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Q&A François Englert
Boson beginnings

François Englert shared the 2013 Nobel Prize in Physics with Peter Higgs for the theoretical discovery of a mechanism that gives mass to subatomic particles. For this work, he collaborated with Robert Brout, who died in 2011. He looks back on his contribution to science with Thifhelimbilu Daphney Bucher.

When you were just starting out, what did you find interesting about physics?
Actually, I was an engineer. I started as an engineer, but I also theorized — and I found that more interesting: working out the underlying structure of things rather than their practical applications.

What inspired your early theoretical work?
You have to think back to the situation at the time. At the beginning of the 1960s, physicists understood long-range forces very well. The law of gravity — as described by the general theory of relativity — was proposed by Albert Einstein in 1915. Physicists also understood electromagnetism — the theory of all electric and magnetic phenomena, including the properties of electromagnetic waves. These include light, radio waves, X-rays and γ-rays.

Short-range forces were absolutely not understood back then. So this is what Robert Brout and I, and shortly after also Peter Higgs, initiated — a theory of short-range forces.

What links a theory of short-range forces with the idea of giving subatomic particles mass?
Long-range forces are mediated by the exchange of particles that have no mass. A particle that has no mass, like a photon, travels with the velocity of light. So the idea in our theory of short-range forces was to give particles mass because when they have a mass they do not travel at the speed of light, they are slower than that. And the forces mediated by them become short-range.

How did you and Brout develop the concept of the scalar boson?
At the time, we were studying the theory of phase transition. Phase transition involves a change in the physical properties of matter —such as water becoming vapour or ice. We drew very much from the work of physicist Yoichiro Nambu, who worked on phase transitions and quantum-field theory and showed that they have similarities. This inspired us to introduce to field theory some new particles called scalar bosons, which have the property of being able to form condensates, as occurs in phase transitions.

How does that give particles mass?
The condensate of bosons gives rise to a kind of sea that pervades the whole Universe. Particles travel through that medium, and because of the action of the medium, they may slow down. And so they acquire mass. It is the interaction of the condensate that gives mass, not the individual bosons.

Are there any differences between your theory and the one put forward by Higgs?
There is a difference in the method. Our one — which was inspired by Nambu — is more in line with modern physics than the Higgs approach. At the time, however, people found it more difficult. But our method was well chosen; all of the subsequent development of theory in the field has been done with it.

So why is the term scalar boson less well known than 'Higgs boson'?
That is because of an important paper by US theoretical physicist Steven Weinberg, who shared the Nobel prize in 1979. In a *New York Review of Books*' article in 2012 he discusses this. I can read you a few sentences. It says: "As to my responsibility for the name "Higgs boson," because of a mistake in reading the dates on three earlier papers, I thought that the earliest was the one by Higgs, so in my 1967 paper I cited Higgs first, and have done so since then. Other physicists apparently have followed my lead. But … the earliest paper of the three I cited was actually the one by Robert Brout and François Englert … But the name 'Higgs boson' seems to have stuck."

Does the name of the particle bother you?
When we finished our calculations about scalar bosons, we celebrated because we had worked out something that was mathematically and logically consistent — not because we expected recognition at that time. So I did not care about the name. But the problem is that it is not correct. Correct labelling would be the 'BEH boson' and that would be welcome. I do not wish to complain, however — not now that I have won the Nobel prize! ■

This interview has been edited for length and clarity.

Thifhelimbilu Daphney Bucher is a South African experimental nuclear physicist. Her research involves developing a γ-ray tracking technique for iThemba LABS's large-volume segmented HPGe detector.