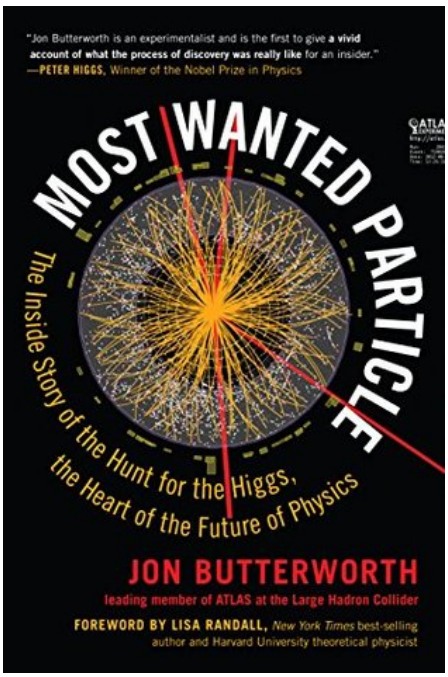

Most Wanted Particle: The Inside Story of the Hunt for the Higgs, the Heart of the Future of Physics

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Now in paperback: the “vivid account of what the process of discovery was really like for an insider.”—Peter Higgs

Particle physics as we know it depends on the Higgs boson: It’s the missing link between the birth of our universe—as a sea of tiny, massless particles—and the tangible world we live in today. But for more than 50 years, scientists wondered: *Does it exist?*

Physicist Jon Butterworth was at the frontlines of the hunt for the Higgs at CERN’s Large Hadron Collider—perhaps the most ambitious experiment in history. In *Most Wanted Particle*, he gives us the first inside account of that uncertain time, when an entire field hinged on a single particle, and life at the cutting edge of science meant media scrutiny, late-night pub debates, dispiriting false starts in the face of intense pressure, and countless hours at the collider itself. As Butterworth explains, our first glimpse of the elusive Higgs brings us a giant step closer to understanding the universe—and points the way to an entirely new kind of physics.

Most Wanted Particle: The Inside Story of the Hunt for the Higgs, the Heart of the Future of Physics Details

Date	:	Published January 27th 2015 by The Experiment (first published May 2014)
ISBN	:	
Author	:	Jon Butterworth
Format	:	Kindle Edition 308 pages
Genre	:	Science, Nonfiction, Physics, Audiobook

From Reader Review Most Wanted Particle: The Inside Story of the Hunt for the Higgs, the Heart of the Future of Physics for online ebook

Tim Ellis says

I listened to this on audio which may not have been such a great idea. There is a lot of detailed physics in it but without the ability to flick back easily to an earlier chapter and re-read a crucial paragraph as you can do in a book, I quickly lost track of which fundamental particle is which and what they all do. I've now started listening to it again, in the forlorn hope I may take in more the second time around.

The book is entertaining though, and it was useful for someone such as myself with an understanding of some fields of science but who doesn't yet know his quarks from his leptons as far as physics goes. It's a detailed account of the discovery a couple of years ago of the Higgs boson particle at the CERN Large Hadron Collider, written by a British scientist who was working on the project. It's something I've heard a lot about on the news but have never quite understood what all the fuss is about. I'm still not entirely clear, but I have a better idea of what a Higgs boson is, why it was so hard to find, and why the theorists are so delighted they have proved its existence at last (that latter is because the discovery validates their lifetimes' work and all the billions that have been spent on it, I reckon.)

The narrative mixes hardcore physics with a chronological account of the search for the particle, interspersed with anecdotes relating to the author's involvement in the project and some of his private life, which lends a human angle to what could have been a very dull book. There is also an undercurrent in which the author seems to be trying to justify the huge amounts of public money from many countries, the human resources and electrical power, that have been channelled into the CERN project over the years.

Natural skeptic that I am I'm not totally convinced. I'm as curious as anyone to know how the universe works, but at this point in history when we're told by other scientific experts that the world has about twenty years left to sort out the problem of greenhouse gas emissions before the climate tips irretrievably towards calamity, I wish the governments of the world would be throwing all their scientific resources at developing renewable energy instead of trying to prove theories that may not yield any practical application for another century. The author rightly points out that one day in the distant future mankind may be able to save the planet from a disaster such as a meteorite strike as a direct result of the work they are doing, and that people in that future won't regard CERN to have been a waste of money any more than we ourselves begrudge any scientific advances in the past. My point is that the way we're "progressing" now, all technological endeavour in the future is going to be about trying to feed a massive human population on a planet that is rapidly losing all its fertile land to rising sea levels, extreme storms and desertification. Sort out the urgent problems now, and future scientists can do experiments to resolve the paradoxes of theoretical physics a lot more inexpensively and less damagingly to the climate than they presently can at CERN.

But my opinions make me digress from reviewing the book. If you have any interest in how the universe works, I recommend this as something that will increase your knowledge at least a little. If you have no interest in the search for a scientific explanation for everything, you need to read this book even more urgently to find out what fascinating revelations you have been missing out on!

Brett says

Most Wanted Particle is an insider's tale of the hunt for the Higgs boson, the field which imparts mass to, well, nearly everything. Written by Jon Butterworth—a physicist working with the ATLAS team at the Large Hadron Collider—the book documents the construction of the Large Hadron Collider, the catastrophe after it was first turned on, and the global excitement as evidence for the Higgs boson grew incontrovertible.

Most Wanted Particle has already received glowing praise from the likes of Brian Cox and even Peter Higgs—for whom the boson is named—and I'm sure that several physicists reading this site already have the book on their 'to read' list. But what about the rest of us? As a biology PhD whose last physics class was about 15 years ago, I decided to see if the book was accessible enough for your average science geek.

First and only warning: the book discusses some very fundamental physics, and if you're afraid to learn about topics like quarks, gluons, and hadronic jets, then this book will be tough going for you (all three of these are introduced on page 22, for instance). This complexity should be largely expected given the subject matter of the book; the alternative would be like a WW2 book that didn't mention Normandy. So if learning some jargon scares you, you'd best stick to reading the news headlines from CERN.

With that caveat out of the way, Butterworth is a stellar writer and teacher, and he employs a number of tricks to make *Most Wanted Particle* extremely readable. First of all, equations are largely absent—they are described rather than displayed. (More kudos are due for making it over halfway through the book before the first Feynman diagram appears). Second is Butterworth's impressive facility with analogy: often, even if you are struggling with the specifics of a concept, you will be able to grasp the broad brush strokes, and that's enough to follow along with the tale.

Finally, there is the journalistic style. The book is written as a passionate first-person account, and the main narrative is pleasingly interrupted by diversions. It's not uncommon to have a dense description of, say, super symmetry, broken up by a blog-like chapter discussing an international trip to a conference. (Other topics include meeting etiquette and 'taking things offline'; what makes a good acronym; and a particularly memorable drunken night for the author and friends in Hamburg.)

Do you have friends who are scientists? If so, you will feel at home reading this book, and it took me a while to understand why. It's because the general impression that I get from this book is very similar to taking a scientist friend to the pub, and having them describe their work to you over a beer. Sometimes you'll get a little lost in the more thorny parts of the science; often you'll get carried off by a tangent; but overall you'll just enjoy a rollicking good tale, told by an intelligent storyteller.

Highly recommended. I drop a single star because I can't unreservedly recommend this for everyone; but if you have some basic understanding of physics, and a will to learn about the topic, you could do far worse than this book.

Full disclosure: reviewed for Universe Today

Arko says

A very well written & up close account of a herculean scientific endeavour towards unravelling the nature of the physical universe we find oursleves in. Sincere thanks to the author in writing this book which enables science enthusiasts & laypersons alike to learn a lot from the grand work done to find the elusive [standard model] Higgs boson. Kudos !

Jasim says

It's all about the author's experience in CERN.

David says

An entertaining personal account that doesn't hold back on the physics. Recommended.

Richard says

A very interesting book about the history and the work done at the Large Hadron Collider (LHC).
By no stretch of the imagination is this an easy book to read (the previous owner of my second hand copy seemed to give up at page 16). However, if you are up for it, this book will give a good basic knowledge about modern models of quantum theory. It's also surprisingly witty in places.
If you are really interested in the work at the LHC, this is about as good a book as you can read on the subject.
A reasonable knowledge of Relativity and spectroscopy is also very useful.

Patrick Ritchie says

An entertaining read about the large Hadron collider, and I am now much more familiar with the standard model.

Ram says

This is an amazing book on the journey leading up to the discovery of the Higgs boson. I have always been fascinated by Physics and have eagerly followed (or tried to, with my limited understanding!) the developments in particle physics theories and the experimental results. The search for the Higgs boson has been in the works for a long time, but the interest levels accelerated since the opening of the Large Hadron Collider in 2009. Jon Butterworth is an experimental scientist who has been associated with the collider and its search from the start, so in this fascinating book he takes us on the journey leading to the culmination of the search and the formal announcement of the discovery of the Higgs boson in the summer of 2012.

The book provides a view of the theory & data that existed prior to the LHC’s commissioning, then a step by step and ringside view of the progress made between 2010 and 2012. Along this journey, Jon describes the

theories and the experiments using (close to) layman terms & analogies where possible. I will not claim that I followed every word and every aspect of the sub-atomic world of hadrons, fermions, quarks, matter and anti-matter, QCD & QED, etc but at a broad level it is hard not to get a small feel for the sense of excitement that the author tries to convey. Even for someone who is not a hard-core physics person, this book should be a fascinating read – some of the sections may be a bit “heavy” – but if one persists and refers to offline (or online) content referred in the book, it is possible to get a glimpse of the incredibly complex science behind this discovery.

One of the criticisms of this book is the amount of personal narrative that the author has put in – space that could’ve been filled up with science – but I view that as a way for readers – lay readers – to connect with the human persona of the scientists who are engaged at the cutting edge of high-energy physics research. In that, this book does a wonderful job.

Also, one book is never enough to understand the continuous search for new physics. Theories abound so every such book is a step towards establishing a better and clearer picture in our minds. Again, in that direction, this book is a fantastic view of what the LHC did and why it did what it did.

Smashing Physics is a well-deserved contender for the Science Book award from the Royal Society’s Winton Prize for books on science. That alone is a good reason to buy and read this book.

https://theprintedword.wordpress.com/...

Davide Nole says

Jon, il caro Jon, spiega benissimo tutto quello cheha portato alla scoperta del bosone di Higgs. Per una volta, il fulcro è sul lavoro sperimentale, e non solo su quanto il povero Peter (Higgs) e gli altri teorici aspettassero questa scoperta.
Nel caso vogliate farvi un'idea di quanto lavoro ci sia voluto, questo libro è probabilmente il migliore sussidio. Non sono chiaramente necessarie conoscenze pregresse in nessun campo scientifico.

Petr says

A particle physics walk-through for wide range of interested readers. I could not follow some of the parts as I am just a layman in physics but nevertheless I was able to enjoy the story of finding Higgs boson.

Norjak says

A good overview of the events, people and experiments in the LHC for demonstrating the existence of the Higgs field/boson. If you are not as familiar with the associated quantum mechanics, I would suggest a read through over a listen on audio-book - the small divestitures into the physics typically required more attention/concentration to grasp the concept than my usual audio books. I expect it would have been more useful to see the equations and interactions in print.

Shreya says

(not the kindle edition)
this book was something i really treasured when i was certain i wanted to study physics. even after having changed my mind, upon reflection, it revived in me a desperate sort of curiosity about the universe.

Andrei Scurei says

It's a great book that combines a lot of theory with short stories about the author's life experiences, some quite funny and entertaining. This probably helps you go through the drier sections. I admit I often got lost and confused just in the number of particle types mentioned and used, and it becomes a bit hard to follow especially in an audiobook. Still, I wouldn't change this, I liked the fact that the book is a bit of a mind stretch. It also covers a lot of aspects about working in a team, in a corporation or in a research lab, and things like politics and government spending on science. But it's mostly light-hearted so it's a very pleasant, educative book.

Rebekah says

The discovery of the laws that describe what is going on inside atoms has been one of science's greatest triumphs. It was achieved with remarkable speed, subatomic science having begun little more than a century ago as an academic backwater and developed into a quintessential example of "big science".

The first subatomic particle, the electron, was discovered by the Cambridge physicist JJ Thomson in 1897 using desktop apparatus that cost only a few thousand pounds at today's prices. Few people in the outside world knew what he had done, and still fewer cared. It was a very different story in July 2012, when scientists at the Cern laboratory in Switzerland announced their discovery of the latest subatomic particle to show its face, a so-called "Higgs boson" or "Higgs particle", named after the Edinburgh University theoretician Peter Higgs. The total cost this time was a few billion pounds.

This was good value, as Jon Butterworth implicitly argues in Smashing Physics, a delightful account of his life as a Cern experimentalist, based at University College London. He explains why he and his colleagues are so curious about the subatomic world, and gives a vivid glimpse of life on a huge international project in modern experimental particle physics. In the course of the book, we accompany him to Cern, to quite a few meetings, to an interview with John Humphrys and to conferences all over the world.

Butterworth begins with a brisk account of the standard model, which describes the fundamental interactions that govern the inner workings of atoms, though not gravity (the effects of which are negligible on the atomic scale). The Higgs particle was the model's only missing piece for a long time, and it was crucial to know whether it existed as it was expected to be a clear manifestation of the mechanism that explains why some fundamental particles have mass and are not as insubstantial as light. The theoreticians made several predictions about the Higgs and its behaviour, but its own mass was a mystery, making life exceptionally difficult for the experimenters trying to hunt it down.

To find the Higgs – or to rule out its existence – was one of the aims of the Large Hadron Collider, a huge machine that accelerates protons (sub-nuclear particles) to within a squillionth of the speed of light before smashing them together (hence the book's title). If the particle existed, it should have quickly fallen apart into other particles in ways that experimenters could study. This is much easier said than done: as Butterworth explains, it was always going to be extremely difficult to pin down the particle, as the evidence was expected to be largely – but not completely – obscured by huge numbers of tracks due to other subatomic processes. Several months after the collider was switched on, there was no clear sign of the particle, leading some theoreticians to get cold feet and even to doubt its existence.

Butterworth tells the story of how the particle was eventually tracked down, making clear the extent of the challenge. He is an engaging guide, generous to all his colleagues, especially in the media – "We should be more forgiving of some of the excitable headlines" – but is sometimes a tad harsh on theoreticians. "Experimentalists get ignored if they are right … and hugely cited if they are wrong," he writes, whereas "Theorists are ignored if they are wrong, but get a Nobel prize if they are right." In my experience, theorists soon find themselves on the scrapheap if they are trivial, let alone wrong.

It is hard to come up with truly innovative ideas that are not ruled out by combining the two great underpinning theories of relativity and quantum mechanics, and by the experimental data that support them. Yet it is plain that the standard model will not be the last word on subatomic physics – we need a better-understood, more comprehensive theory that can describe all the fundamental forces, including gravity. The only viable candidate for this is string theory, which has huge potential but "struggles to predict anything remotely measurable", as Butterworth puts it. He is one of many who disparage the theory, though I suspect he and his fellow sceptics will be proved wrong in the long term and that physicists will one day reap the benefits of the work now being done on string theory, even if it is superseded by another approach.

Like all good experimenters, Butterworth keeps his feet firmly on the ground. He was a "confirmed Higgs sceptic" until the closing weeks of 2011, but, after seeing a new display of data a few weeks later, he changed his mind – "I knew in my guts we had it." It is fascinating to read how the particle's existence was eventually demonstrated using a tiny proportion of telltale tracks in the detectors. Butterworth describes the problems he and his colleagues encountered as they repeatedly checked their analyses to avoid any possibility of career-ending mistakes. Only when the discovery of a new particle was beyond reasonable doubt did the Cern authorities announce it, triggering worldwide media "Higgsteria".

The discovery led to the sharing of last year's Nobel prize for physics by Higgs and his fellow pioneer François Englert. They certainly deserved it, but, as Butterworth says, it is a pity that the experimenters who actually proved the theoreticians were right have not yet had a share of the Nobel glory. I, for one, hope that the experimentalists – or, at least, Cern – will be rewarded with Nobel honours after they have made another exciting discovery, preferably one that the theoreticians did not expect. Theoreticians have been calling the tune in particle physics for too long.

In a bravura passage towards the end of his book, Butterworth extols the virtues of this kind of research and bewails the attempts by some bureaucrats to guess its impact on society in advance. The point of doing fundamental particle physics is – like great art – not specifically to improve our material wellbeing, but to enrich our understanding and appreciation of our place in the world. The spinoffs – including Cern's invention of the world wide web (Tim Berners-Lee was a scientist there) – are a bonus. All in all, it is plain that the UK gets excellent value from its support of this basic science, at an annual cost to each of us of a fancy cappuccino.

When reading Smashing Physics, I found myself reflecting on how much the world of subatomic physics has

changed since its earliest days. Butterworth shows that the conventional image of experimenters working alone in a laboratory has long been superseded by huge international teams, in which individuals struggle to make their mark. Butterworth himself comes across as both a team player and a gifted individual, capable of doing first-class research; he is also a first-rate populariser. This rare talent is handsomely on display in this charming, enlightening bulletin from one of the most exciting fields of human endeavour.

M. Azhaari Shah Sulaiman says

The inside of story of the hunt for the Higgs boson by the hundreds of Physicians working in Large Hadron Collider for the sole mission of making one of the most eminent scientific breakthrough of the 21 century, the Higgs boson or the Higgs particle. A particle much much smaller than that of an electron and how it will change the world as we know of today.

Despite all the scientifical jargons and technical terms, the writer is quite good at humor. Making this writing less boring, less exhausting, less hectic journey.
