

Colloquium

Department of Physics

Why is the proton
2000-times heavier than the electron

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Abstract

The 2013 Nobel Prize in Physics was awarded to Peter Higgs and Francois Englert following discovery of the Higgs boson at the Large Hadron Collider. With this discovery the Standard Model of Particle Physics became complete. Its formulation and verification are a remarkable story. However, the most important chapter is the least understood. Quantum Chromodynamics (QCD) is that part of the Standard Model which is supposed to describe all of nuclear physics and yet, fifty years after the discovery of quarks, we are only just beginning to understand how QCD builds the basic bricks for nuclei: pions, neutrons, protons. Critically, the Higgs boson is often said to give mass to everything. However, that is wrong. It only gives mass to some very simple particles, accounting for only one or two percent of the mass of more complex things like atoms, molecules and everyday objects. The vast majority of mass is an emergent feature of QCD, contained fundamentally in Nambu's share of the 2008 Nobel Prize. Its appearance appears simultaneously to forever imprison quarks within the proton, preventing them from escaping to directly trigger detection. Contemporary and future terrestrial experiments are capable of verifying these notions and thereby completing the book on the Standard Model.

Monday, April 17, 2017 at 3:00 pm

SERC, Room 116

Refreshments will be served at 2:45 pm