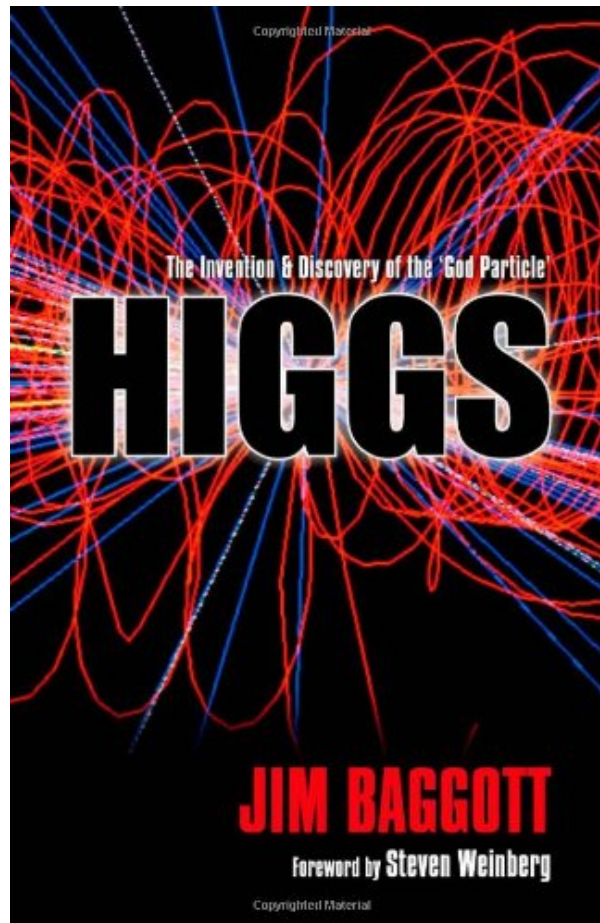
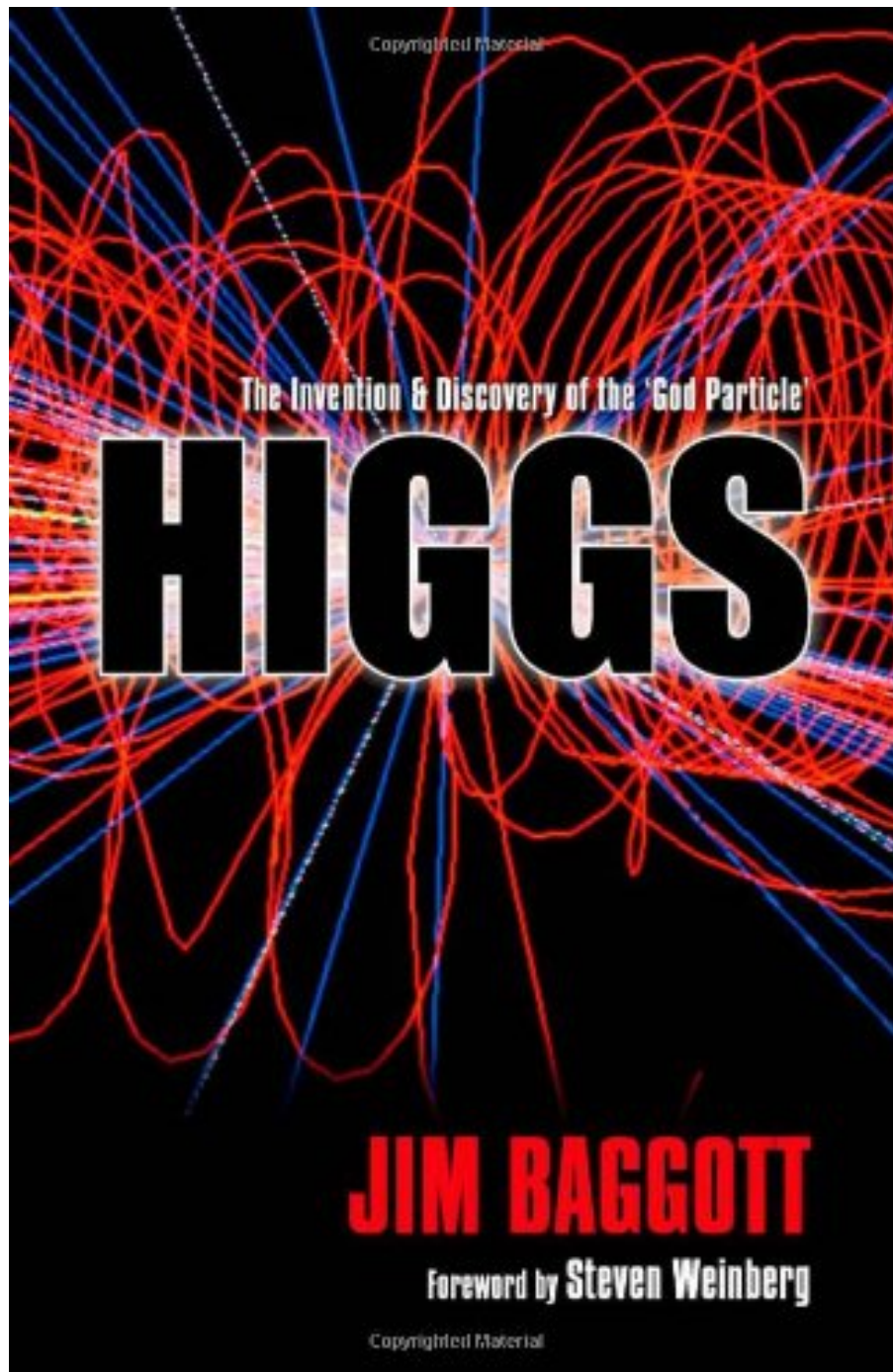


# HIGGS: THE INVENTION AND DISCOVERY OF THE 'GOD PARTICLE' BY JIM BAGGOTT



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## Review

"A tendency towards brevity and clarity make for a handy guide to the long hunt for an elusive quarry." - Nature

"For those who want the full story, there is Jim Baggott's Higgs....His detailed explanation of how the Higgs mechanism gives particles mass is extremely elegant." -- New Scientist

"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."  
-- San Francisco Book Review

## About the Author

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).

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The hunt for the Higgs particle has involved the biggest, most expensive experiment ever. So what is this particle called the Higgs boson? Why does it matter so much? What does this "God particle" tell us about the Universe? And was finding it really worth all the effort?

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.

Here, Jim Baggott explains the science behind the discovery, looking at how the concept of a Higgs field was invented, how it is part of the Standard Model, and its implications on our understanding of all mass in the Universe.

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## Most helpful customer reviews

47 of 48 people found the following review helpful.

### Good Narrative but Lacking True Illumination

By J. R. Trtek

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 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. Fine, but why is it that a particle must slow down if its wave-function acquires a third dimension in the direction of motion? I assume that it's related to issues of viewing the particle in other reference frames moving at different velocities and the transformations that would result but which don't if the particle is massless and must move at lightspeed.... Of course, what I just started writing probably makes no sense to many people, so perhaps I've just managed to appreciate the difficulty of Baggott's task in writing his book. My point, however, is that few of the "explanations" in Baggott's text really explain in fundamental way. But as I stated at the beginning, perhaps that's an impossible goal when it comes to modern physics. My bottom line, after this too-long of a review, is that you'll get some interesting history and a fine explanation of the experimental side of the topic, but don't expect to understand the theoretical side after you read this book unless you already understood it going in.

60 of 65 people found the following review helpful.

### A Brief Summary and Review

By A. D. Thibeault

\*A full executive summary of this book is available at [newbooksinbrief dot com](http://newbooksinbrief.com).

The main argument: 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.

Jim Baggott's new book 'Higgs: The Invention and Discovery of the 'God Particle"' is meant to remedy this situation and provide the necessary context that the general public needs in order to understand the discovery of the Higgs boson and what it all means.

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. And then takes us through the discovery of the still more fundamental particles of quarks, leptons and bosons, and the 4 fundamental forces that govern these particles: gravity, the electromagnetic force, the weak nuclear force, and the strong nuclear force.

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.

While the discovery of the Higgs boson solved one major problem with the Standard Model, there are a few others that have yet to be solved--including the hierarchy problem, and the problem of explaining gravity--and Baggott does touch on these issues as well.

Amazing science, wonderfully told. A full executive summary of the book is available at [newbooksinbrief dot com](http://newbooksinbrief.com).

17 of 18 people found the following review helpful.

Well written but not easy to understand.

By Roger Curry

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.

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