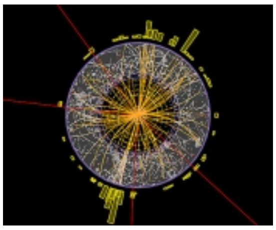
PHYSICS UPDATE

Hints of the Higgs heighten anticipation

There's less and less room for particle theory's long-sought capstone to hide.

January 9, 2012



that mediate the weak interaction, and on the quarks and leptons. The SM doesn't predict the Higgs mass M_H, but precision measurements of electroweak parameters and null results of searches at various colliders have restricted its range to 115–156 GeV. (The proton's mass is about 1 GeV.) Now the ATLAS and CMS detector collaborations at CERN's Large Hadron Collider (LHC) have reported tantalizing—but still statistically marginal—evidence of the Higgs near 125 GeV. Because the Higgs would live only 10^{-22} seconds, one could find and weigh it only by measuring the energies of its decay products in many collision events. A particularly useful decay mode ends with four high-energy muons (the red tracks in the display of one event's collision products in ATLAS). Though each team's sighting could easily be a two-standard-deviation statistical fluke, the fact that the two teams saw very similar peaks near the same mass in several decay modes heightens the anticipation of experimenters and theorists. The teams have already excluded M_H greater than 130 GeV, and by the end of this year's LHC run they should have enough data for a statistically robust discovery, or exclusion, of a standard-model Higgs in the remaining mass range. Either result would be momentous. (ATLAS collaboration, http://cdsweb.cern.ch/record/1406358/files/ATLAS-CONF-2011-163.pdf; CMS collaboration, http://cdsweb.cern.ch/record/1406347/files/HIG-11-032-pas.pdf.)—Bertram Schwarzschild

Comment on this article

This balanced assessment of the current situation is refreshing. I would only add that even if the Higgs boson is indirectly supported by future data, the Standard Model of particle physics has deficiencies that tell us that something very important is still missing from our understanding of the microcosm. To wit: 1. The Standard Model is primarily a heuristic model with 26-30 fundamental parameters that have to be "put in by hand". 2. The Standard Model cannot predict the masses of the fundamental particles that make up all of the luminous matter that we can observe. 3. The Standard Model did not predict the existence of the dark matter that constitutes the overwhelming majority of matter in the cosmos. The Standard Model describes heuristically the "foam on top of the ocean". 4. The vacuum energy density crisis clearly suggests a fundamental flaw at the very heart of particle physics. The VED crisis involves the fact that the vacuum energy densities predicted or measured by particle physicists (microcosm) and cosmologists (macrocosm) differ by up to 120 orders of magnitude (roughly 10^70 to 10^120, depending on how one estimates the particle physics VED). 5. The Planck mass is highly unnatural, i.e., it bears no relation to any particle observed in nature, and calls into question the foundations of the quantum chromodynamics sector of the Standard Model. 6. Many of the key particles of the Standard Model have never been directly observed. Rather, their existence is inferred from secondary, or more likely, tertiary decay products. Quantum chromodynamics is entirely built on inference, conjecture and speculation. It is too complex and "adjustable" for simple definitive predictions and testing. Robert L.

Oldershaw Discrete Scale Relativity Fractal Cosmology

Written by Robert L. Oldershaw, 9 January 2012 22:14