On the Higgs Boson

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It's often lamented that the Higgs mechanism is terribly difficult to explain but it's like wading through a field of deep snow. What Higgs actually did was to show that one certain chunk of math can go off and be by itself.

Performing the normal multiplication that everyone is familiar with gives a good example. To multiply two numbers write 11 on one line, 'x' space seven on the next line, and then underline it. Write some math underneath and you have your answer. From the top down, one little chunk of math is there.

Higgs showed how the answer from the first math entity was actually a flux of probability current going through it. The Higgs boson is the smallest possible amount of that current. The boson is a distinct math entity defined by the probability current. Of course, the probability current was previously derived from the flux through the original chunk of math. Higgs discovered the probability current of the Higgs boson but there are other currents such as electron and neutrino currents.

Quantum is fuzzy so we have the probability current as the relevant field. If quantum was not fuzzy, instead of the probability current one would have a trajectory which is a curved line. The fuzziness turns the linear trajectory into a probability current in some volume. It predicts where in that volume one is more likely to find a Higgs boson. Similarly, the displacement field of classical mechanics predicts where one is likely to find areas of concentrated stress in a volume of material as it bends or twists.

The maths of the probability and displacement are the same; it's called field theory. In one case the field's physical quantity is the location of a Higgs particle. In the other it's the location of a set of discrete grid points representing the location of each part of the extended material body. (Truly the field tells us the limit where there are infinitely many of those grid points but computationally we just choose some number.) If one models the whole piece of material as just one point then the system is exactly the same as the Higgs. Only the interpretation is different.

How do you go from the one chunk of math to the other chunk of math? Well... that's the miracle of calculus. You integrate over the first chunk to get the flux. Then impose some arbitrary boundary condition(s) to get a probablility current. Due to some other math (noncommutative operators (this has to do with the *imaginary* number i)) there is a smallest possible amount of probability current. That smallest amount is now an independent Higgs boson.

One of the most widely looked-to places in the search for new physics is the development of new boundary conditions. With different boundaries, your math becomes a different kind of current upon application of the calculus. For instance, one might say that the Higgs boson resides between an apple tree and a ship or even between the distant future and the distant past.