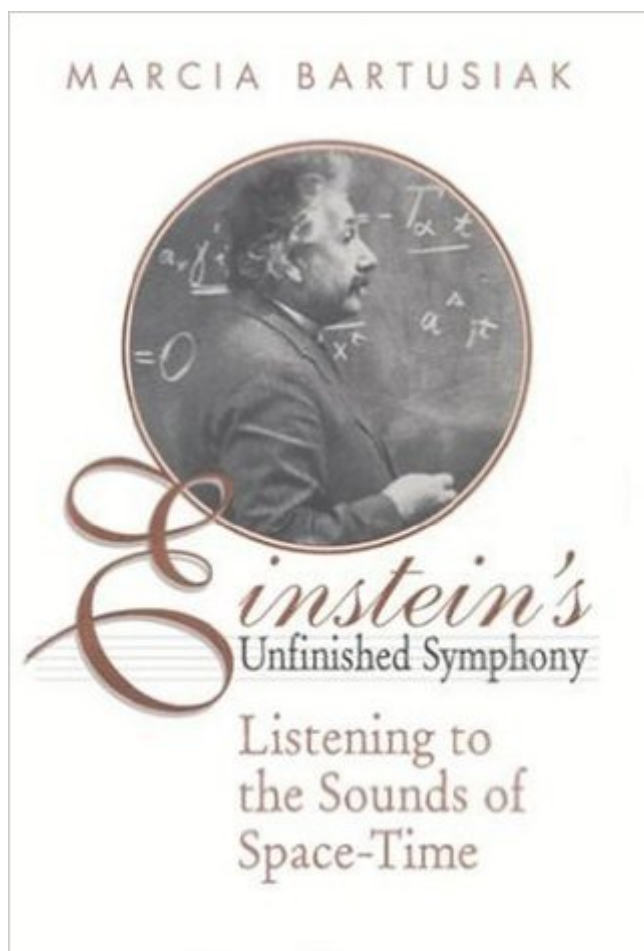


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# Einstein's Unfinished Symphony: Listening To The Sounds Of Space-Time



## Synopsis

A new generation of observatories, now being completed worldwide, will give astronomers not just a new window on the cosmos but a whole new sense with which to explore and experience the heavens above us. Instead of collecting light waves or radio waves, these novel instruments will allow astronomers to at last place their hands upon the fabric of space-time and feel the very rhythms of the universe. These vibrations in space-time-or gravity waves-are the last prediction of Einstein's general theory of relativity yet to be observed directly. They are his unfinished symphony, waiting nearly a century to be heard. When they finally reveal themselves to astronomers, we will for the first time be able to hear the cymbal crashes from exploding stars, tune in to the periodic drumbeats from swiftly rotating pulsars, listen to the extended chirps from the merger of two black holes, and eavesdrop on the remnant echoes from the mighty jolt of the Big Bang itself. When Einstein introduced general relativity in 1915, it was hailed as a momentous conceptual achievement. Einstein attained celebrity status. But, once scientists verified what they could of the theory, given the scant experiments available at the time, general relativity became "largely a theoretical curiosity," writes Marcia Bartusiak. Now, after decades of technological advancement, general relativity is being tested with unprecedented accuracy. It even affects our everyday lives. Satellites used by both travelers and soldiers to peg their positions require constant corrections of Einsteinian precision. Meanwhile, the first gravity-wave "telescopes"-including the LIGO facility-are about to come alive. In Einstein's Unfinished Symphony, Bartusiak captures the excitement as two gravity-wave observatories in Louisiana and Washington State, as well as others in Italy, Germany, and Japan, approach operation and physicists gear up to begin their work to register the long-predicted quakes in space-time. With each chapter, Bartusiak continues her musical metaphor in tracing the story of general relativity, from the time "Maestro" Einstein enters physics, through the "Starlight Waltz" of neutron stars twisting space-time around themselves, to the "Dissonant Chords" of controversy as physicists fight to get their radically new observatories approved, through the "Finale" as a worldwide endeavor in gravity-wave astronomy is launched.

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## Customer Reviews

Galileo could drop balls of various weights from the Leaning Tower of Pisa to investigate gravity, but the latest in gravity research, finding gravity waves, is high cost, big science, it is enormously complicated, and no one even knows if it will find anything. *Einstein's Unfinished Symphony* is the story of LIGO, the Laser Interferometer Gravitational Wave Observatory, a series of facilities in different places that will use lasers traveling in vacuum tubes that are over two miles long to detect any gravity waves as they stretch and compress us when they flow by. Catching a gravity wave would be the last major experimental confirmation of Einstein's ideas. The problem is that any gravity wave effect is unimaginably small, thousands of times smaller than an atomic nucleus. Bartusiak has interviewed many of the scientists involved in the project, and explains their work in good but not numbing detail. Her explanations of the weirdness of Relativity are excellent. Her examples and descriptions are good fun to read, and a model of clear scientific writing for the public. What will LIGO find? That's something like asking Galileo what he would see in the telescope before he looked through it. LIGO will not be a one-task apparatus, but will be more like an observatory. The biggest game it is after is black holes; after all the theory, we still have only circumstantial evidence that black holes exist, and this could be a way of getting hard data. It would be very nice to see two of them collide, or whirl around each other before the inevitable collision in thousands of years. Neutron star collisions and supernovas are targets, too. We are going to have a new instrument and we don't know what we are going to find; that's an exciting scientific stance. *Einstein's Unfinished Symphony* communicates that excitement, and those who read it will be well prepared to understand the upcoming results.

This book provides a rare opportunity for non-scientists to understand an important scientific advance before it happens. Bartusiak provides readers with a thorough history of the decades of theorizing, organizing, and development that have led to the current generation of

gravitational-wave observatories eagerly awaiting the first detection of the space-distorting pulses predicted by Einstein's theory of relativity nearly a century ago. From my point of view, the book presents a bit more of the history and politics of gravitational-wave research, and a bit less of the science, than I might like. Still, Bartusiak tells a very important story in great detail. She clearly did her homework; the book is full of the kind of details that come only from visiting sites and interviewing key players face-to-face. I thought that the most important point Bartusiak made did not come until at least two-thirds of the way through the book. She finally made it clear that the key problem in detecting gravitational waves rippling through spacetime is isolating the detector from every other influence, insulating and quieting it to the point that a change in length no larger than a fraction of the diameter of an atom can be detected. That's why, when gravitational waves are finally detected, it will be a great technical triumph as well as a vindication of Einstein's theory and a powerful new window on the universe. On the whole I'd describe Bartusiak's writing as clear and well organized, but not inspiring. However, she did come up with one delightful metaphor. In describing the impending collision of two black holes, one of the predicted sources of detectable ripples in spacetime, she wrote, "Picture two black holes slowly circling each other, like a pair of sumo wrestlers warily checking each other out in the ring." I would have liked the book even more if Bartusiak had provided more imaginative writing like that, and more science as well. Still, if you want to know what the first detection of gravitational waves will mean, and the enormous amount of effort that has gone into this impending discovery, *Einstein's Unfinished Symphony* is well worth reading. Robert Adler, author of *Science Firsts: From the Creation of Science to the Science of Creation* (Wiley & Sons, 2002); and *Medical Firsts: From Hippocrates to the Human Genome* (Wiley & Sons, 2004).

This is an amazing book for both its historical and scientific content. The prose is clear and engaging; the subject matter, i.e., the attempts at detecting of gravity waves, is fascinating. Although gravity waves have never been knowingly and officially detected as yet, projects to build expensive apparatus to detect them are actually getting funded. This is clearly tribute to the confidence that the scientific community has on Albert Einstein and the General Theory of Relativity. This is a great book that deserves to be read by all!

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