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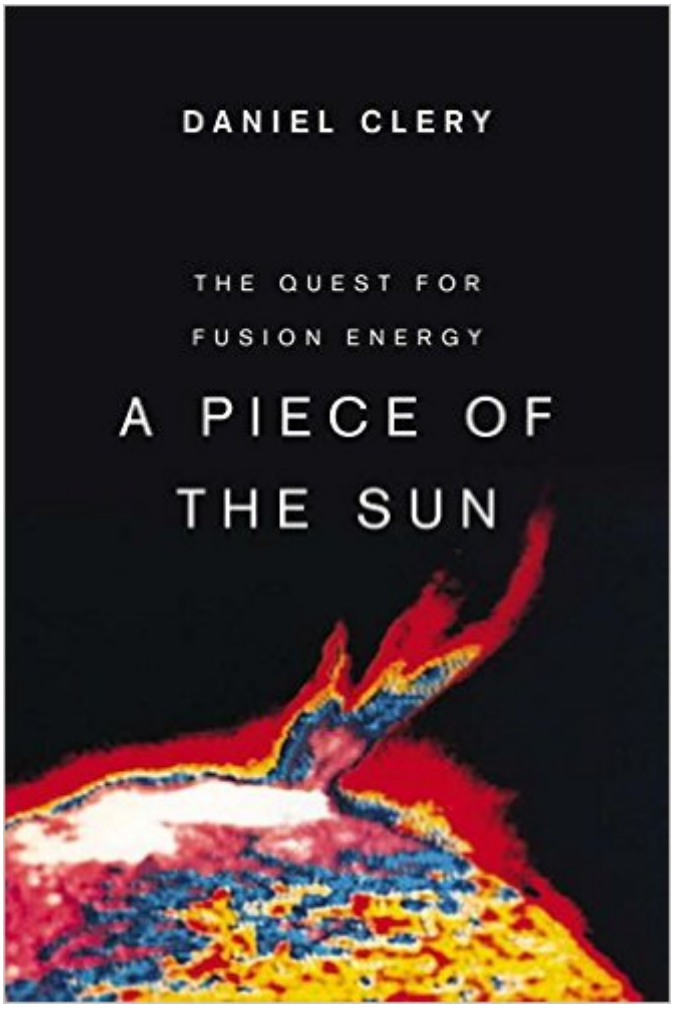
A Piece Of The Sun: The Quest For Fusion Energy



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Synopsis

Our rapidly industrializing world has an insatiable hunger for energy and conventional sources are struggling to meet demand. Oil is running out, coal is damaging our climate, many nations are abandoning nuclear, yet solar, wind, and water will never be a complete replacement. The solution, says Daniel Clery in this deeply researched and revelatory book, is to be found in the original energy source: the Sun itself. There, at its center, the fusion of 620 million tons of hydrogen every second generates an unfathomable amount of energy. By replicating even a tiny piece of the Sunâ ™s power on Earth, we can secure all the heat and energy we would ever need. Nuclear fusion scientists have pursued this simple yet extraordinary ambition for decades. Skeptics say it will never work but, as A Piece of the Sun makes clear, large-scale nuclear fusion is scientifically possibleâ •and has many advantages over other options. Fusion is clean, green and virtually limitless and Clery argues passionately and eloquently that the only thing keeping us from proving its worth is our politiciansâ ™ shortsightedness. The world energy industry is worth trillions of dollars, divert just a tiny fraction of that into researching fusion and we would soon know if it is workable. Timely and authoritative, A Piece of the Sun is a rousing call-to-arms to seize this chance of avoiding the looming energy crisis.

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Customer Reviews

Clery’s new book captures the "can-do" spirit of early fusion researchers and explains how we’ve come to construct the $20 billion international ITER experiment. His writing style is captivating,

clear, and at times "inspiring". Clery organizes his narrative into eight chapters and each chapter is a self-contained story relating fusion’s history, politics, and many technical issues.I noticed Clery took a few "liberties" with how the sequence of events evolved. There are a couple of places where the book could have better explained the scientific reasons behind program decisions and could have better explained the implications of scientific discoveries. Fusion scientist have accomplished a great deal of physics in 60 years of fusion research. If there is a weakness to "A Piece of the Sun" is that Clery did not explain fusion’s important scientific ideas as well as it related the history of big science politics and personalities along fusion’s road to bigger and bigger machines.The book is an exciting read, and I couldn’t put it down.Spoiler alert: Fusion’s story is still unfolding, and Clery’s final chapter ends abruptly with about as many questions left hanging as when he began with Chapter 1. No one knows today how fusion energy research will unfold. in a decade or so, Clery will need to write a sequel...Summary: A terrific and well written introduction to one of the world’s greatest scientific efforts.I highly recommend this to everyone interested in science, technology, and politics.Mike Mauel[...]

The curve of nuclear binding energy is very revealing: split a heavy nucleus into smaller ones (fission) and excess energy is produced; combine light nuclei together to make heavier ones (fusion) and excess energy is also produced. Controlled fission has been with us since the 1940s, however, controlled fusion still eludes us to this day. In this excellent book, the author recounts the tumultuous history of humanity’s quest for controlled nuclear fusion.In his narrative, the author details the many breakthroughs, the disappointing setbacks, the joy of discovery and the agony of defeat - and of course the many brilliant minds that have tackled so many seemingly intractable problems in this elusive quest. On the technical side, the basics of how fusion works are discussed clearly as are the nature and behaviour of plasma and how it can be confined. Over the more than six decades that work has progressed in this field, and billions of dollars later, there has been some progress - steady but slow. Funding is also shown to have played an essential role and how dependent it has been on the social/political/economical climates over the decades.I found this book to be lively, fast-paced, accessible, captivating and difficult to put down. The only less than positive comment that I have is that the book could have had a few more adequately detailed diagrams to illustrate the technical descriptions in the text. This book can be enjoyed by anyone, but science enthusiasts and those interested in the recent history of science and technology should be in for a treat.

XXXXX"We owe everything to [nuclear] fusion. Our own Sun and every star that shines in the night sky are powered by fusion. Without it, the Cosmos would be dark, cold, and lifeless. Fusion fills the Universe with light and heat, and allows life to happen on Earth and probably elsewhere. The Earth itself, the air we breathe, and the very stuff we are made of are the products of fusion."The above comes is the first paragraph of this informative book by Daniel Clery. He studied theoretical physics at York University in the UK. For more than two decades, Clery has edited and written for some of the world's top science magazines such as "New Scientist" and "Science." He has covered many of the biggest science news stories of our time.So, just what is nuclear fusion? The best way to answer this question is to compare nuclear fusion to nuclear fission (which is what occurs in the nuclear power plants of today). Nuclear fission occurs when a heavy atomic nucleus (such as that of the element Uranium) captures a neutron and then fragments into two lighter nuclei. Sustaining this process to other heavy nuclei, we are able to get a chain reaction which releases large amounts of energy.Nuclear fusion, on the other hand, occurs when light nuclei reduce their energy by combining to form a heavier nucleus. Before they are able to unite, the light nuclei must travel at high speeds (that is, they must have large energies) in order to overcome the repulsion between their like charges. There is a net release of energy during the nuclear fusion process only when a dense mass of light nuclei is maintained at a very high temperature. The nuclei then acquire high speeds because of their thermal energy and consequently potentially enormous amounts of energy are released.Nuclear power is a possible solution to the world's energy crisis, but at present we are able to control chain reactions in a nuclear fission process but there are a few problems, two of the main ones being thermal pollution and disposal of radioactive wastes.One of the most promising energy sources of the future is a controlled nuclear fusion process. Why? Because its fuel in raw form (namely hydrogen or its isotopes) is abundant. An added bonus is that there is no radioactive wastes.So, what's the problem? The biggest problem is that we are unable to maintain the light nuclei at the extremely high temperatures (that is, temperatures ten times those in the core of the Sun) that are required to sustain nuclear fusion. But we can try.This is where this book comes in. It covers quite thoroughly the excitement and numerous frustrations (such as technical challenges, politics, funding, etc.) of the quest for fusion energy, a quest that has been going on for the last seven decades.This book concentrates on nuclear fusion reactor design and we get a glimpse at how this design has changed or been modified throughout the years. The science and history of fusion research is also well-presented.There are 25 black and white illustrations peppered throughout, some are pictures and some are schematics.Finally, I had a few problems with this book:(1) There are numerous abbreviations in this book that are only spelled out once in the main

narrative. If you forget what one abbreviation stands for, I guess you're supposed to find the one time it was spelled out. This can be quite tedious and frustrating. I think it would have been beneficial to have these abbreviations listed and spelled out on a separate page perhaps at the end of the book so that the reader could easily refer to it when necessary.(2) There are certain scientific terms and reactor design terms that are explained only once in the main narrative. As in the above problem, if you forget what a certain term means, you have to hunt for its definition. Thus a glossary would have been most helpful.(3) I think more illustrations especially in the form of schematics would have aided this book considerably.In conclusion, this book beautifully captures the excitement and frustrations of the quest for fusion energy. I leave you with the author's answer to the question: "What would a world powered by fusion be like?" Here is his answer:"There will be no more mining for coal or digging up tar sands; no more pipelines scything across wildernesses; and no more oil tankers or oil spills. The geopolitics of energy--with all the accompanying corruption, coups, and wars of access--will disappear. Countries with booming economic growth...will no longer have to resort to helter-skelter building of coal-fired and nuclear power stations...Fusion power...won't damage the climate, it won't pollute, and it won't run out."(first published 2013; 8 chapters; main narrative 305 pages; further reading, acknowledgements; index)XXXXX

Clery has provided an excellent synthesis of the history of controlled fusion research, reviewing the most important milestones. It helps the reader to understand the hurdles found on the road to the design of a fusion reactor, and gives an updated account of the problem, without going into the technical details. I also found some of his "behind the scene" anecdotes quite amusing.

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