Air Force-funded research and the Higgs Boson

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On 4 July, scientists at Geneva-based CERN, the European Organization for Nuclear Research, announced they had found the Higgs boson, or something significantly like the Higgs boson. This piece of subatomic matter, dubbed the "God Particle," in physicist Leon Lederman's 1993 book of the same name, has been hunted since the early 1970s, but theorized about for many years prior.

The Higgs particle takes its name from British physicist Peter Higgs and is a key to the Standard Model, which, in physics, accounts for all the particles that make up nature. In the case of the Higgs, it is thought to be critical to the existence of the universe itself because this particle is thought to provide the property of mass.

But the theoretical effort was not Higgs' alone. This key to the Standard Model was proposed by several physicists besides Higgs at about the same time. There were five additional figures who contributed significantly to the Higgs theory in 1964, and those five--Drs. Gerald Guralnik, Carl Hagen and Tom Kibble, at Imperial College in London, and Drs. François Englert and Robert Brout at the University of Brussels, were funded in two grants through the European Office of Aerospace Research and Development (EOARD), the overseas office of the Air Force Office of Scientific Research, the basic research arm of the United States Air Force.

Physical Review Letters (PRL) selected all three groups 1964 "symmetry breaking" papers for their Milestone Papers honor. Englert and Brout were the first to publish (PRL, August 1964), followed by Higgs (PRL, October 1964) and lastly by Guralnik, Hagen and Kibble (PRL, November 1964). While taking similar approaches to the boson issue, all three independently came to essentially the same conclusion.

What is noteworthy with regard to the PRL milestone papers are the critical contributions of each supporting the point that the particles that carry the weak force acquire their mass through interactions with what we now term the Higgs field, an all-pervasive force that provides the environment in which interactions occur via particles now known as Higgs bosons. The Higgs boson and the Higgs field provide the basis for why elementary particles have mass. Without the verification of the Higgs boson, the Standard Model was incomplete in its arrangement of the myriad of particles and forces of nature.

The beauty of theoretical physics is the ability to postulate the existence of nature's building blocks, many of which were predicted decades before their existence was proven in the laboratory--or in the 17 mile long tunnel of CERN's Large Hadron Collider. The beauty of basic research, and the Air Force commitment to such research, is the revolutionary long term benefit--in this case, on an international scale.

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