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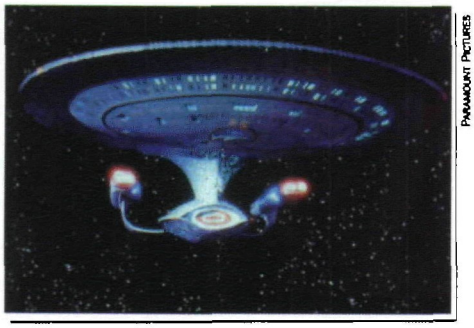
Learning physics from science fiction

Beyond Star Trek: Physics from Alien Invasions to the End of Time
Lawrence Krauss
1997 Basic Books 176pp $21.00



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Physics, but not as we know it – Starship Enterprise

Many science-fiction authors try to use ideas from the cutting edge of science before exploring the human and technological consequences of these ideas. It is, however, rarer to see an author go in the opposite direction – in other words, one who starts with popular ideas from science fiction, before tackling the relevant physics.

It may sound somewhat surprising that topics such as unidentified flying objects (UFOs) and extrasensory perception should have any relevant physics, but they do. And anyone who wants to evaluate such phenomena even remotely seriously will find that there is physics one needs to be aware of and understand – even if one expects to eventually dismiss the ideas. In his last book, *The Physics of Star Trek* (HarperPerennial 1996), Lawrence Krauss – a particle astrophysicist at the Case Western Reserve University in the US – explored topics from contemporary physics in the context of the science fiction series *Star Trek*. This sequel continues in the same vein, boldly going where no physics writer has gone before, to paraphrase the famous opening lines of the series.

"Newton's second law becomes interesting when you try to apply it to UFOs."

In addition to *Star Trek* itself, Krauss this time looks at the movies *Independence Day* and *Star Wars*, as well as the television series *The X Files*. (I should point out, however, that one does not need to have seen *Star Trek*, *Independence Day*, *Star Wars* or *The X Files* to enjoy the discussions.) There are also general references to other concepts that are familiar from science fiction and fantasy. For example, Krauss addresses the physics of interstellar travel, the frequency of extrasolar planets and the potential mechanisms behind extrasensory perception. He also looks at how the laws of physics would need to be obeyed even if time travel were permitted.

The easiest way to approach the physics of science fiction would be to find flaws in the science-fiction physics, and then explain the fallacies. Krauss has taken a more difficult road that is at least as interesting, still lots of fun and also serves a higher purpose. His technique is to bring up a specific science-fiction idea and then discuss the relevant physical principles. In this way the reader ends up understanding some solid physics. For example, anyone who wants to investigate the potential mechanisms by which extrasensory perception might be transmitted and received – assuming, for the moment, that it exists in some form – should first have a good working knowledge of electromagnetism.

Of course, there are plenty of good reasons why extrasensory perception is unlikely to be transmitted by classical electromagnetism. But before one can understand these reasons, one must first learn some basic electromagnetism, and extrasensory perception is at least an entertaining motivation to do so. Similarly, to understand the limitations of spaceships, one needs a grounding in Newtonian propulsion theory (and a few tidbits of general relativity). However, in the hands of the wrong teacher in a lecture hall, this topic could be a bit on the dry side. But delivered by Krauss, in the context of spaceships, it takes on a whole new attraction.

Another almost insidiously delivered lesson is in probability and statistics, which takes place while the author evaluates the likelihood of finding extrasolar intelligent life. Krauss introduces, describes and then critiques the Drake equation, which estimates the number of intelligent civilizations in the galaxy. This estimate is calculated as the number of stars in the galaxy, multiplied by the probability that such a system has an Earth-like planet, multiplied by the probability of the star being stable long enough for life to evolve, multiplied by the probability of life evolving into intelligence, and so on.

Of course, most of these probabilities are unknown, but the equation at least allows one to compartmentalize our ignorance. Krauss also points out that many of these probabilities are not independent, and should not therefore be merely multiplied. This leads into an intelligent, entertaining discussion on the distinction between absolute and conditional probabilities, and by the time the chapter is over, the reader has learned much more than originally bargained for.

While reading and thinking about popular ideas in current science fiction, such as UFOs and extrasensory perception, one can learn a lot of interesting and fundamental physics. To the average science-fiction fan, the physics of Newton's second law pales next to ideas like the particle–wave duality of quantum mechanics or the space–time-warping physics of general relativity. But Newton's second law suddenly becomes interesting when your try to apply it to UFOs that make instantaneous right-angle turns at supersonic speeds. Basic electromagnetism, meanwhile, becomes intriguing when applied to extrasensory perception messages transmitted from one person's brain to another.

Often the same person enjoys science fiction and science itself, since both can inspire the imagination in similar ways. Indeed, someone who is not (or not yet) a professional scientist may find that exploring one area enhances the exploration of the other. The ideal readers for this book will therefore be curious science-fiction fans and – to a slightly lesser extent – professional (or student) physicists who fancy a bit of science fiction. The book should also, I believe, be mandatory reading for science-fiction writers. Both physics novices and physics experts alike will find the physics discussions interesting and amusing. And experts in both physics and science fiction will find pleasingly little to quibble about, since the author obviously knows both subjects well.

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