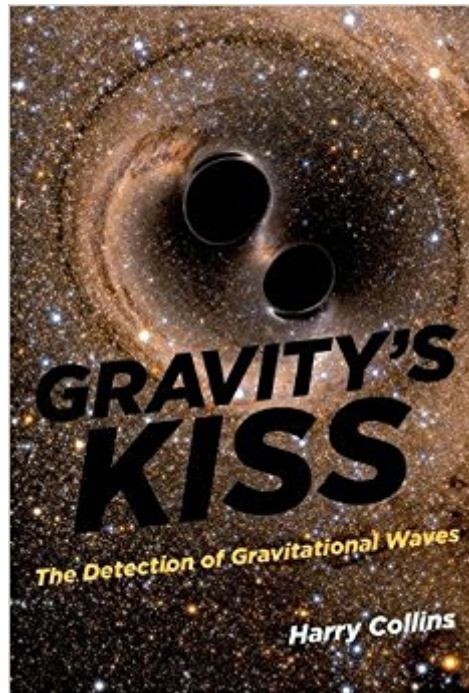




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# Gravity's Kiss: The Detection Of Gravitational Waves (MIT Press)



## Synopsis

Scientists have been trying to confirm the existence of gravitational waves for fifty years. Then, in September 2015, came a "very interesting event" (as the cautious subject line in a physicist's email read) that proved to be the first detection of gravitational waves. In *Gravity's Kiss*, Harry Collins -- who has been watching the science of gravitational wave detection for forty-three of those fifty years and has written three previous books about it -- offers a final, fascinating account, written in real time, of the unfolding of one of the most remarkable scientific discoveries ever made. Predicted by Einstein in his theory of general relativity, gravitational waves carry energy from the collision or explosion of stars. Dying binary stars, for example, rotate faster and faster around each other until they merge, emitting a burst of gravitational waves. It is only with the development of extraordinarily sensitive, highly sophisticated detectors that physicists can now confirm Einstein's prediction. This is the story that Collins tells. Collins, a sociologist of science who has been embedded in the gravitational wave community since 1972, traces the detection, the analysis, the confirmation, and the public presentation and the reception of the discovery -- from the first email to the final published paper and the response of professionals and the public. Collins shows that science today is collaborative, far-flung (with the physical location of the participants hardly mattering), and sometimes secretive, but still one of the few institutions that has integrity built into it.

## Book Information

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## Customer Reviews

The electrifying excitement of frontline science, in one of its great success moments, reported with wit, sincerity, and details. Thrilling like a spy story. (Carlo Rovelli, Professor of Physics, Aix-Marseille University; author of *Seven Brief Lessons on Physics* and *Reality Is Not What It Seems*) Harry Collins gives us an unprecedented look at how science is practiced in large collaborations and the inside view of a major discovery, the observation of gravity waves by the LIGO collaboration. It is a fascinating and readily understandable account yet with enough technical detail to satisfy a scientist. This is a great story and I strongly recommend this book to anyone interested in science and its practice. (Allan Franklin, Professor of Physics, University of Colorado; winner of the 2016 Pais Prize for History of Physics) Harry Collins queued for nearly half a century for his front-row seat at a theater nobody was sure existed. He was there on opening night, as the curtain went up to show us a new science. We sit there with him, this most enlightened guide, to witness this most extraordinary human achievement. (Peter Bernard Ladkin, Professor of Computer Networks and Distributed Systems, Bielefeld University)...a gripping day-by-day account of how it became almost universally accepted that gravitational waves had finally been detected. (Times Higher Education) It's both a topical must-read, and a future classic of the genre. (Sky at Night)

Harry Collins is Distinguished Research Professor of Sociology and Director of the Centre for the Study of Knowledge, Expertise, and Science at Cardiff University. He is the author of *Changing Order*, *Gravity's Shadow*, *Gravity's Ghost*, *Gravity's Ghost and Big Dog*, and other books. He is coauthor of *Bad Call: Technology's Attack on Referees and Umpires and How to Fix It* (MIT Press).

I happen to live close to the Livingston LIGO facility so was extra-interested when the news of the gravitational waves discovery broke. This book provides a fascinating account of how the story unfolded, from the moment the instruments picked up the signals to the final decision to publish and go public with the discovery. If you want to know more about the process, scientific and social, of validating a Big Science discovery, this fits the bill. The pages fly by.

Author Harry Collins, a distinguished sociologist of science, had the remarkable persistence to study for over forty years the various attempts to detect the existence of gravity waves predicted by Einstein. During that time, Collins became enmeshed in this research community and wrote multiple books on the search. This despite its continued failure to detect a gravity wave. But he hung on until an international cooperative of over 1,000 scientists succeeded in 2015. By that time, using the internet, Collins could follow the unfolding discovery, communicate with participants, and write this

latest book from the comfort of his sofa at home. It is a good story well told, giving an insider's view of the reasoning and argument among physicists trying to interpret their data and socially construct an epochal "discovery." What most interested me about this tale is the web of understanding that links people like Collins, who only marginally knows the physics, to those with core knowledge of gravity models, black holes, and interferometry. To bolster his own understanding, Collins turns repeatedly to physicist Peter Saulson, a faculty member at Syracuse University (as am I, though we have never met). Saulson's lucid explanatory emails appear throughout the book. Yet we see that even Saulson doesn't understand it all, so he seeks clarity from people elsewhere in the web. At the end of one chapter (p. 224), Collins emphasizes "all we [i.e., the physicists] have seen are a few numbers representing strains on some mirrors [i.e., interferometry data] and all that has been described [as a gravity wave] is a structure built on trust and a huge and intricate body of social agreements about what these must be taken to mean." That is, of course, the social web of understanding, within which no person knows everything. Remarkably, we trust these scientific webs unless they conflict with our strongly-held ideologies about, say, climate change or Noah's Flood. Collins' explanations are clear but perhaps include too much detail for most readers. I sometimes skimmed, probably without missing anything important. I wish he had addressed how physicists were recruited into the project. Who participated and who was left out, and why? These are quibbles. Overall, this is a fine sociological account of a landmark scientific accomplishment, perhaps the recipient of the next Nobel.

If you really want to know what happened in the gravitational wave community after "The Event" on Sept 14th, 2015, you have to read this book. Harry Collins is a sociologist of science who has monitored the development of gravitational wave physics since the 1970s. His "interactional expertise", as he calls it, and his knowledge of the community in which he has many personal friends, make this book a source of unique insights. Collins tells in chronological order how the story unfolded, about observations, emails, discussions and telephone conferences. He reports in detail, yet the pages turn easily when one comes to know how the extraordinary strong signal of "The Event" changed the character of the field almost immediately. As hundreds of hard-working, skeptic scientists became convinced that their decade-lasting search had eventually been successful. Aside from discussing the interpretations of the signal as a pair of merging black holes at a distance of billions of light years

ÃfÂçÃ â ¬Ã â œ Collins gives also a proper mention to the doubts that had troubled many scientists in the collaboration: the possibility of a ÃfÂçÃ â ¬Ã Å blind injectionÃfÂçÃ â ¬Ã Å“, a fake signal, that could have been inserted also maliciously against the rules. Interestingly, this concern was so pronounced that many scientists assessed that if after three months nothing happened, one should start to worry; many would have objected to publish the event without an independent confirmation (see also former LIGO director Barry Barish in <https://www.youtube.com/watch?v=UD9sF6EDMe8&t=14m50s>). Collins acknowledges (ÃfÂçÃ â ¬Ã Å with a sense of guiltÃfÂçÃ â ¬Ã Å“) that as a sociologist, he had preferred this stressful scenario. But eventually, a second event came in on Dec 26th. Not as strong as the first one, it had a convincing significance, given the form of a signal that was expected from merging black holes or neutron stars. Though the belief of the community considerably relied on that December event, it was not mentioned at the famous press conference on Feb 11th, 2016 and publication was delayed until June. Collins criticizes this kind of concealing and more generally, he questions way the policy of hiding data, publishing misleading statements for the sake of secrecy and the ÃfÂçÃ â ¬Ã Å blind injectionÃfÂçÃ â ¬Ã Å“ practice. He argues that for no good reason, a science that should be a honest search for signals has been infiltrated too much by such exercises of deceiving the public. More generally again, the attitude of the community, according to Collins, is changing from ÃfÂçÃ â ¬Ã Å craftsmanship with integrityÃfÂçÃ â ¬Ã Å“ that did it's best in extracting signals from a noisy background, to a triumphant enterprise whose exclusive duty is to reveal nature's secrets and to deliver cosmic truth to the public. The latter is precisely that idealized, yet wrong picture of science Collins has fought to correct throughout his career. His disappointment goes so far that Collins even questions his long-held statement that such a group of honestly working scientist could be a role model for decision makers in society and politics. At the time the world started to admire the field of gravitational wave physics, it seems that the admiration of its most intimate adept, Collins, had begun to fade. Maybe the most valuable feature of this book is that it is not written for the sake of selling books. The author was rather driven to give an unbiased and complete account of what happened, with some satisfaction that the efforts of the community he knows so well have now been rewarded. Avoiding the usual exaggeration and fancy about the subject, Collins maintains a sober style, without wrongly mentioning Einstein at every page. The book is written in detail, but never boring, not even in the last chapters when he ads some more general lessons on epistemology and sociology of science that may seem a deviation to the reader eager for the latest news. Yet it is this broader context that constitutes the lasting value of the book.

As an outside observer who spent decades observing LIGO from within, Collins brings a unique perspective. He does well to concentrate on the science and the working crew of LIGO, rather than solely on the founders which makes this an interesting read. Blind Injection is a controversial part of the LIGO program whereby designated individuals have the facility to insert a fake reading and to the world it would be real. It was of major interest to me how the "fake injection" was fully ruled out. This is because LIGO Observations cannot be replicated because they are one of a kind setup. Collins was on the inside with the LIGO group for decades so it and brings a view of someone who was with the team while things were happening but is also independent. Being very interested in this topic, I have also read his previous book - Gravity's Ghost and Big Dog - that dealt with LIGO observations that turned out to be official Blind Injections. That was of course before the real observation. I recommend that book too as a companion. Truly remarkable books by Collins - based on decades of the author actually being immersed in LIGO.

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