The Invention & Discovery of the 'God Particle'

HIGGS

JIM BAGGOTT

Foreword by Steven Weinberg

Higgs: The invention and discovery of the 'God Particle', Jim Baggott, Oxford University Press, 2012, 019165003X, 9780191650031, 304 pages. The hunt for the Higgs particle has involved the biggest, most expensive experiment ever. So exactly what is this particle? Why does it matter so much? What does it tell us about the Universe? Has the discovery announced on 4 July 2012 finished the search? And was finding it really worth all the effort? The short answer is yes. The Higgs field is proposed as the way in which particles gain mass - a fundamental property of matter. It's the strongest indicator yet that the Standard Model of physics really does reflect the basic building blocks of our Universe. Little wonder the hunt and discovery of this new particle has produced such intense media interest. Here, Jim Baggott explains the science behind the discovery, looking at how the concept of a Higgs field was invented, how the vast experiment was carried out, and its implications on our understanding of all mass in the Universe. The book was written over the eighteen months of the CERN Large Hadron Collider experiment, with its final chapter rounded off on the day of the announcement 'that a particle consistent with the standard model Higgs boson has been discovered.'.

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Massive The Hunt for the God Particle, Ian Sample, 2011, Higgs bosons, 320 pages. A prize-winning science writer's history of the forty-year search for the Higgs boson, and the intense rivalries, clashing egos, and grand ambition that led to a world-changing ....

The Standard Model A Primer, Cliff Burgess, Guy Moore, 2007, Science, 542 pages. This 2006 book uses the standard model as a vehicle for introducing quantum field theory..

Massive The Missing Particle that Sparked the Greatest Hunt in Science, Ian Sample, 2010, Science, 260 pages. A prize-winning science writer provides a history of the 40-year search for the Higgs boson, also known as the "God" particle, and the intense rivalries, clashing egos and ....

A Course in Field Theory , Pierre van Baal, Aug 13, 2013, Science, 224 pages. Extensively classroom-tested, this textbook provides material for an introductory, one-semester field theory course for advanced undergraduate or graduate students in physics ....

Higgs particle(s) physics issues and experimental searches in high-energy collisions, Ahmed Ali, 1990, , 498 pages. .

Physics up to 200 TeV , Antonino Zichichi, 1991, , 478 pages. .

Particles and Fundamental Interactions An Introduction to Particle Physics, Sylvie Braibant, Giorgio Giacomelli, Maurizio Spurio, Nov 16, 2011, Science, 512 pages. Based on the celebrated lectures of the influential particle physicist Giorgio Giacomelli, this volume, now in a new edition, aims to provide the basic theoretical foundations ....

Nuclear and Particle Physics An Introduction, Brian Martin, Apr 28, 2006, Science, 411 pages. This text is an accessible, balanced introduction to nuclear and particle physics, providing an overview of the theoretical and experimental aspects of the subject..

Decoding Reality: The Universe as Quantum Information , Vlatko Vedral, Feb 25, 2010, Science, 240 pages. For a physicist, all the world's information. The Universe and its workings are the ebb and flow of information. We are all transient patterns of information, passing on the ....

Very High Multiplicity Physics Workshops Proceedings of the VHM Physics Workshops, JINR, Dubna, Russia, 17-19 September 2007, Aleksey Sissakian, Joseph Manjavidze, 2008, Science, 186 pages. This proceedings volume provides a comprehensive overview of the selected reports given at the International Workshops on Very High Multiplicity Physics from 2000 through 2007 ....

Higgs Discovery The Power of Empty Space, Lisa Randall, 2012, Science, 64 pages. On July 4th, 2012, one of physics' most exhilarating results was announced: a new particle Ð²Ð‚â€œ and very likely a new kind of particle Ð²Ð‚â€œ had been discovered at the Large Hadron ....

Quantum Field Theory , Franz Mandl, Graham Shaw, May 24, 2010, Science, 492 pages. Following on from the successful first (1984) and revised (1993) editions, this extended and revised text is designed as a short and simple introduction to quantum field theory ....

The God Particle , Valentine L. Krumplis, May 22, 2012, Philosophy, . Today the discovery of the so-called God particle, the Higgs boson particle is forcing us to rethink our idea of God and how he thinks. Applying the theory of the God particle ....

Particle Physics , Brian Martin, Graham Shaw, Nov 20, 2008, Science, 460 pages. An essential introduction to particle physics, with coverage ranging from the basics through to the very latest developments, in an accessible and carefully structured text ....

Neutrino , Frank Close, Oct 14, 2010, Science, 192 pages. What are neutrinos? Why does nature need them? What use are they? Neutrinos are perhaps the most enigmatic particles in the universe. Formed in certain radioactive decays, they ....

The God Particle The Discovery and Modeling of the Ultimate Prime Particle, Ted Jaeckel, Jun 1, 2007, Science, 208 pages. Dubbed the "God particle" by Nobel Prize-winning physicist Leon Lederman, the Higgs boson is a hypothetical particle which, like divinity, is all pervading but undetectable ....

Farewell to Reality How Modern Physics Has Betrayed the Search for Scientific Truth, Jim Baggott, Aug 6, 2013, Science, 336 pages. From acclaimed science author Jim Baggot, a pointed critique of modern theoretical physics In this stunning new volume, Jim Baggott argues that there is no observational or ....

The short answer is yes, and there was much at stake: our basic model for the building blocks of the Universe, the Standard Model, would have been in tatters if there was no Higgs particle. The Higgs field had been proposed as the way in which particles gain mass - a fundamental property of matter. Little wonder the hunt and discovery have produced such intense media interest.

"Higgs is an impressive volume, clarifying details, making the concepts that have been in dispute for years finally lucid... Higgs drills deep under your skin, constantly ferreting out new vistas, easily escaping our eyes. Baggott brings these-and more-together to form a solid concept of the God Particle effort-read it."

Jim Baggott is a freelance science writer. He was a lecturer in chemistry at the University of Reading but left to pursue a business career, where he first worked with Shell International Petroleum Company and then as an independent business consultant and trainer. His many books include Atomic: The First War of Physics (Icon, 2009), Beyond Measure: Modern Physics, Philosophy and the Meaning of Quantum Theory (OUP, 2003), A Beginner's Guide to Reality (Penguin, 2005), and A Quantum Story: A History in 40 Moments (OUP, 2010).

Up until very recently, news out of the European Organization for Nuclear Research (CERN) regarding the progress of the new Large Hadron Collider (LHC) had been slow in coming, and nary a major discovery had been announced. On July 4th, though, all of that changed. As on that day CERN announced the discovery of nothing less than the Higgs boson, the 'God particle'.

The potential discovery of the Higgs boson had been one of the principal reasons why physicists were so excited about the LHC; and therefore, within the scientific community the announcement was cause for a major celebration indeed. For most of the general public, however, while the announcement was certainly intriguing, there were many basic questions yet to be answered: Just what was the Higgs boson, and why had it been labeled the God particle? Why were physicists expecting to find it, and what did the discovery really mean? Adequately answering these questions was more than what journalists were able to do in their compressed news segments and newspaper articles--and, besides this, it was a task that many journalists were not up to regardless.

With impressive clarity, Baggott first takes us through the history of the development of the Standard Model of particle physics (which theory the Higgs boson is a part). He begins with the discovery that atoms are made up of the still more elementary particles of electrons, protons and neutrons.Read more ›

Writing popular explanations of modern physics is not easy. There are a wealth of books about introductory quantum mechanics for the layman, but finding a well-written explanation of advanced topics that actually does some true explaining is about as easy as, well, finding the Higgs Boson. Sadly, this book by Jim Baggott is not what you're likely to be looking for. It is well-written, and it does provide some very nice behind-the-scenes history -- I didn't know, for instance, that Sheldon Glashow and Steven Weinberg were classmates at at the Bronx High School of Science. And when it comes to detailing the experimental history of seeking and presumably finding the the Higgs Boson, Baggott does a fine job of narration. The author fails, however, to give meaningful verbal explanations for many quantum processes. And in fairness, perhaps in some cases that's just not possible. There may come a point where the reality is expressed so completely in the mathematics that physical understanding -- to the extent that that's possible in the quantum world -- can be achieved only through an understanding of the mathematics. There are several instances where Baggott introduces a concept in a sketchy way, then simply declares that one result or the other is a consequence of the concept in question without giving a real sense of why that effect comes about. A prime example is the Higgs mechanism itself. Here's the tail end of Baggott's explanation: "Breaking the symmetry creates a massless Nambu-Goldstone boson. This may be 'absorbed' by the massless spin 1 field bosons to create a third degree of freedom...In the Higgs mechanism the act of gaining three-dimensionality is like applying a brake. The particle slows down...." And the slowdown effect is what we interpret as the particle having mass.Read more ›

With due credit to the author for tackling a very esoteric subject. I am still struggling with mathematics developed in the 18th century so I don't have the tools to work with to really understand particle physics. The history of our understanding of atoms and then the more elementary particles of which they consist is a very interesting read. The discussion on symmetries was the clearest I have ever read. This is a very good book written for non-scientists and I give the author high marks for bringing this subject down to a level that can help the reader follow future developments with some comprehension. I expect a second reading will help me understand even more. Kudos to Jim Baggott. I hope he will continue writing books like this one.

Jim Baggot tries initially to explain symmetry on few pages and jumps instantly into Lie groups and gauge symmetries. This is bad. Then you read about 'subtracting one perturbation series from the other, thereby eliminating the infinite terms'. He explains further this 'renormalization procedure' by quoting after John Gribbin, that series 1+2+3+4+.. diverges into infinity. This is wrong (see Lawrence Krauss' "Hiding in the Mirror" where he explains plenty about symmetries and that infinite series do not look like they seem).

The hunt for the Higgs particle has involved the biggest, most expensive experiment ever. So exactly what is this particle? Why does it matter so much? What does it tell us about the Universe? Did the discovery announced on 4 July 2012 finish the search? And was finding it really worth all the effort?

The short answer is yes. The Higgs field is proposed as the way in which particles gain mass - a fundamental property of matter. It's the strongest indicator yet that the Standard Model of physics really does reflect the basic building blocks of our Universe. Little wonder the hunt and discovery of this new particle produced such intense media interest.

At every step of the way, Baggott is sure to explain what difficulties confronted the understanding of particle physics that was current at the time, what theoretical models were developed to overcome these difficulties, and the empirical evidence that was used to establish which theoretical model won the day. For instance, and of crucial importance here, is that--after learning of the 3 types of elementary particles, and the 4 basic forces--we learn that there was a problem with the then-current theory regarding the masses of the elementary particles--in that the 4 forces alone were simply unable to account for it. In order to overcome this difficulty, some physicists postulated that there must be a charged field pervading space, since such a field appeared to be the only appealing way to solve the mass mystery. This field was called the Higgs field.

The problem was that there was as yet no empirical evidence that the Higgs field actually exists. What physicists did think, though, was that if it did exist, it would imply the existence of a certain type of boson particle, dubbed the Higgs boson. What this meant is that if physicists could find the Higgs boson, they would have empirical evidence that the Higgs field does in fact exist, and the problem regarding the masses of elementary particles would be adequately solved. On July 4th, it was the discovery of this very particle that was announced, and Baggott takes us behind the scenes at the LHC to explain just what went into the discovery.

What I wanted from this book is a real explanation of what the Higgs field is and how the so-called 'massless particles' interact with it and acquire mass. In order to make up my mind whether to buy this book or not, I decided to 'taste' i...more WARNING: My opinion of â€˜Higgs: The Invention and Discovery of the â€˜God Particleâ€• by Jim Baggott is based on the Amazon sample of the book, which includes Prologue: 'Form and Substance', as well as on an executive summary I found @ newbooksinbrief.wordpress.com.

Both the sample and the summary of the book contain numerous physics concepts which I do not understand and it seems to me they are not well explained. Though I'm not a physicist, I've noticed lots of misleading things, logical fallacies and inconsistencies and my impression is that this book would fail to meet my expectations.

For instance, the first logical fallacy I came accross is Baggott's description of 'mass' in the very Prologue (loc. 227), which reads: "Mass, we now believe, is not an inherent property or 'primary' quality of the ultimate building blocks of nature. In fact, there is no such thing as mass. Mass is constructed entirely from the energy of interactions involving naturally massless elementary particles."

I can't help but wonder what the author wants to say with such description. A particle without mass does not exist. Besides, if there is no mass, there is no energy, i.e. capacity for performing any kind of interaction/work. If there's no such thing as mass, then I do not exist, and therefore I cannot buy and read the Baggott's book.

This interpretation of Einsein's equation is totally wrong. The equation doesn't read E=m but E=mc squared, which makes a huge difference. In addition, if I have no mass (as Baggott's interpretation of the equation implies), how can I have energy, i.e. capacity to perform any work, including buying and reading this book?

'According to the theory, the Higgs field interacts with particles and slows them down in the process(loc. 1178). This makes it appear as though the particle has mass in itself, but truly it only acquires its mass through the nature of the interaction. The degree to which the Higgs field slows down any given particle (and therefore, the mass that that particle acquires) depends on the degree to which that particle interacts with the field.'

So, it appears that non-existant massless particles acquire mass because a charged field (the existence of which is to be confirmed by the Higgs bosone discovery) slows them down. What produces that charged field? Massless particles?! How can massless particles have energy to produce anything? These questions are giving me a headache and I don't like books which give me a headache.

Baggott further explains the process thus: "our instinct is to equate inertial mass with the amount of substance that the object possesses. The more 'stuff' it contains, the harder it is to accelerate. The

Higgs mechanism turns this logic on its head. We now interpret the extent to which the particle's acceleration is resisted by the Higgs field as the particle's (inertial) mass. The concept of mass has vanished in a puff of logic. It has been replaced by interactions between otherwise massless particles and the Higgs field" (loc. 1189).

What logic does the Higgs mechanism turn on its head? What's 'a puff of logic' in which the concept of mass has vanished? Perhaps that 'puff of logic' is a sudden confession that the terms 'massless' and 'energy' are wrongly and misleadingly used throughout the book. My 'puff of logic' is telling me again not to buy this book.

On the other hand, it appears that this book contains a good historic review of attempts to discern a whole zoo of particles, some of which (bosons) are not considered as actual particles but carriers of force, and some of which (fermions) are considered as actual(matter)particles. For this reason I give this book 2 stars, which means: 'Ah, well, it's OK.'