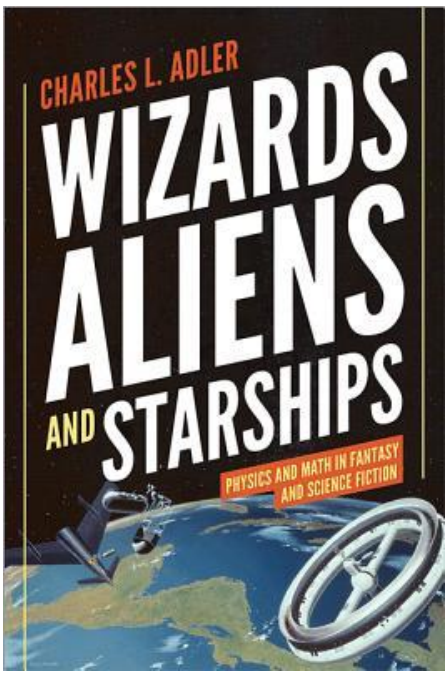

Wizards, Aliens, and Starships: Physics and Math in Fantasy and Science Fiction

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Wizards, Aliens, and Starships: Physics and Math in Fantasy and Science Fiction Charles L. Adler From teleportation and space elevators to alien contact and interstellar travel, science fiction and fantasy writers have come up with some brilliant and innovative ideas. Yet how plausible are these ideas--for instance, could Mr. Weasley's flying car in the Harry Potter books really exist? Which concepts might actually happen, and which ones wouldn't work at all? *Wizards, Aliens, and Starships* delves into the most extraordinary details in science fiction and fantasy--such as time warps, shape changing, rocket launches, and illumination by floating candle--and shows readers the physics and math behind the phenomena.

With simple mathematical models, and in most cases using no more than high school algebra, Charles Adler ranges across a plethora of remarkable imaginings, from the works of Ursula K. Le Guin to Star Trek and Avatar, to explore what might become reality. Adler explains why fantasy in the Harry Potter and Dresden Files novels cannot adhere strictly to scientific laws, and when magic might make scientific sense in the muggle world. He examines space travel and wonders why it isn't cheaper and more common today. Adler also discusses exoplanets and how the search for alien life has shifted from radio communications to space-based telescopes. He concludes by investigating the future survival of humanity and other intelligent races. Throughout, he cites an abundance of science fiction and fantasy authors, and includes concise descriptions of stories as well as an appendix on Newton's laws of motion.

Wizards, Aliens, and Starships will speak to anyone wanting to know about the correct--and incorrect--science of science fiction and fantasy.

Wizards, Aliens, and Starships: Physics and Math in Fantasy and Science Fiction Details

Date	:	Published February 2nd 2014 by Princeton University Press (first published January 1st 2014)
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From Reader Review Wizards, Aliens, and Starships: Physics and Math in Fantasy and Science Fiction for online ebook

R.Z. says

Author Charles Adler has given a great gift to all scifi writers by showing how recognized science can make a science fiction novel more intriguing. Adler begins by analyzing the Harry Potter novels and discussing the difference between fantastical magic fiction and science fiction. By doing this, he sets the case for why those scifi novels that make up their own fantasy science often fall short when compared to the novels that carefully draw upon known science to create their stories. Adler is a physicist who clearly enjoys science fiction, and takes it upon himself to present graphs, statistics, and formulas to demonstrate why some science fiction concepts work and others do not. He covers forms of space travel, space colonies, habitable planets, aliens, building worlds in unusual ways, and much more. While not written for the general reader, this book is invaluable for those who like to read or those who attempt to write science fiction. For those special people, this book is a keeper.

Miloš Petrik says

Everything you never thought to ask, answered.

Daniel says

When wormtail becomes a rat, why isn't he a 150 lb rat and huge. Such questions bother Mr. Adler and me. When we see magick in a book we like to have it an internally consistent science which doesn't violate certain physical laws such as the conservation of mass energy and motion.
After discussing magic, Mr Adler goes on to discuss Dyson spheres, ringworlds and interplanetary and interstellar flight. Bad news, using little more than high school level math and the rocket equation the author shows interplanetary travel to be very difficult and interstellar flight in any reasonable time to be almost impossible. This book was a lovely little foray into Newtonian physics, very enjoyable.

Kevin says

Whether it's the destruction of Hogwarts theory or nay saying Mars colonization possibility, this one will keep you hooked by either shining a light on impossibility you thought you caught or shattering your dreams of a brighter future.

Avarla says

First off, I didn't finish this one.
I once read that you statistically lose a lot (50% even?) of readers with every formula you use in a popular-science book. Whether it's true or not, it definitely worked with me in this one.

While the premise sounded interesting, it was just way too formula heavy to be enjoyable to me. I like to find out about concepts, not do the math myself.
Generally I still like the idea of explaining why the typical fantasy/sci-fi ideas don't work along physics very well, but I'd love to see it explained in a less technical way.

Sam says

A decent treatment of the science if science fiction.

Felicia says

Ok so this is a DENSE BOOK GUYS. Very VERY well researched and supported by science, sometimes a bit too much, but nonetheless, a really fun perspective on the actual plausibility of the worlds and rules in the sci-fi and fantasy literature that we love so much. Only thing: He dogged on Harry Potter rules a BIT much for me, but hey, he does have a lot of points, lol.

Definitely eye opening, but not a light read. Take your time and you'll learn a lot of science, and approach your genre literature and media with more educated eyes!

Scarlett Pulsipher says

I really enjoyed this read, although I should caution anyone that picked this up because of the fantasy/scifi factor that Adler does stray pretty far from that at times. Obviously this is a science/math book, not a fictional story, but for the average bear (like myself) some of the concepts were difficult to follow and in places I had to reread certain passages multiple times before I understood what the author was saying.

But overall I really enjoyed myself, and I came out knowing far more than I did going in.

(Although Adler does seem to be afraid of being attacked by Star Trek fans for some reason??)

Sookie says

I was pleasantly surprised how Adler didn't bow down to the expectations of over simplification and glossing over complex theories with a thin analogy. It **does** require college entrance level understanding of physics and calculus for maximum understanding and enjoyment.

It was a delight to read the science fiction aspects of it. Could have been better without Harry Potter and other fantasy elements. All in all, a great read.

Bojan Tunguz says

Science fiction is one of my favorite genres, and I have pretty much grown up on a steady diet of reading about spaceships, robots, aliens, stars, and planets. In that regard I am probably very similar to most of my fellow Physicists, but by and large I had never actually set down and used any of my actual Physics knowledge in order to figure out how feasible are some of the traditional sci-fi themes. Fortunately, in this fascinating and extraordinarily well-presented book Charles Adler has gone to the trouble of exploring the Physics behind science fiction, and the result is a very intriguing and insightful book that would appeal to all die-hard sci-fi fans.

In order to get the most out of this book you should be at least comfortable with the kind of Physics that is usually taught at college freshmen level. There are a lot of equations throughout the book, and even though you won't see any calculus or really long calculations, you should be comfortable enough with Physics equations in general in order to appreciate this material.

The book primarily focuses on science fiction literature, and a few science fiction writers in particular. Even though many of us (myself included) primarily consume science fiction in the form of movies, hardly any specific movies are ever mentioned. For the most part this works out fine, since the kind of general themes discussed here are equally applicable to both the movie and books. However, I really would have appreciated more of the references to such a staple movies as Star Wars and E.T. for instance.

The book takes a hard look at many of the most popular themes in science fiction – space travel, aliens, space colonies, tame travel, etc. – and presents a rigorous account of how feasible those themes are based on our best knowledge of the physical laws. Unfortunately, many of the more common sci-fi themes turn out to be if not quite impossible, then either unlikely or unfeasible. This is bound to put a damper on many science fiction fans' expectation of what the future might bring in these domains (at least this is the effect it partially had on me), but at least it made me appreciate all the fantastical technological challenges that need to be overcome if we are going to have even a fraction of the fantastic gadgets that generations of the science fiction writers have been promising us.

I was less than enthusiastic about the part of the book that deals with fantasy. Granted, I am not the biggest fan of fantasy to begin with, but I do enjoy a well-written fantasy movie or a novel every once in a while. However, in fantasy writing, unlike science fiction, there is not even the pretense of trying to be constrained by the laws of nature. This going through the trouble of showing why so many of the fantasy themes are impossible in the real world, while intellectually entertaining, feels rather futile.

I would particularly recommend this book to any aspiring, or even established, science fiction writers. It can be used as a quick reference for all the main physics-related issues and themes that constantly pop up within the sci-fi genera.

There are a few other themes that constantly pop up in science fiction, but are either mentioned only in passing and in the broadest terms in this book, or not at all. These include advanced robots, artificial intelligence, advanced weapons (lightsaber!), cyberspace, cloning, extinct advanced ancient civilizations, etc. As the central theme of this book was physics in sci fi, it's understandable why these other themes would not be covered. It would be great if some experts in those other fields offered their insights in another book similar to this one. Or if a group of authors joined forces and composed a reference work of sorts that would include all of these themes in a single volume. Thanks to the self-publishing revolution there has been an explosion of new writers writing science fiction for the first time, and a book like that one could greatly help them get a single resource where they could all the main scientific and technological facts necessary for writing believable stories.

Brian Clegg says

Subtitled ‘physics and maths in fantasy and science fiction’, this is one for the hardcore science fan. In fact the best reader may well be a scientist who likes a bit of science fiction and wants to play around with how likely all the science in the stories really is.

Strangely, the most readable part is the first section, where Charles Adler deals with the goings on of fantasy, rather than science fiction. I think this is because we don’t really expect the science to work in fantasy, and we can enjoy laughing at distortion of the conservation of energy, or the second law of thermodynamics, and thinking about the physics of dragons. But when the book starts to pull apart basics like space travel, it feels like something of a betrayal.

Once we got onto science fiction, Adler shows us that practically every major theme of space-based science fiction from the basics of space travel being possible to constructing vast space stations and ring worlds and the like is all extremely unlikely because of problems with energy and many other aspects of physics. It’s frankly a bit depressing, but I could cope with it, were not that the style gets considerably more hardcore than it was in the fantasy section. In the science fiction parts we have far more pages of calculation with relatively little and relatively impenetrable explanation.

This can make the book decidedly opaque to the non-technical reader. Take, for instance, the section describing the trajectory of an apple thrown inside a spaceship that is being rotated to produce artificial gravity. Adler points out the way that the Coriolis effect will result in strange movements. But the whole description, complete with completely unnecessary equations and diagrams which explain nothing is difficult to follow and lacks any feel for the reader’s response. It is far more like a simplified textbook than anything else. This is disappointing, as it wasn’t the case with the early sections.

In the end, I didn’t enjoy the book as I much as I thought I would initially. There are two reasons. One is the old W. B. Yeats favourite ‘Tread softly because you tread on my dreams.’ For many science fiction and fantasy fans (even quite a few who became scientists), what is particularly wonderful about SF&F is that it is a matter of dreams. It takes us away from boring reality, and if it has to sacrifice a little accuracy in the way of a good story, so be it. Forget treading softly, here the dreams get the hobnail boot treatment. The other problem is that there is too much calculation and not enough explanation, as a result of which it all too often reads more like an exercises section in a textbook, rather than a popular science book.

Don’t get me wrong – this is an interesting, well-written book, and Adler has put a lot of work into it. It should be invaluable for anyone wanting to write really accurate science fiction. But it isn’t as much fun as I expected it to be.

Charles Daney says

Although the title suggests it's about science fiction and fantasy in general, the book's main value is probably in its treatment of interplanetary space travel, "terraforming", and similar relatively near-term topics – as well as its approach to dealing with such questions. These themes, of course, have made up a very large portion of science fiction, especially in the first half of the twentieth century. Many other large themes of science fiction, such as time travel, FTL (faster-than-light) space propulsion, teleportation, advanced alien civilizations, etc. are also covered. However these latter themes are much more speculative, and often rendered implausible on good physical and mathematical grounds.

As far as fantasy themes (such as Harry Potter's world) are concerned, they're not extensively treated –

deservedly so, as fantasy almost by definition has aspects that deliberately transcend scientific explanation. But even in this case, there are excellent explanations using basic physics to explain (as the title of one chapter says) "Why Hogwarts Is So Dark". Fundamental physical laws, such as conservation of mass-energy and momentum, are also introduced.

The general approach of the book is to treat each scientific/engineering topic as a "Fermi question" – that is, considering the question by making a clever rough estimate using plausible assumptions of the general magnitude of various numerical or physical quantities. For (a non-science-fictional) example, "How many piano tuners work in Chicago?"

The book's author, Charles L. Adler, is a college professor of physics, and he does a fine job of applying a wide variety of physical laws to the various engineering and scientific issues raised in most science fiction stories. Readers who have a background in physics will find the technical details both interesting and easily understandable. Non-technical readers will just have to take the results on faith. Hint: there are *many* formulas and equations. But the mathematics is mostly quite elementary. Although I haven't carefully checked most formulas and calculations, there don't seem to be any important flubs.

Many science fiction authors aren't trained scientists. Even so they may be quite well aware that such things as FTL travel, teleportation, and time travel are beyond any known science, yet these are often used for the sake of the story. Adler notes that some well-known SF writers, including Isaac Asimov, Larry Niven, and Gregory Benford do have training in science or math. This short list could also include prominent authors like Rudy Rucker, Vernor Vinge, and David Brin, all of whom have science and/or math PhDs. Adler reports that "back in the 1970s and 80s" he "read a lot of science fiction". It appears he may be less familiar with more recent SF. For instance, Kim Stanley Robinson's Red Mars deals with the terraforming of Mars, but that excellent novel isn't noted in the present book. The names of two more recent SF authors (Greg Egan and Bruce Sterling) are also slightly garbled (in the same paragraph!). There are a few other glitches that a good copy editor should have caught. These include confusion between the words "immeasurable" and "unmeasurable", a few incorrect chapter or bibliography references, and a few other very minor problems.

On the whole, however, the text seems pretty error-free, and the exposition is very good. Among the dozens of topics covered, two related to relatively near-future concerns are especially interesting. The first of these is the difficulty of transporting humans to Mars, landing on the planet, and returning successfully. The big problem here is the efficiency and fuel requirements of chemical rockets – the only form of interplanetary propulsion likely to be feasible for carrying humans to Mars in the next several decades. A fairly simple equation, the "rocket equation", is explained. It demonstrates that the serious hang-up is the rather large amount of fuel that has to be carried in proportion to payload. And on top of that, the need to minimize fuel:payload ratio dictates following trajectories between Earth and Mars that are considerably longer in duration than a direct beeline flight would entail. And that in turns means additional weight, from having to carry more food and radiation shielding for the human passengers. This is the basic reason the first possible human trip to Mars keeps receding in in time. The rocket equation implies that technological improvements in chemical rocket technology can do very little to make the trip to Mars much faster, easier, or sooner.

The second very interesting relatively near-term topic is terraforming. What that means, simply, is making a planet (Mars in particular) more like Earth so that it's much better suited for human habitation. The main problem with Mars is its atmosphere's thinness and lack of oxygen. It's obviously necessary to have a lot more oxygen for humans to survive on the surface without space suits. Much more gaseous carbon dioxide is also needed to sustain a greenhouse effect (a good thing on Mars) so that the surface temperature – presently an average of about -55°C. – allows for liquid water and is much more comfortable for humans. An atmosphere that's a lot thicker would also provide much better shielding from cosmic rays. There's plenty of oxygen on Mars, but it's almost entirely locked up in rocks and frozen CO2 and water. There are various chemical processes to liberate the oxygen, but all require lots of energy. Photosynthesis (from green plants) does the job, though it's not very efficient. However, it is driven by the Sun, which provides energy for free,

but takes a long time – at least 300 years, perhaps much more. Sufficient energy from other sources (nuclear or thermonuclear, e. g.) is expensive, with a total cost of at least $300 trillion. (However, the cost of dealing with climate change on Earth by the end of the century is estimated to be in the range of 10 times as much.)

Dozens of other more "far-out" SF ideas are examined in the book. They include things like space colonies, interstellar travel, searching for signs of extraterrestrial life, and even building entire planets from scratch. The book can be highly recommended for all these scientific and technological topics, quite apart from their relevance to contemporary science fiction.

Dennis Robbins says

I read this book because I was attracted to the title. Precisely, it should be “The Mathematical Physics of Speculative Space Exploration”. To appreciate the narrative it requires more than a single year acquaintance with calculus-based physics. Nearly every other page has a formula so the audience for this style is limited. The “Wizards” portion is devoted to the physics of fantasy (Harry Potter novels) but is only 50 odd pages of 350 and so it seems like an add-on. The book is best when it discusses starship propulsion systems and contact with intelligent alien life. Fantasy and science fiction fans would want more details of their favorite novels, movies and television shows than the book offers. The book is relatively true to its subtitle. I could imagine this book in a course for physics major devoted to analyzing fantasy and science fiction genres.

Brian Greiner says

Overall, this is really good stuff for anyone who's ever wondered if the fantasy or SF story they've just read has any basis in reality.
The book covers VERY wide range of topics (but you probably guessed that from the title). In most sections I found myself hoping for just a bit more discussion, and taking notes on things to check out from stories I'd read.
Some of the real physics gets a bit hard to follow for the layperson, but the book is really quite readable overall. Yes, there are equations - that's the real appeal of the book - but he shows how to use math and physics to answer interesting questions. Sort of a 'gateway drug' to perhaps tease people into delving more deeply. The author is a university professor, after all.
So, if you are a SF or fantasy fan with a knowledge of high-school math and physics plus a yearning to learn about how real physics might apply to the fiction, you'll probably enjoy this book.

Maurizio Codogno says

Fantascienza dovrebbe significare "scienza su premesse fantastiche" ma in realtà oggi è un termine onnicomprensivo. Resta però un nucleo di persone che continua a fare fantascienza hard, cioè su serie premesse fisiche ancorché portate a conseguenze estreme, e parallelamente c'è chi si mette a questionare tali premesse dal punto di vista scientifico, come Adler fa in questo libro. In realtà la prima parte è una presa in giro della fantasy, mostrando come i principi di conservazione dell'energia rendono impossibile non solo far apparire e sparire cose, ma anche illuminare il salone di Hogwarts solo con le candele. Non che Adler si preoccupi della cosa: lui afferma di apprezzare la saga della Rowling senza dover necessariamente pensare alla scienza in ogni momento. La seconda parte del libro è invece legata alla fantascienza vera e propria, pur

con divagazioni come la sua infatuazione per il filosofo e scrittore degli anni '20 del secolo scorso Olaf Stapledon (che ammetto di non avere mai letto). Mi sono molto piaciuti i conti spammometrici fatti a ogni passo, perché danno davvero l'idea di cosa potrebbe essere davvero possibile prima o poi: un esempio è l'ascensore spaziale, che però con le tecnologie attuali è ancora improponibile. Mi è piaciuta meno la parte finale, quella "cosa succederà tra un googol di anni", soprattutto perché mi ha dato l'aria di non essere stata rivista e quindi presenta molte ripetizioni. Direi comunque che i curiosi apprezzeranno questo libro, anche perché è aggiornatissimo e permette di scoprire le teorie del ventunesimo secolo, che non si leggono poi così spesso.
