

The origin of elementary particle masses

Abstract

The story I will tell begins around 1960. At that time, the *long range interactions* within our universe were well understood from the laws of classical general relativity, Einstein's generalisation of Newtonian gravity, and of quantum electrodynamics, the quantum version of Maxwell's electromagnetic theory. But there was no hint of how to formulate consistent fundamental theories of short range interactions, acting at subatomic levels.

Inspired by the success of quantum electrodynamics and by Nambu's work on *Spontaneous Symmetry Breaking*, Robert Brout and I initiated a solution to the latter; and so did independently Peter Higgs. This is the BEH mechanism that led to a general interpretation of the origin of elementary particle masses and became the cornerstone of the Standard Model of elementary particles. My friend Robert Brout passed away in 2011 and left me alone to tell the story.

I will present the BEH mechanism and comment on the magnificent discovery of its predicted BEH boson by the ATLAS and CMS groups at CERN. This discovery provides a direct confirmation of the theory and of the Standard Model up to presently known energies. It delineates the known from the unknown. I shall dive into the unknown and emphasise its call for a deep understanding of the quantisation of gravity.