

Physicist clarifies Higgs boson in human terms

May 31 2013, by Linda B. Glaser

Why did the journal *Science* name the Higgs boson – an elementary particle – last year's most important discovery? And why did it need something as enormous as the Large Hadron Collider, about 27 kilometers in diameter, to find it?

Peter Wittich, associate professor of physics involved in the discovery of the [Higgs boson](#) last July, answered a peppering of questions at the Science Cabaret May 28 in Ithaca.

Wittich explained to the packed crowd that the [Large Hadron Collider](#) works by smashing beams of [protons](#) together, with the collisions recorded by cameras taking 40 million pictures a second. "We think of ourselves as big data pioneers," said Wittich, describing the analysis necessary to find significant events. "It's the ultimate needle in a haystack. Out of 6 million billion collisions there are maybe 100,000 Higgs events, and we can find maybe 1 percent of them."

Taking the audience on a fast-paced journey through basic particle physics, Wittich outlined a [fundamental problem](#) with the [Standard Model of particle physics](#): It predicts a symmetry in which all particles have zero mass – which experiments have conclusively disproven. "So you could throw out the model, or you could try to fix it, and that's what we did," said Wittich. "We found a way to keep the symmetry but break it in a subtle way: It's called spontaneous symmetry breaking."

This is what the Higgs field does, Wittich told the crowd. It breaks the

symmetry between particles and gives them all masses, interacting with the particles via the Higgs boson.

"The Higgs field permeates space," Wittich said. "Mass is the property that governs how particles interact with the Higgs field. Heavier particles bump into the field more, so they have more mass; lighter [particles](#) interact with the field less, so they have less mass. The photon, a massless particle, goes through without interacting at all."

Not content with a verbal explanation, Wittich created a human illustration. People in the front row formed a staggered line a foot apart and called it a Higgs field. Wittich then played the part of a heavy particle, bumping into the lines as he made his way between them. A small woman, so slight that she could easily walk between the lines without bumping into anyone, portrayed a light particle.

Wittich maintains audience attention through humor: In response to a question he confessed that the Standard Model "doesn't actually know anything about gravity, which is kind of embarrassing because that's the first force we encounter as babies when we fall over."

"He certainly has an engaging way of presenting information," said Ithaca resident Tom Ruscitti. "I'd read about the Large Hadron Collider in the news, but his description of the Higgs boson put it all into perspective."

"Research is important," noted Ithaca resident Neil Oolie. "Bringing it out to the masses – which is us – is part of that. Get kids involved, get kids interested and the next thing you know they're working on their Ph.D.s."

More information: The Ithaca Science Cabaret is a free monthly event organized by local professors, graduate students and members of

the Ithaca community, held at Lot 10, 106 S. Cayuga St.

Provided by Cornell University

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