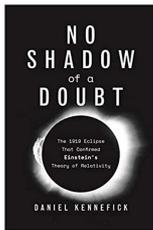


No Shadow of a Doubt*

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*No Shadow of a Doubt:
The 1919 Eclipse That Confirmed
Einstein's Theory of Relativity*
Daniel Kennefick
Princeton University Press
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The British eclipse expeditions of 1919 that confirmed Einstein's theory of relativity made Einstein an overnight celebrity. Kennefick's book details the excitement, adventure, and fanfare of these expeditions that changed the face of physics forever. The events come to life with the personal and scientific experiences of the principal characters: Arthur Eddington, Albert Einstein, Frank Dyson, and many others. The book is unique in its attention to detail. It deals with the political and scientific turbulence that surrounded the principal characters with great care. It debunks all the incorrect claims that have emerged over the years, maligning the expedition teams, especially Eddington. Thereby, as the title goes, it leaves no shadow of a doubt on the science of the 1919 observations.

The book was published in 2019, marking the 100th anniversary of the famous eclipse expeditions. The expeditions aimed to measure deflection in the position of stars visi-

ble in the background of the 29 May 1919, total solar eclipse. That the stars were deflected was suggested by Einstein's General Theory of Relativity. Frank Dyson—the British Astronomer Royal at the time—devised the experiment. Two teams went on expeditions to observe the eclipse at Sobral (Brazil) and the island of Principe (off the West coast of Africa) respectively. At the sites, the teams took photographs of the star fields near the eclipsed Sun. The Sobral team had two telescopes and Principe team had one. The science of these expeditions has been widely discussed in modern times: there are several websites dedicated to it, e.g., <https://eclipse1919.org/>; several conferences and lectures have been organised celebrating the expeditions over the years; there are even movies about it, e.g., *Einstein and Eddington*. However, a historically precise, accessible account was missing. Kennefick's book fills in that gap.

Numerous over-simplified accounts of the story are available. In several such accounts, Eddington is made the sole leader of the expeditions and the word “fraud” is sometimes mentioned. Such claims gather further support from sentences from famous books such as Hawking's *Brief History of Time*. Hawking writes: “It is ironic, therefore, that the later examination of the photographs taken on that expedition showed the errors were as great as the effect they were trying to measure. Their

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measurement had been sheer luck, or a case of knowing the result they wanted to get, not an uncommon occurrence in science.” Sean Carroll, in his textbook *Spacetime and Geometry* writes: “Later re-evaluation of Eddington’s results has cast doubt upon whether he actually obtained the precision that was originally claimed;...”. Kennefick’s book shows in its true light all such claims.

The book starts with a discussion of the challenges involved in implementing the mission during the uncertain times of WWI. How Eddington got out of his war duties? How Dyson influenced those negotiations with the authorities? As it turned out, for his war duties, Eddington was given the difficult task to go to the island of Principe for the cause of science in the national interest.

One thing that stands out upon reading Kennefick’s book is that Eddington is not the only hero in the story. Lesser-known people like Dyson and his assistants played equally essential roles. This meticulously researched book answers all thorny questions surrounding the expeditions: Why was Eddington alone at Principe? Did his internationalism and his pacifist ideology influence his science? Was Eddington biased towards the theory of general relativity? Why was the expedition framed as a contest between 200-year-old well-established “British” Newtonian theory of gravity versus “German” Einstein’s general relativity? Why have the eclipse measurements not improved over the years to a level of precision expected from a typical experiment?

The book celebrates the expertise and the rigorous scientific training of the key people involved. Those involved in the expeditions were the most qualified people to do the work they did. Dyson was the Royal Astronomer. He was the most experienced person to do the data analysis from the eclipse expeditions. Dyson was not biased towards general relativity. Eddington was among the brightest in the Cambridge tradition of theoretical physicists. He understood general relativity early on and had the observational skills to go out and test the theory. Charles Davidson was in charge of handling the trickiest instrument that was sent to Sorbal, Brazil. Davidson was considered the master operator of the instrument, whose opinions were as best as it could be.

Much of the controversy about the 1919 expeditions surrounds the fact that the team of Dyson, Eddington, and Davidson decided to throw away part of the data from Sorbal expedition in their final published results. It is a historical irony that this decision in which Eddington had no role to play is often blamed on Eddington. The book highlights that dismissing Davidson and Dyson entirely from this discussion and placing the blame on Eddington is wrong at many levels.

As Eddington over-shadows others in fame, he draws more and more criticism. The great qualities he possessed—his ability to comprehend the most complex scientific theory of the time quickly, his ability to concentrate on his work at the time of great turmoil of WWI, his great artistry in carefully managing public campaigns in favour of Einstein at the



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same time giving due credit to Newton—are all used with negative overtones to malign his integrity.

The book also discusses the lives and science of several other notable vital players, the German eclipse chaser Erwin Freundlich, the famous lens maker Howard Grubb, the former Director of Kodaikanal Observatory John Evershed, and many others. The book is full of scintillating tidbits from the history of astronomy, history of eclipse predictions, little details about the WWI military and technological advancements, and curious stories about ships!

Although the book is not a bedtime reading, it is not too technical. The author's attention to detail is what distinguishes this work from the other works on this topic. This is a story that needed to be told in detail. Kenefick does the job meticulously. The details occupy most of the book; be it the political circumstances during WWI or the technological developments that made the instrumentation possible for the 1919 eclipse expeditions. The correct understanding of details is much needed to appreciate the circumstances under which Dyson, Eddington, and Davidson made the decisions they made. In that respect, the book goes much beyond the 1919 expeditions. It gives broader lessons in the history and sociology of science. It also teaches lessons on how scientific ideas move in society and the

role of science popularisation. The role of theory in experiments is discussed, treating with due fairness and appreciation the oft-quoted remark by Eddington: "It is also a good rule not to put overmuch confidence in the observational results that are put forward until they are confirmed by theory."

I recommend this book to all serious science libraries, especially for undergraduate students. Anyone interested in history and sociology of science will significantly benefit from reading this book.

Two final remarks are in order here. First, Eddington's own 1920 account is accessible via the internet in his popular science book *Space, Time and Gravitation*. Chapter VI and VII give an easy to understand account of the science, observations, and error analysis of the 1919 expeditions. Second, in March 2016 issue of the *Resonance*, another book by the same author was reviewed by Rajaram Nityananda. That book takes the readers through the theoretical controversies on the subject of gravitational waves—another much-discussed topic in the history of general relativity.

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Share this Rating. Title: Shadow of a Doubt (1943). 7,8/10. Want to share IMDb's rating on your own site? As it happens we are to find out that Joseph Cotton's character is guilty almost straight away yet spend the rest of the film in suspense as we doubt ourselves. This partly because of the tale of his personal history and partly because of the love and affection of his niece, a wonderful performance from Teresa Wright. Shot largely on location and using a lovely old property in which the large family tumble this way and that in marvellous abandon while the lady of the house tries to maintain control. I learn from the extras that in the end, more shots were required by Hitch and so a set ha But now, I'm lost in the crowd No shadow of a doubt It's all over now No shadow of a doubt. You changed the dream You changed the scenery The tender touch, the urge to breath, oh There under a lovelit sun what's lost could be found (found, found, found...) But now, no trace of a sound No shadow of a doubt I'm faraway boundd No shadow of a doubt. But now, l/m lost in the crowd No shadow of a doubt It's all over now No shadow of a doubt. But now, no trace of a sound No shadow of a doubt I' faraway bound No shadow of a doubt. Roxette "Shadow Of A Doubt": I heard your heart, you held it close to me. The wild embrace, the silent sea, a whisper of image... But now I'm lost in the crowd, no shadow of a doubt it's all over now, no shadow of a doubt. You changed the dream. You changed the scenery, the tender touch, the urge to breathe, there under a lovelit sun what's lost could be found. But now, no trace of a sound, no shadow of a doubt. I'm faraway bound. No shadow of a doubt. That proves conclusively, beyond a shadow of a doubt, that this is class legislation. From the. Hansard archive. Example from the Hansard archive. Contains Parliamentary information licensed under the Open Parliament Licence v3.0. Private enterprise demonstrated beyond a shadow of a doubt that it was impossible for private enterprise to meet the demand for houses. From the. Hansard archive.