



The Work of an Experimental Physicist at ATLAS: An Interview with Dr. Evelyn Thomson

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The quest to understand the natural world is of paramount importance and takes the dedication of many driven minds. One part of this journey is the demystification of the Higgs boson, an elementary particle that gives all matter mass. Such a particle is amongst many others being studied by physicists today, an effort bolstered by Dr. Evelyn Thomson, an experimental particle physicist at the University of Pennsylvania. Her work at the A Toroidal LHC Apparatus (ATLAS), one of the general-purpose detectors at the [Large Hadron Collider](#) (LHC) that detects elementary particles from stimulated particle collisions, aims to further the understanding of elementary particles, including the Higgs boson.

Dr. Thomson's path in elementary particle physics started in her early years of graduate school.

"While conducting my work at the University of Glasgow, I worked on the [ALEPH](#) experiment, a large electron-positron collider at the CERN laboratory in Geneva, Switzerland," Thomson said. The ALEPH experiment is a large collaboration of hundreds of physicists and engineers from various universities and national laboratories. At CERN, she measured aspects of the W boson, an elementary particle that interacts weakly with other particles. This particle carries the weak nuclear force that is essential for the nuclear fusion reactions that power distant stars.

"I specifically focused on improving the measurements of the W boson mass," Thomson said. This mass can be thought of in terms of the standard model in physics, a theory which describes three of the four fundamental forces of the universe, electromagnetism, weak interactions, and strong interactions, but not gravitational force. Improved measurements of the W boson mass would allow for a better understanding of the [Higgs boson mass](#). In particular, theory necessitates that the Higgs has a mass that is within a certain range following photon collisions in a controlled apparatus. Thus, the detection of remaining mass in the apparatus upon experimentation would allow researchers to locate the Higgs.

Following her graduate work at CERN, Dr. Thomson pursued a postdoctoral fellowship with the Ohio State University and eventually moved to the University of Pennsylvania as a professor of physics where she now teaches courses in thermodynamics, wave motion, and special relativity.

At Penn, Dr. Thomson found herself working with CERN once again. "I soon joined the ATLAS experiment at the CERN Large Hadron Collider (LHC) to commission one of



Photo courtesy of Evelyn Thomson.

the ATLAS detector's transition radiation trackers," she says. This decision ultimately led to ATLAS's ability to detect proton-proton collisions. Dr. Thomson's work at CERN ultimately laid the groundwork from which many discoveries, including that of principle fundamental particles, could be achieved.

Today, Dr. Thomson is working with graduate students at Penn to study electron identification, jets, and violations of supersymmetry that will further the understanding of [electroweak gauginos](#), a [hypothetical supersymmetric field quantization](#), that influences the way that the Higgs boson is understood. A supersymmetric field is a state which uses properties from high-energy physics, which studies the properties of matter and radiation, and quantum mechanics, the field that primarily focuses on events at very small scales, to describe the nature of fundamental particles. One of the



fields in this intersection of physics is the Higgs field, which is significant for investigating the Higgs boson because of the wave-particle duality, a principle which suggests that a wave and particle are one and the same at the quantum-mechanical scale.

Outside of her research, Dr. Thomson enjoys working with students in her courses, helping them to explore the world of physics at a more fundamental level. In particular, through introductory courses in thermodynamics, she draws from her experience as an experimental particle physicist in order to unravel the properties of classical systems, exploring heat engines, relativistic models, and the laws of thermodynamics so as to reveal the significance that they hold in the natural world and current research.

Dr. Thomson urges students to explore a potential career in physics to gain a better understanding of the world around them. Learning physics would allow students to develop a unique perspective on life, regardless of whether they choose to pursue it as a career.

The field of physics is one that is diverse and requires investigation into some of the most fundamental phenomena of the universe. Dr. Evelyn Thomson's work as a particle physicist parallels this pursuit, both through her research and through her passion for the field as a whole. For, as the journey to understanding the world requires sacrifice, so too has Dr. Thomson's dedication to her career helped uncover many secrets behind the fundamental universe and inspire students from all over the world to pursue an understanding of physics. "Physics is interesting because there is always something to explore and there is always a question to be answered," Thomson said. "We are just one part in this process."

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