Sun in a Bottle: The Strange History of Fusion and the Science of Wishful Thinking

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When weapons builders detonated the first hydrogen bomb in 1952, they tapped into the vastest source of energy in our solar system--the very same phenomenon that makes the sun shine. Nuclear fusion was a virtually unlimited source of power that became the center of a tragic and comic quest that has left scores of scientists battered and disgraced. For the past half-century, governments and research teams have tried to bottle the sun with lasers, magnets, sound waves, particle beams, and chunks of meta. (The latest venture, a giant, multi-billion-dollar, international fusion project called ITER, is just now getting underway.) Again and again, they have failed, disgracing generations of scientists. Throughout this fascinating journey Charles Seife introduces us to the daring geniuses, villains, and victims of fusion science: the brilliant and tortured Andrei Sakharov; the monomaniacal and Strangelovean Edward Teller; Ronald Richter, the secretive physicist whose lies embarrassed an entire country; and Stanley Pons and Martin Fleischmann, the two chemists behind the greatest scientific fiasco of the past hundred years. *Sun in a Bottle* is the first major book to trace the story of fusion from its beginnings into the 21st century, of how scientists have gotten burned by trying to harness the power of the sun.

Sun in a Bottle: The Strange History of Fusion and the Science of Wishful Thinking Details

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From Reader Review Sun in a Bottle: The Strange History of Fusion and the Science of Wishful Thinking for online ebook

Andres L says

"Sun in a Bottle", by Charles Seife, is a great expository book. Throughout the book are stories after stories of how people tried to unleash the power of the sun on planet earth. It started with the Manhattan project. Oppenheimer was in charge of the operation. However, the atomic bomb was not enough for Edward Teller. He did everything he could to build a fusion device, to build the H-Bomb. That's when it all started. Teller was obsessed with harnessing the power of fusion. He saw nuclear fusion as the answer to just about anything. Later on, several different scientist attempt to create fusion for different reasons. One of the main ones is an alternative energy source. Scientist attempt different methods from lasers to magnets. All through history, people lie, cheat, and deceive others to try to accomplish fusion. I truly enjoyed this book. It is very thorough. Throughout the book are diagrams to help understand just how things work. Bundles of information are packed into an understandable piece of text. I truly enjoyed this book. I would relate to Oppenheimer. He understood lots of things. One of the quotes from the book was "why, Oppenheimer knows about everything. He can talk to you about anything you bring up. Well, not exactly, I guess there are a few things he doesn't know about. He doesn't know anything about sports." That is similar to me. (Besides the knowing everything part). I can talk about anything academically. However, if you mention sports, I don't understand most of it. However, Oppenheimer did eventually start to get a little weird. But then again, lots of scientist did. I truly enjoyed this book. I wouldn't change a single thing. It was great. It definitely deserved five stars. I recommend this to any science lover. They will love this book. I know I did.

Ann says

There are plenty of books about the discovery of radioactivity, the Manhattan project, the atomic bomb and nuclear fission in general. This book focuses on fission's lesser-known cousin, nuclear fusion, the process that generates the energy we receive from the sun and other stars. The red thread through this book is the belief that lab- or reactor-generated fusion could be a cheap and reliable source of energy, a clean alternative to the dangers of the classic nuclear reactors. As the author shows, this belief has repeatedly been shown to be erroneous, or at least hugely optimistic. He is particularly interested in the two or three times that scientists announced they had achieved fusion by experiments that other scientists then showed were wrong (think of the Pons and Fleischman Cold Fusion debacle in the late eighties). He also does a good job of describing the congressional and international politics involved in the decisions to build or not build the increasingly complex and expensive reactors that the "believers" wanted to build. I thought that the science itself was a bit summarily treated. The illustrations were okay, nothing special. The diagrams of various experiments and reactions could have been clearer. Still, overall this was an enjoyable book for those what ever became of nuclear fusion.

Pete says

Sun in a Bottle (2008) by Charles Seife looks at the history of fusion research. Seife starts with a look at nuclear weapons and leads into the development of various attempts to generate power with fusion.

The book looks at how Stellarators and then Tokomaks and various other devices have attempted to achieve

fusion. Seife also gives considerable coverage to claims of fusion that have been shown to be false. First the claims of Richter in Argentina, then Cold Fusion and then bubble fusion. Seife was a reporter for science when the bubble fusion claims broke.

Finally ITER's slow progress is described and Seife ends oddly with a conclusion that self-deception is a major part of fusion research. It's not a strong ending. Sun in a Bottle isn't a bad book, but the book A Piece of the Sun is definitely a better history of fusion. However, there is still a lot of interesting information about fusion research in the book.

Ushan says

The world's first fission bomb (Trinity) was exploded in 1945, and the world's first fission power plant (in Obninsk, Russia) was connected to the grid in 1954, 9 years later. The world's first fusion bomb (Ivy Mike) was exploded in 1952. We'll be lucky if the fusion power plants are connected to the grid in 2052, 100 years later. The difference is so large because a fission power plant has solid fuel rods and either solid or liquid moderator, and the fuel in a fusion power plant is plasma, and it took decades to understand how difficult it is to make plasma stable. In Cory Hall at UC Berkeley in the 1990s there was an exhibit made by a graduate student of plasma physics: a plastic aquarium holding alcohol and glycerin colored with different dyes, and a little knob-regulated electric motor shaking it. When the shaking speed was small, the boundary between the two liquids was well-defined, but when it increased, the boundary became a mess. For decades, scientists have said that practical fusion is 20 years away, but this has been a moving target, Seife says because of wishful thinking. A fusion power plant would be inherently safe from Chernobyl-type disasters; it would produce a lot less radioactive waste than a fission power plant; peak deuterium would never come, unlike peak uranium. ITER (which is pronounced "eater") is supposed to be finished in 2018, but such projects often go over budget and over the deadline. When I thought about it, I realized that even if a fusion device produces less energy than what was put into it, you can put uranium and plutonium around it and use it as a neutron source for a a subcritical fission reactor, and have some of the advantages of a pure fusion power plant. An Internet search showed that this idea was not original, and in fact such experiments are planned for ITER.

Joe says

This book is just about the perfect thing to read for a quick, easy explanation and history of fusion and its role in society.

The book starts off talking about the politics and development of nuclear weapons. This section, like most parts of the book, doesn't go very deep into the subject -- but then again, a full treatment has been the subject of other (very good) books. The next chapter talks about the physics of fusion reactions and weapons. I think it does a great job of balancing out a real description of what's happening with a directness that keeps it simple to understand.

The book moves into describing some of the politics of nuclear weapons. Again, it's a good overview -- a full treatment could more than cover a thick book of its own. It also describes some of the bizarre proposed peaceful uses of nuclear weapons, such as weather control. This chapter also transitions into the heart of the matter of this book: fusion power.

The first chapter of fusion power involves efforts in the 50's to create true high-temperature controlled

thermonuclear reactions. The book describes the difficulties that the first researchers encountered, and the difficulties of determining exactly how successful they were: whether they achieved a true fusion reaction, or whether some other phenomenon was only giving that appearance. The following chapter describes later attempts at achieving break-even fusion power: a reaction that delivers back as much power as it took to start.

After talking about high-temperature fusion reactions, the book describes the history of cold fusion attempts. I remember cold fusion announcements and later realization, but this book helped fill out the picture of what was really attempted, and how it came to be so public.

This book is a pretty compelling combination of physics, politics, and history. If there's any part of the discussed topics that interests you, you can find a book that covers it in more depth, but I don't think you'll find a better one that ties all of the topics together.

Rayma Nilsson says

History combined with a teaching of fusion

Charles is very good at telling an historical story while at the same time explaining scientific concepts. Great read and I recommend it.

Luis Brudna says

Excelente livro sobre a história da busca pela fusão nuclear. A leitura é muito agradável. (ainda não está disponível em português)

Todd Martin says

‘Sun in a Bottle’ examines nuclear fusion – the process by which multiple atomic nuclei join together to form a single heavier nucleus and a release of energy, and the force that powers the sun. Scientists were first able to create a fusion reaction in the form of a hydrogen bomb in the 1950’s and ever since have been looking for a more beneficial use of the phenomenon as a source of clean energy. Charles Seife describes the history of these efforts, and as the subtitle alludes, their repeated and continuing failures.

Efforts to use fusion as an energy source have been going on for the past 50 years with billions having been spent on research. Along the way the path has been littered with the careers of physicists and chemists who have deluded themselves and others as to whether fusion (or it’s seedier pseudo-science counterpart … cold fusion) could be achieved. The obvious allure of cheap and abundant energy has kept the dream alive even if fusion is not as clean as one would like, or cheap, or easy. As Seife points out, the promise of fusion energy has always been 10 years in the future. There is no evidence that this time horizon is about to change.

The book is very well written and geared towards the general science reader and does not require any prior knowledge of physics. As a science writer, Seife knows how to keep the story interesting and informative at the same time. My only complaint of the book is that the illustrations are extremely crude. They look as though they were created by a child in PowerPoint using the ‘shapes’ tool and are often so primitive that they

confuse rather than illuminate the point the author is trying to convey.

Odette Knappers says

This book starts of a bit slow and hard to read - but hey it is about nuclear fusion so I was not expecting a easy read. I was not expecting to read so much about the atomic bombs at the start of this book, but it is logical - it is where the idea of nuclear fusion starts.

This book takes you through the history of the nuclear fusion research in a chronological way. I feel the book is not totally objective everywhere, closer to the end it gets clearer why. But I did not mind that a lot, I've read this to understand the scientific process of nuclear fusion better. I've achieved that goals, and I've learned a lot about the politics and egos involved.

This book shows you science is more than just that single breakthrough. It is about a lot more, and sometimes things go not according to plan. This book shows you that is all part of the process.

Victor says

I thought the book had an excellent start, but disagreed with the tone the book took toward the end, and especially its conclusions. The author seems to think believe that we somehow can't achieve reliable and useful fusion because of the hubris of many scientists that work on the problem. It's as if the human difficulties of politics, ego, etc are the main barrier rather than the monumental technical difficulties.

Mike says

Another really well-researched (fusion seems to be a pet interest of the author) and well-written book. I found it interesting that the Mr. Seife has migrated from being a science reporter to a journalism professor. He certainly is qualified both from his experiences as a reporter and the quality of his work.

One of the things I learned from this book is that we are still decades (or more) away from a viable method of using fusion as a power source.

Before reading it, I knew of fusion bombs (the "super" as it was referred to during and after The Manhattan Project), attempts to use magnetic fields and lasers to compress & confine plasmas for fusion, and, of course, the infamous "Cold Fusion" scandal.

What I didn't know was that there have been other attempts (some successful, some not) to create "table-top" fusion. In fact the earliest such attempt was by Philo Farnsworth (the same man that invented electronic television in 1927). He came up with an idea in the late '50s and actually created fusion with a fairly cheap and simple apparatus. As have several people (including at least two teenagers) that applied his basic concept.

And, there was a whole second family of failed table top fusion experiments that were initially promising, but proven to be unworkable.

It's a great read even if you know little about the history and science behind at A-bomb, the H-Bomb, or nuclear reactors. There is enough explanation of concepts and terms to help those who need it, without making those in-the-know annoyed.

A final "fun fact": Back when the rest of The Manhattan Project was working on the fission bomb, Edward Teller was mostly working on his concept of "The Super" of fusion bomb. In his office at Los Alamos, he would write down his blackboard each increasingly powerful device that he conceived along with its delivery method. The last entry on the board had "back yard" written next to it. It was so powerful that the human race would be wiped out no matter where it was set off.

Joshua says

In 1939, Hans Bethe submitted a scientific paper which revealed how the stars, and our sun, convert matter into vast amounts of energy, just as Einstein had theorized, by fusing light elements together. Ever since, the governments of the industrialized nations have spent billions of dollars in searching for a way to bring that energy to earth; the holy grail of generating virtually unlimited energy from cheap, abundant hydrogen. Except for the uncontrolled destructive power of the hydrogen bomb, that effort has been, to this point, a dismal failure. And yet, billions of dollars continue to be thrown into the black hole of fusion power generation; such is it's lure.

Charles Seife has written a concise, easy to read history of the efforts to achieve fusion power and of the current state of that quest. Seife is not a scientist. He is a science journalist with a long and impressive resume and this, I am convinced, is what makes "Sun in a Bottle" such an enjoyable book. He doesn't bog you down with dry science. He presents the subject in the best tradition of investigative journalism and with the literary skills to make it exciting and entertaining.

Bottom line: I enjoyed "Sun in a Bottle" so much that I had my library procure a copy of Seife's award winning book from 2000, "Zero: The Biography of a Dangerous Idea," which it did and which I am currently reading with great relish. What fun!

Adam says

'Sun in a Bottle' by Charles Seife is not just about the history of fusion-This book is about the lives of those affected by fusion & about the state of the world as fusion technology progressed throughout the years. This brutally honest account of the rise and decline of fusion research is gripping and educational, as Seife begins by explaining how fusion works as well as the early projects that prefaced the Fusion Age (such as the Manhattan Project and Project Plowshare, which was a plan to use atomics for 'peaceful' purposes). He then begins to tell stories of those involved in early fusion research, and how their lives took turns for the better (or worse). Finally, he finishes his book by discussing how science and research is perception-free despite the claims of researchers; in other words, how science frees scientists from what they 'want' to see and reveals the true face of nature.

I was surprised by this gem. I picked it up as a way to whittle the time away during bus rides and breaks, but I found myself poring over the novel a 3 or 4 in the morning! 'Sun in a Bottle' starts quickly, moves faster, and never lets you go. Ultimately, though, it is a sad account of the current state of fusion research, of tokamaks and high-powered lasers, of broken careers and lies and fringe science. A little depressing, true-

Nevertheless you must check this out!

Scott Margo says

Well written description of the problems with fusion power.

Ed Romano says

Charles Seife does a magnificent job recounting the marvels and failures of the quest for sustainable fusion, as it continues today. It's a story complete with characters forlorn, achieving the heights of fame and then falling from grace, like Pons and Fleischmann. But other than the personal stories, Seife is a master storyteller of things scientific and technical, giving masterful overviews of the instabilities in current platforms -- namely Inertial and Magnetic Confinement Fusion. Before the culmination into current ventures he lays the ground for the nuclear fusion process, describing in great textbook-worthy detail on how such events proceed.
As a former scientist in one such project, I was elated to see the story told so keenly.
