Strings and philosophy

Cormac O'Raifeartaigh, Elizabeth Moore, Michael Duff

From
Physics World
November 2007

ISSN: 0953-8585

Institute of Physics Publishing
Bristol and Philadelphia

Letters

Letters to the editor can be sent to *Physics World*, Dirac House, Temple Back, Bristol BS1 6BE, UK, or to **pwld@iop.org**. Please include your address and a telephone number. Letters should be no more than 500 words and may be edited

Strings and philosophy

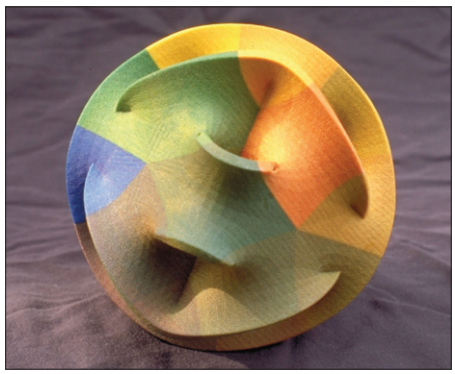
The article by Nancy Cartwright and Roman Frigg ("String theory under scrutiny" September pp14–15) makes the familiar charge of reductionism in theoretical physics. Dare one respond by remarking that physicists do not set out to reduce, but instead they notice things? In classical physics, for instance, it would be a poor physicist who did not notice that the equations describing gravity and electromagnetism are of a similar form. In modern physics, Felix Kaluza did not set out to unify the modern theory of gravity with electromagnetism; the idea suggested itself when the equations of general relativity were written in higher dimensions. Today, if physicists are striving to establish a unified framework for the four known fundamental forces, it is not to blindly follow a particular philosophy but because deep connections between some of these interactions have already been uncovered in theory and experiment.

On a separate point, the authors' conclusion that "string theory is not progressive" seems rather arbitrary, since it is based on a number of philosophical criteria laid down by Imre Lakatos and others yet no concrete justification for these criteria is offered. The statement that "a research programme that progresses only in some dimensions while being stagnant in others is not progressive" would appear to consign many research programmes in modern physics to the dustbin!

Cormac O'Raifeartaigh
Waterford Institute of Technology, Ireland
coraifeartaigh@wit.ie

Alfred Scharff Goldhaber's assertion that "we need faith to do science" (September pp16–17) suggests that in order to get experimental results, we have to "believe" that science will give us the answer. Does this mean that if someone does not have scientific faith, then they will get the wrong results from an experiment? No – they will get the same results as all the rest of us, because the science is true in spite of their lack of faith.

Many scientists have thought deeply about their own personal (including religious) beliefs and about the philosophy of science. I think that if "scientific faith"



Kayla Jacobs

had anything to do with science, then we would actually be acutely aware of it – and not, as Goldhaber claims, unaware that we are acting on faith.

Perhaps what the author means is that, as individuals, in order to lead a meaningful life in science, we need to believe in science itself. The religious analogy would be that in order to become a vicar/imam/rabbi, one needs to believe in Christ/Allah/God. I can see that life would be a lot easier if one accepted the faith, but is it necessary? There are plenty of examples of religious leaders struggling with their faiths. Indeed, regarding "scientific faith", that urge to question belief is actively encouraged – and to have doubts is in fact one of the driving forces of science!

Elizabeth Moore
Philips Medical Systems, UK
elizabeth.moore@philips.com

Alfred Scharff Goldhaber replies:
Isn't the fact that Moore says "science is true" at least a tacit admission of scientific faith? Past successes of science makes it implausible – but still logically possible – that science will collapse in future. To do science, we assume it will continue to work, which is my definition of scientific faith.

Matthew Chalmers tells us that "modern string theory is not even a theory of strings but one of higher-dimensional objects called branes" (September pp35–47). What a pity, then, that his 13-page article gave a complete history of strings but completely ignored the history of branes, thus creating the impression that they arrived on the scene only in 1995.

During the period between the 1984 "superstring revolution" and the 1995 "M-theory revolution" two rival communities were working on apparently different approaches to a final theory: 10D superstrings and 11D supermembranes. Since there are no superstrings in 11D space–time, most string theorists avoided it. Allowing 11 dimensions would mean embracing "branes" – objects that were banished (for reasons beyond me) by the "sultans of string" orthodoxy. This resistance to branes persisted even when, in 1987, it was shown that the 10D Type IIA superstring is just the 11D supermembrane wrapped around a small, circular 11th dimension. Moreover, in 1991 branes in 10D were discovered as "soliton" solutions of the string equations, thereby implying that branes were part of string theory whether you liked them or not. Yet even then, branes were still marginalized by the string community.

It was not until M-theory came along that the two apparently opposing strands of research were finally reconciled. The realization by Joe Polchinski in 1995 that certain solitonic branes admit a dual interpretation as surfaces (called D-branes) on which open strings can end was significant because it swept away any lingering doubts about branes in the minds of string theorists. But it was certainly not the beginning of the subject.

Michael Duff
Imperial College London
m.duff@imperial.ac.uk

Education is simply common sense

How ironic that the same issue in which new UK science minister Ian Pearson called for "world-class science and innovation" (September p9) also featured an article outlining the woeful inadequacies of the new GCSE physics specifications (p7). As a physics teacher in a highly successful school, I too am dismayed at the reduction in real content and the vagueness of the current syllabus for 14–16 year olds. The examination questions are often ambiguous and rarely test a student's depth of understanding. I dread to think what further damage will be done when the new A-level specifications appear next year.

David Verity
Withington Girls' School, Manchester, UK
david.verity@ntlworld.com

I find it highly worrying that the *21st Century Science* syllabus for GCSE seems to comprise mainly common-sense issues rather than dealing with the basics of physics. Even more worrying is the emphasis on discussion-based teaching with no element of note taking, and the fact that most work is based on worksheets that often lack key scientific principles. I agree that the designers of the course have attempted to generate interest among pupils, but I fear in the long term that this is basically "dumbing down" the science. If physics is to survive as a subject and we, as a country, still value physics graduates, then the GCSE course must be modified to suit.

Michael Cooke
Newton Aycliffe, UK
drmdcooke@hotmail.com