

# Research concludes there is no 'simple theory of everything' inside the enigmatic E8

March 26 2010

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The "exceptionally simple theory of everything," proposed by a surfing physicist in 2007, does not hold water, says Emory University mathematician Skip Garibaldi.

Garibaldi did the math to disprove the [theory](#), which involves a mysterious structure known as E8. The resulting paper, co-authored by physicist Jacques Distler of the University of Texas, will appear in an upcoming issue of *Communications in [Mathematical Physics](#)*.

"The beautiful thing about math and physics is that it is not subjective," says Garibaldi. "I wanted a peer-reviewed paper published, so that the scientific literature provides an accurate state of affairs, to help clear up confusion among the lay public on this topic."

In November of 2007, physicist Garrett Lisi published an online paper entitled "An Exceptionally Simple Theory of Everything." Lisi spent much of his time surfing in Hawaii, adding a bit of color to the story surrounding the theory. Although his paper was not peer-reviewed, and Lisi himself commented that his theory was still in development, the idea was widely reported in the media, under attention-grabbing headlines like "Surfer dude stuns physicists with theory of everything."

Garibaldi was among the skeptics when the theory hit the news. So was Distler, a particle physicist, who wrote about problems he saw with Lisi's idea on his blog. Distler's posting inspired Garibaldi to think about the issue more, eventually leading to their collaboration.

Lisi's paper centered on the elegant mathematical structure known as E8, which also appears in [string theory](#). First identified in 1887, E8 has 248 dimensions and cannot be seen, or even drawn, in its complete form.

The enigmatic E8 is the largest and most complicated of the five exceptional Lie groups, and contains four subgroups that are related to the four fundamental forces of nature: the electromagnetic force; the [strong force](#) (which binds quarks); the [weak force](#) (which controls [radioactive decay](#)); and the [gravitational force](#).

In a nutshell, Lisi proposed that E8 is the unifying force for all the forces of the universe.

"That would be great if it were true, because I love E8," Garibaldi says. "But the problem is, it doesn't work as he described it in his paper."

As a leading expert on several of the exceptional Lie groups, Garibaldi felt an obligation to help set the record straight. "A lot of mystery surrounds the Lie groups, but the facts about them should not be distorted," he says. "These are natural objects that are central to mathematics, so it's important to have a correct understanding of them."

Using linear algebra and proving theorems to translate the physics into math, Garibaldi and Distler not only showed that the formulas proposed in Lisi's paper do not work, they also demonstrated the flaws in a whole class of related theories.

"You can think of E8 as a room, and the four subgroups related to the four fundamental forces of nature as furniture, let's say chairs," Garibaldi explains. "It's pretty easy to see that the room is big enough that you can put all four of the chairs inside it. The problem with 'the theory of everything' is that the way it arranges the chairs in the room makes them non-functional."

He gives the example of one chair inverted and stacked atop another chair.

"I'm tired of answering questions about the 'theory of everything,'" Garibaldi says. "I'm glad that I will now be able to point to a peer-reviewed scientific article that clearly rebuts this theory. I feel that there are so many great stories in science, there's no reason to puff up something that doesn't work."

**More information:** Paper: <http://arxiv.org/abs/0905.2658>

Provided by Emory University

Citation: Research concludes there is no 'simple theory of everything' inside the enigmatic E8 (2010, March 26) retrieved 25 April 2024 from <https://phys.org/news/2010-03-simple-theory-enigmatic-e8.html>

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