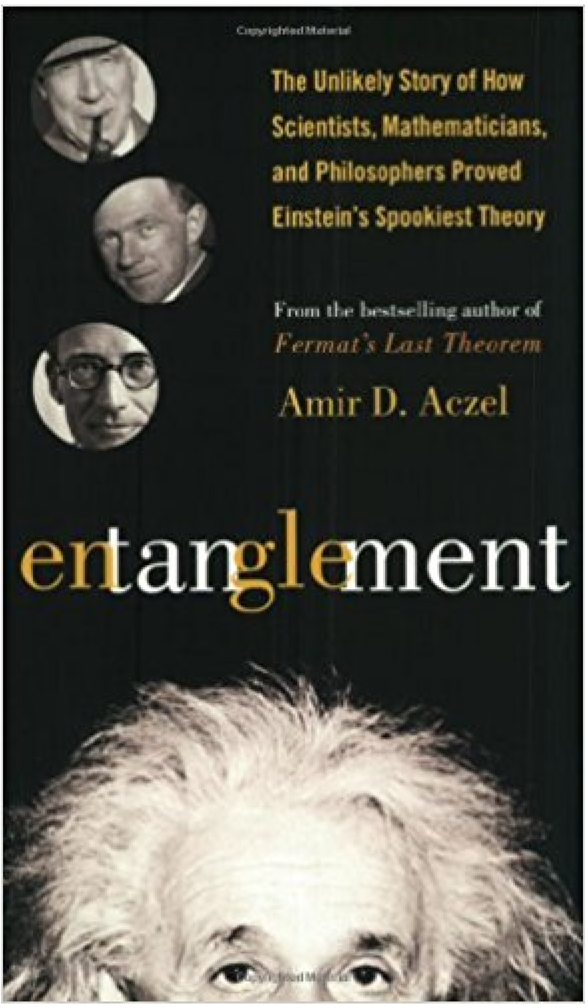
Entanglement



Synopsis

Can two particles become inextricably linked, so that a change in one is instantly reflected in its counterpart, even if a universe separates them?Â Albert Einstein’s work suggested it was possible, but it was too bizarre, and too contrary to how we then understood space and time, for him to prove.Â No one could.Â Until now. Entanglement tells the astounding story of the scientists who set out to complete Einstein’s work.Â With accesible language and a highly entertaining tone, Amir Aczel shows us a world where the improbableâ ”from unbreakable codes to teleportationâ ”becomes possible.

Book Information

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Customer Reviews

This is one of the best books I’ve read this year. It’s easy to read, highly informative, accurate and fun. Aczel has done a masterful job of combining a book on scientific history with an introductory tomb explaining one of the especially non-intuitive aspects of the quantum world - the entanglement of multiple quantum particles.Entanglement as a consequence of quantum mechanics was actually predicted by Einstein and used in a thought experiment to try and discredit the new theory. Einstein believed in strict determinism and considered quantum mechanics to be incomplete. He had a lifelong friendship and debate with Bohr, who was one of the founders of quantum theory. Einstein, along with Podolsky and Rosen developed a "thought experiment" in which the outcome was so weird - if quantum physics was correct - that it simply couldn’t be accepted (by Einstein, anyway). Einstein considered this weird outcome in quantum mechanics to essentially prove that it was incomplete.In Einstein’s thought experiment he imagined two entangled quantum particles whose quantum properties were dependent upon each other. For example, the particles could be photons produced by a reaction that starts out with zero spin. Since spin is conserved, and photons have integral spin, if one photon has spin +1 the other must have spin -1.Quantum mechanics says that, until the particles are measured, their spins are in a superposition of states, and when one photon's spin is measured, the other photon instantly assumes the opposite spin - no matter how far apart the two are. Indeed, before they are measured, quantum mechanics doesn't treat the two photons as distinctly different particles at all.

I should begin by saying that I was expecting (or hoping for) a different book, though perhaps from the other book by Aczel that I have read (Mystery of the Aleph), my expectations were probably misplaced. The book that I was hoping for would have been much more technical, though given the fact that only a handful of equations appeared in the book at all, this would not be difficult), and one that would explain what this entanglement thing is, or at least provide arguments for some of the prevailing theories.What this book did provide, though, was a brief account of the history of entanglement as a controversial physical concept. I first encountered entanglement while doing some studies in quantum computation, and my studies were on the computer science/mathematical side, which basically meant that entanglement was a given, and it never really occurred to me that there would have been much controversy --- in retrospect, this was quite naive of me. By going through the breakthroughs made by many physicists over the passed century, Aczel was able to bring light to the fact that while science textbooks state principles as undeniable truths, doing science and interpreting science are more akin to a somewhat political struggle. For this reason, there is much to commend this book.However, a great shortcomming is the length. The book is divided into 20 chapters with an average length of about 12 short pages. Most chapters have a two-fold purpose --- to introduce and give a brief biographical sketch (leaning more towards intellectual development) of someone involved in the history of entanglement, and also to explain briefly what that person did.

I found this book to be interesting, but not the easiest book that is devoted to the idea of quantum entanglement. I also have a problem with the subtitle, which I think is highly misleading. The spookiness referred to was not Einstein's idea, and the book is about how he was wrong in his objection to the spookiness inherent in others' interpretation of quantum mechanics, an interpretation that he did not believe in, but one that has stood the test of experimental verification. Since the publisher generally writes titles and subtitles I will try to ignore this misrepresentation.The first half of the book is concerned with background material covering the Thomas Young double slit experiment, the beginnings of quantum mechanics and Einstein's objection to the standard interpretation of the peculiarities of the double slit experiment performed on individual photons or electrons. This is a general treatment, with no mathematics, but one that I found a little more complex than that in Rosenblum and Kuttner's "The Quantum Enigma", and not as detailed as that given by John Gribben in "In Search of Schroodingers Cat". Among these books, I prefer the one in Gribbin's book the best, but for someone with no math or physics background at all I would recommend "the Quantum Enigma" for this sort of background material.The last half of Entanglement is concerned with Bell's Inequality, the idea of entangled quantum states and the experimental verification of Bell's ideas. I would recommend this book for someone who is specifically interested in this material. This book provides a very personal account, gained from interviews with the participants. It is quite interesting and shows the interactions between physicists and how they went about designing and performing their experiments.

Towards Solid-State Quantum Repeaters: Ultrafast, Coherent Optical Control and Spin-Photon Entanglement in Charged InAs Quantum Dots (Springer Theses) Entanglement (Polish State Prosecutor Szacki Investigates) Entanglement Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning The Quantum Handshake: Entanglement, Nonlocality and Transactions