A relativistic QFT basis for spin-0 boson mass differences in CMS and ATLAS

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ABSTRACT

Massive spin-0 boson (often assumed to be “Higgs boson” of conventional electroweak symmetry breaking, which fails to predict a falsifiable mass for the particle; for an alternative electroweak symmetry which is broken in a different and cleaner way[1]) decay product searches in TeV collisions at CERN’s Large Hadron Collider detected a possible difference in masses between the CMS detector channels for electromagnetic decay ($h \rightarrow \gamma\gamma$) and ATLAS’s weak boson decay chain detector ($h \rightarrow ZZ \rightarrow 4l$); ATLAS gave 123.5 GeV for weak decay chain $h \rightarrow ZZ \rightarrow 4l$, while CMS gave 126.5 GeV for $h \rightarrow \gamma\gamma$. We argue that if this mass difference is real (rather than a systematic detector miscalibration of some kind), it indicates a statistical relativistic effect: the Lorentz contraction in the direction of motion affects self-interactions of a moving spin-0 massless boson with its own field quanta, affecting weak and electromagnetic decays to a differing extent. So in a spectrum of massive spin-0 boson velocities produced by an LHC collision, the fastest moving massive spin-0 bosons could be more likely than expected to decay by double gamma emission; the slower ones might be expected to be more likely than expected to undergo weak decays and four lepton emissions. The higher the speed, the greater the slowing due to time-dilation on massive Z boson decay processes, whereas there is no time-dilation velocity effect for massless gammas (which go at light velocity in regardless).

CMS measures the production of two gamma rays from the decay of massive spin-0 bosons; ATLAS measures the production of four leptons produced by the decay of massive spin-0 bosons into two Z bosons (which each decay into two leptons). The larger mass found by CMS may be the first evidence that a statistical effect is at work: faster spin-0 bosons (with relativistic mass increase over the rest-mass) may be statistically more prone to undergo electromagnetic (double gamma) decay emission, rather than weak (double Z) emission.

Although it is traditional to assume that decay rates are intrinsic and uniformly affected by relativity’s time-dilation formula (which predicts that both electromagnetic and weak decays are affected in precisely the same manner by relativity), this is only a first-order approximation and could neglect subtle vacuum corrections, corresponding to the effects of the motion of a particle on its interaction with its own quantum field. The Lorentz contraction may have some effect on the UV cutoff energy (and radius in the direction of motion) for high-order quantum field perturbative corrections (loops carrying large momenta), and since weak decay rates depend on quanta in the field, it could be that the CMS vs. ATLAS spin-0 massive boson decays from electroweak symmetry breaking are the first clean evidence for a second-order relativistic correction. (Other *very* high-energy experiments always create jets with too much noise to see this effect.)

Massive spin-0 boson (often assumed to be “Higgs boson” of conventional electroweak symmetry breaking, which fails to predict a falsifiable mass for the particle; for an alternative electroweak symmetry which is broken in a different and cleaner way[1]) decay product searches in TeV collisions at CERN’s Large Hadron Collider detected a possible difference in masses between the CMS detector channels for electromagnetic decay (h→γγ) and ATLAS’s weak boson decay chain detector (h→ZZ→4l); ATLAS gave 123.5 GeV for weak decay chain h→ZZ→4l, while CMS gave 126.5 GeV for h→γγ. We argue that if this mass difference is real (rather than a systematic detector miscalibration of some kind), it indicates a statistical relativistic effect: the Lorentz contraction in the direction of motion affects self-interactions of a moving spin-0 massless boson with its own field quanta, affecting weak and electromagnetic decays to a differing extent. So in a spectrum of massive spin-0 boson velocities produced by an LHC collision, the fastest moving massive spin-0 bosons could be more likely than expected to decay by double gamma emission; the slower ones might be expected to be more likely than expected to undergo weak decays and four lepton emissions. The higher the speed, the greater the slowing due to time-dilation on massive Z boson decay processes, whereas there is no time-dilation velocity effect for massless gammas which go at velocity c in any case.[2]

We are not referring to the SM “electroweak symmetry breaking” or non-mass-predicting “Higgs bosons”, but to the actual experiments at CERN, which should not be dogmatically tied down to mainstream non-mass-predicting, non mechanistic “theory” (*the “Higgs mechanism” for mass does not include quantum gravity, for which mass is quantum gravitational charge*), any more than Kepler should have interpreted Brahe's data on Mars using Ptolemy’s “theory” of epicycles:

“Higgs did not resolve the dilemma between the Goldstone theorem and the Higgs mechanism. … I emphasize that the Nambu-Goldstone boson does exist in the electroweak theory. It is merely unobservable by the subsidary condition (Gupta condition). Indeed, without Nambu-Goldstone boson, the charged pion could not decay into muon and antineutrino (or antimuon and neutrino) because the decay through W-boson violates angular-momentum conservation. … I know that it is a common belief that pion is regarded as an “approximate” NG boson. But it is quite strange to regard pion as an almost massless particle. It is equivalent to regard nuclear force as an almost long-range force! The chiral invariance is broken in the electroweak theory. And as I stated above, the massless NG boson does exist ... Pion’s spin is zero, while W-boson’s spin is one. People usually understand that the pion decays into a muon and a neutrino through an intermediate state consisting of one W-boson. But this is forbidden by the angular-momentum conservation law in the rest frame of the pion.”

- Professor N. Nakanishi[3]

Nakanishi states that despite the Higgs mechanism which produces massive weak bosons (Z and W massive particles), a massless Nambu-Goldstone boson is also required in electroweak theory, in order to permit the charged pion with spin-0 to decay without having to decay into a spin-1 massive weak boson. In other words, there must be a “hidden” massless alternative to weak bosons as intermediaries.[1]

References:

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