inwards on our experiments, treating them as closed controlled systems where we can understand all the rules of a game of particles and forces. As for what this means for the universe, we just hope that cosmologists will read our papers and figure out the implications.

This compartmentalization is bad for us all. Any discussion with non-specialists will make it clear that what we do has relevance only because it helps us understand the cosmos. Few people care about understanding proton-antiproton collisions at 2 TeV; many people care about understanding the universe. Moreover, our own physics experience should teach us that we cannot separate the forces we observe from the symmetries of the cosmos: in a real sense, they are the same thing.

We should never talk about finding the Higgs as if it's another particle to add to our list of trophies. We should talk about it (and think about it) as a weird property of space-time that we are trying to explore experimentally. The universe is not an empty space in which the rules of particle physics apply; the universe is the rules and the rules are the universe.

My discussion at this conference didn't change the physics that I did—we'll still look for the Higgs in the same way. But it helped to change my appreciation of why we are doing what we do. I believe it may help to change

Respond online at  
[www.fnal.gov/pub/ferminews/  
interactions/index.html](http://www.fnal.gov/pub/ferminews/interactions/index.html)  
or send email to  
[ferminews@fnal.gov](mailto:ferminews@fnal.gov)

“Trying to talk about **PARTICLE PHYSICS** without talking about the **COSMOS** is like talking about **DNA** without talking about **LIFE**”

the public's appreciation, too. One way to foster that appreciation is to use a different language. The term “life sciences” is used to cover biology, medicine, biochemistry, and genetics, because they seek to understand, and ultimately manipulate, the processes of life. Recent advances have blurred the boundaries between them and created new sub-disciplines, but life sciences as a whole are vibrant and active.

By analogy, I believe we should refer to astronomy, particle physics, cosmology, string theory, gravitational wave searches and so on as “cosmic sciences.” They all seek to understand (and, yes, ultimately manipulate) the processes of the cosmos.

Trying to talk about particle physics without talking about the cosmos is like talking about DNA without talking about life—it may be scientifically valid, but it is devoid of context. Our accelerator-based particle physics experiments are cosmic science because the ways in which matter behaves, and which these experiments reveal, apply everywhere in the universe.

At the highest level, what we are trying to do is to understand the recipe we would need if we were going to create this universe from scratch. By recipe, I mean what kind of space, time, forces, symmetries and matter we would need to use and how to set them up. For millennia, philosophers have tried to answer this question, but our goal is to understand things through experiments, not through philosophizing.

Cosmologists are often criticized because they cannot conduct experiments to test their hypothesis. That's not true. What we do in the Tevatron is experimental cosmology—the experimental exploration of the structure of the cosmos. 



Photo by Reidar Hahn

DZero Co-spokesperson John Womersley: “Any discussion with non-specialists will make it clear that what we do has relevance only because it helps us understand the cosmos.”