RELATIVITY

The eclipse that made Einstein famous

Two tomes revisit the 1919 solar eclipse that confirmed a key prediction of relativity theory

By **Andrew Robinson**

On 6 November 1919, British astronomers—led by Arthur Eddington, the Plumian Professor of Astronomy at the University of Cambridge, and Frank Dyson, the Astronomer Royal—announced that their observations of a solar eclipse on 29 May from Principe, an island off the coast of west Africa, and Sobral, a city in northeastern Brazil, had confirmed a key prediction of Albert Einstein's controversial theory of relativity. Suddenly, Einstein became famous on both sides of the Atlantic.

When he visited the United States in 1921, New Yorkers lined the streets to cheer his arrival. But when he then traveled to London and gave a lecture at King's College, the overflowing audience kept silent when Einstein mounted the platform. Only after he had won them over came a storm of applause.

Why such a disparity? The answer lies in the lingering anti-German sentiments in Britain in the wake of World War I. Despite the fact that unlike many of his colleagues, Einstein did not contribute to any military projects, he had nonetheless published his theory in Germany at the height of the war.

Relativity's relationship with the world war and the story of the eclipse that confirmed a key component of Einstein's theory are the subject of two remarkable books published for the centenary of the latter's observations. *No Shadow of a Doubt* by physicist and Einstein scholar Daniel Kennefick is intended more for academics than for general readers, with far more technical detail on the eclipse observations than *Einstein's War* by historian of science and Eddington scholar Matthew Stanley. His book skillfully interweaves the lives of Einstein and Eddington into a readable narrative.

Kennefick and Stanley cover similar material, and their interpretations of the eclipse observations are broadly comparable. However, they differ substantially in their interpretation of the influence of World War I on the reception of the observations.

In Stanley's view, Einstein had to fight a private "war" with skeptics who believed in Isaac Newton's absolute space and time and the long-established concept of "ether," in which light could not be deflected by gravity. "Relativity's sudden explosion, and Eddington's zealous evangelism for it, would never have happened in quieter times," Stanley argues. "If Eddington had not cared about pacifism, we would not have had the relativity revolution in 1919."

By contrast, Kennefick writes, "I find it difficult to believe that Eddington's experience of being a pacifist during the war led him to expect public approbation for his efforts." The vital ingredient in Eddington's success, he argues, was his scientific background: "He was a theorist with the right mathematical training.... In addition, he had done extensive work in astrometry, the skill required for actually carrying out the observational test." "It is true that Eddington and Einstein shared pacifist ideals and internationalist sentiment," Kennefick continues, "but their common scientific interests are what brought them together."

Both books deal with allegations against the expedition astronomers—Eddington in particular—that their results were not as conclusive as they claimed. In short, Eddington claimed more precision for the observations than was technically possible in 1919. "This proof of a German theory by British scientists was hailed as a great act of reconciliation between the two countries after the war," wrote Stephen Hawking in *A Brief History of Time*. "It is ironic, therefore, that later examination of the photographs taken on that expedition showed the errors were as great as the effect they were trying to measure." Although the evidence inherent in the photographic plates is complicated, it seems to acquit Eddington of fudging the data, if not of having a theoretical bias in favor of Einstein's theory.

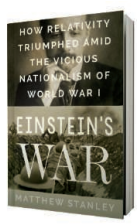
According to Kennefick, one aspect of the eclipse expeditions has long been underestimated. Dyson's role, he argues, was just as important as Eddington's.

Dyson was a long-time skeptic of relativity. Indeed, it was not until 1922, after another set of eclipse observations, that he declared, "I don't think there is 'any possible shadow of doubt' about the correctness of Einstein's prediction of the deflection of light, whatever difficulties may be found with the rest of his theory." His change of mind speaks of the convincing quality of the data collected from the 1919 expeditions.

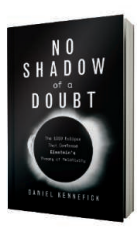
Even more important, Dyson alone was clearly the one who carried out the analysis of the Sobral data that confirmed Einstein's prediction. The data from Principe obtained by Eddington, Kennefick asserts, were too meager for definite conclusions because cloudy weather obscured the sun.

Given how severely limited the available data were in 1915, how did Einstein come up with his theory? He developed it from a very narrow empirical base, relying primarily on his scientific imagination, notes Kennefick. But it has passed every subsequent test for more than a century, most recently its prediction of gravitational waves and black holes.

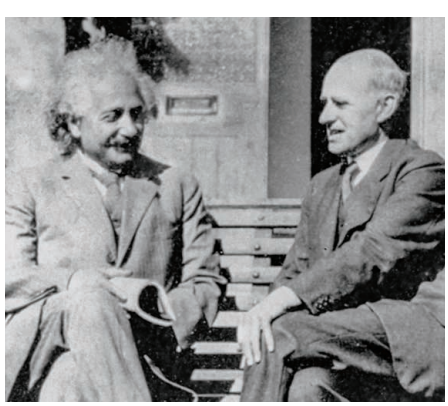
When Einstein lectured on "The origin of the general theory of relativity" at the University of Glasgow in 1933, he disarmingly confessed, "In the light of the knowledge attained, the happy achievement seems almost a matter of course, and any intelligent student can grasp it without too much trouble. But the years of anxious searching in the dark, with their intense longing, their alternations of confidence and exhaustion and the final emergence into the light—only those who have experienced it can understand that." ■



Einstein's War
Matthew Stanley
Dutton, 2019. 400 pp.



No Shadow of a Doubt
Daniel Kennefick
Princeton University Press, 2019. 413 pp.



Eddington's (right) 1919 eclipse observation confirmed Einstein's (left) theory of relativity.

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