

ECLIPSED BY HISTORY: UNDERRECOGNIZED CONTRIBUTIONS TO EARLY
BRITISH SOLAR ECLIPSE EXPEDITIONS

by

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Solar eclipse expeditions in the nineteenth and early twentieth centuries led to new scientific knowledge that is often credited to prominent male scientists such as Einstein and Eddington. Results generated by named individuals nonetheless depended on the collective effort of scientific administrators, government functionaries, manual labourers, domestic assistants, naval crew members and others. Much substantive work, essential to the success of the scientific ventures, was often done by people local to the observing stations. This paper focuses on British solar eclipse expeditions in 1889 and 1919 to highlight ways in which contributions of women and of people in colonized lands have been underrecognized by the expeditioners and in subsequent narratives about them.

Keywords: eclipse expeditions; invisible labour; nineteenth-century astronomy; women in astronomy

INTRODUCTION

Over 30 years ago, Steven Shapin's now classic work highlighted the contributions of technical work to scientific enterprise.¹ In particular, Shapin explores how scientists and astronomers rely on technical and logistical support from people whose contributions are largely invisible in both contemporary scientific reports and often in historical accounts. An editorial by Rob Iliffe discusses subsequent decades of scholarship on a range of technicians and assistants with various levels of skill and contribution at every scale of scientific work.² There is informative interplay between this body of work and accounts of encounters of European travellers with the interiors of Africa and Asia.³

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1 Steven Shapin, 'The invisible technician', *Am. Scient.* **77**, 554–563 (1989).

2 Rob Iliffe, 'Technicians', *Notes Rec. R. Soc. Lond.* **62**, 3–16 (2008).

3 For example, see Johannes Fabian, *Out of our minds: reason and madness in the exploration of central Africa* (University of California Press, Berkeley, 2000).

This scholarship is particularly relevant to British astronomical expeditions in the nineteenth and early twentieth centuries, as astronomers from the British empire crisscrossed the globe in pursuit of scientific results.⁴ Notably, in 1860 British astronomer Warren de la Rue photographed rosy prominences of the corona while observing a total solar eclipse in Spain. Eclipse observations in India in 1868 led to the identification of a new chemical element called helium.⁵ Nineteenth-century solar eclipse expeditions provided astronomers around the world with opportunities to test their theories of solar and lunar motion in hopes of producing more precise tables to improve navigation. Astronomers in this period sought to test and improve the precision of observational techniques and to apply these to open astronomical questions.⁶

Their efforts were energized by some infrastructure of empire. In particular, expanding networks of telegraphs and railways alongside a far-reaching British naval presence facilitated both longitude calculations and transport of heavy equipment to the zone of totality, while new tools such as the camera and spectroscope promised scientific advance. In the final decades of the nineteenth century there was robust debate about whether and how photography could be used for astronomical measurement.⁷ Practitioners meanwhile tinkered with mirror alignments to build spectroscopes capable of new insights on the composition of the chromosphere. Starting in the 1870s, the Royal Society and the Royal Astronomical Society (RAS) formed their earliest planning committees for expeditions to observe total solar eclipses, the first being in preparation for the 1871 eclipse visible from India.⁸

Nineteenth-century observers hoped that their eclipse efforts would provide valuable practice for the widely anticipated transit of Venus—one of the rarest recurring predictable astronomical events that require observers to be in specific global locations—due in 1874 and 1882 (and not again until 2004 and 2012). During the transit of Venus, the path of Venus crosses between the Sun and Earth. Astronomers thought that precise timings of the transit phases would equip them to answer tantalizing questions about the size of the solar system. Since a total solar eclipse closely resembles a transit of Venus, with instead the Moon passing between the Sun and the Earth, astronomers hoped that eclipse expeditions would equip them for successful observations during the transit of Venus in 1874.⁹ While extraordinary global efforts returned only disappointing results from the transit of Venus, many nonetheless remained hopeful that future astronomical expeditions would be fruitful.

In 1888 the RAS established a Permanent Eclipse Committee for formal oversight of eclipse expedition funding and organization. The new committee got their first opportunity to plan for the total solar eclipse of 22 December 1889. That year, the RAS sent two

4 For a thorough general discussion of British eclipse expeditions in Victorian and Edwardian times, see Alex Soojung-Kim Pang, *Empire and the Sun: Victorian solar eclipse expeditions* (Stanford University Press, Stanford, 2002) and Alex Soojung-Kim Pang, 'The social event of the season: solar eclipse expeditions and Victorian culture', *Isis* **84**, 252–277 (1993).

5 David Baron, *American eclipse: a nation's epic race to catch the shadow of the moon and win the glory of the world* (Liveright, New York/London, 2017), p. 53.

6 Deborah Kent, 'The North American eclipse of 1869', *Phys. Today* **72**, 8.46–8.53 (2019) (<https://physicstoday.scitation.org/doi/10.1063/PT.3.4271>).

7 Aud Sissel Hoel, 'Measuring the heavens: Charles S. Peirce and astronomical photography', *Hist. Photogr.* **40**, 49–66 (2016) (<https://doi.org/10.1080/03087298.2016.1140329>).

8 Megan Briers, Mixie Billina and Deborah Kent, 'Chasing change: the lasting legacy of India's 1871 eclipse', *Astron. Geophys.* **63**, 1.24–1.29 (2022) (<https://doi.org/10.1093/astrogeo/atac010>).

9 Rebekah Higgitt, 'Framing the transit: expeditionary culture and identities in Lieutenant E. J. W. Noble's caricatures of the 1874 transit of Venus expedition to Honolulu', *Ann. Sci.* **74**, 214–239 (2017).

expeditions: Stephen Joseph Perry and John Rooney went to French Guiana, and Albert Taylor to Luanda. There was also a third British expedition for this eclipse, though not directly arranged by the RAS. Astronomer Elizabeth Brown travelled to Trinidad, accompanied by her relative Martha Louisa Jefferys, identified for the first time in this paper.

All three of these British eclipse expeditions in 1889 benefited from significant assistance from colonial administrators, local residents and, in the case of French Guiana, also imprisoned labourers. Source material is scant for investigating contributions from these individuals. This paper relies mostly on the committee minutes and publications in the *Monthly notices of the RAS*, as well as newspaper accounts and recollections of observers. Particularly notable is Brown's published volume *Caught in the tropics*, which provides a detailed account of her expedition with Jefferys.¹⁰ This includes specific information about their travels and interactions with the local population in Trinidad. At the time, women were not yet allowed to be fellows of the RAS,¹¹ and their entire eclipse expedition was largely unacknowledged by the astronomical community. Brown and Jefferys are invisible in the official reports of the expedition. This is not unusual; discussions of the scientific output of eclipse expeditions often overlook the roles of women.

Such discussions likewise often minimize the work of assistants and the many practical aspects of the journeys. The outputs of nineteenth-century eclipse expeditions indeed depended on bureaucratic organization, timely travel, luggage transportation, telescope assembly, technical support and logistics of daily room and board. While likely little of this practical work was done by the named scientists themselves, existing narratives of nineteenth- and early twentieth-century eclipse expeditions often credit only a small number of individuals for an entire expedition.

Arguably the most celebrated solar eclipse expedition occurred in 1919; it produced the first observational confirmation of Einstein's general theory of relativity. The RAS Permanent Eclipse Committee had by then joined forces with the Royal Society to create the Joint Permanent Eclipse Committee (JPEC), which sent Arthur Stanley Eddington and Edwin Turner Cottingham to the West African island of Príncipe (now part of the country São Tomé and Príncipe) while Charles Rundle Davidson and Andrew de la Cherois Crommelin went to Sobral, Brazil. Some existing scholarship surrounding these expeditions celebrates the scientific results, the related rise in Einstein's reputation and the impact on the development of physics.¹² The centenary in 2019 revived interest in these 29 May 1919 expeditions, a photo from which appears in figure 1.

Whereas the 1889 eclipse expeditions were the first instance of an expedition organized by the RAS Permanent Eclipse Committee, the 1919 ones marked a coordinated effort between the RAS and the Royal Society in pursuit of landmark scientific observations. These expeditions, separated by 30 years, involved different circumstances and destinations, but

¹⁰ A Lady Astronomer, 'Caught in the tropics. Part ii, 1889: the West Indies', in *In pursuit of a shadow (two eclipse journeys)* (Baily & Woods, Market Place, Cirencester, 1899).

¹¹ Women were only first allowed to be fellows of the RAS in 1916. Brown herself would be rejected from fellowship three years after this 1889 expedition. See Mandy Bailey, 'Women and the RAS: 100 years of fellowship', *Astron. Geophys.* **57**, 1.19–1.21 (2016) (<https://doi.org/10.1093/astrogeo/atw037>).

¹² For a summary of some recent publications discussing the 1919 eclipse, see Peter Coles, 'Einstein, Eddington and the 1919 eclipse', *Nature* **568**, 306–307 (2019) (<https://doi.org/10.1038/d41586-019-01172-z>). For a summary of some events that were planned in commemoration of the 1919 eclipse expedition, see 'Global astronomical community celebrates the 100th anniversary of 1919 solar eclipse', International Astronomical Union, 29 May 2019, <https://www.iau.org/news/pressreleases/detail/iau1907/> (accessed 20 December 2022).

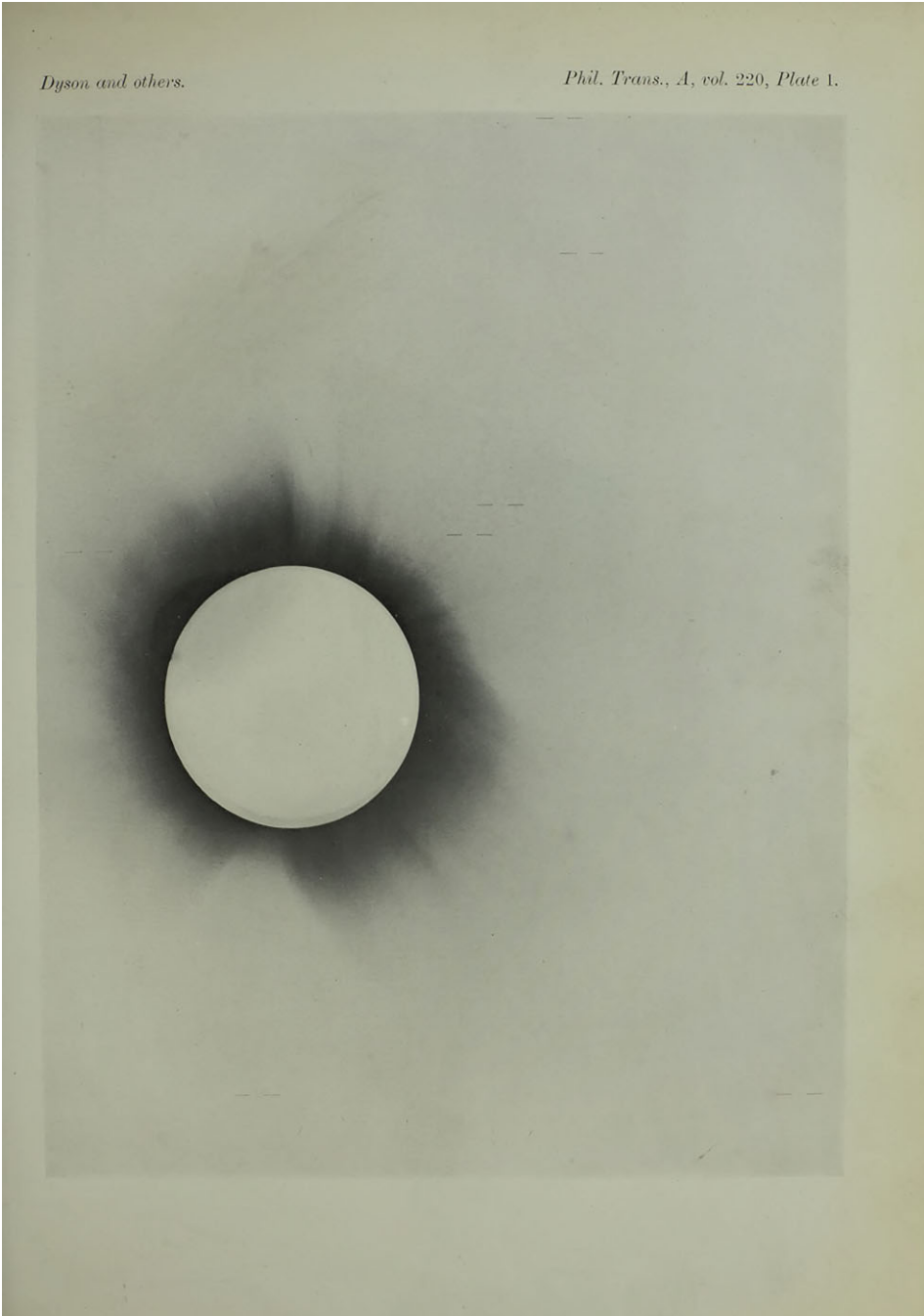


Figure 1. The photograph of the 1919 eclipse that appeared in the report communicated to the *Philosophical Transactions* by the Joint Permanent Eclipse Committee.⁹⁹

nonetheless shared a common dependence on underrecognized labour and colonial administration. This paper seeks to add to an existing body of work surrounding the idea that narratives of European scientific voyage generally lack recognition for countless others who facilitated their expeditions.¹³ Existing sources present a particular point of view on the dynamics of engagement between indigenous and imperial forces that makes it difficult to locate in existing sources the voices of people who did significant work to support scientific output. This paper nevertheless attempts to highlight underrecognized labour, often intertwined with matters of gender and colonial structures, that played key roles in both the 1889 and 1919 solar eclipse expeditions.

INTERCONNECTED BRITISH COLONIAL AND ASTRONOMICAL PROJECTS

The history of British astronomical observation is intertwined with colonial activity due to the far-reaching presence of the British military and the utility of astronomy in navigation and territorial mapping. Seventeenth- and eighteenth-century crashes of Royal Navy ships led to the 1714 establishment of the Board of Longitude to award £20 000 in prize money to whomever could develop a working method of determining longitude to improve navigation on British sea voyages.¹⁴ One of the measures of success for a method of longitude calculation was how well it worked on a voyage from Britain to the West Indies, where the British occupied several territories.¹⁵ In 1763 the soon-to-be Astronomer Royal, Nevil Maskelyne, journeyed to Barbados on an Admiralty ship.¹⁶ Connections between astronomical work and the British military continued throughout the nineteenth and into the twentieth century.

The earliest RAS eclipse committee meetings thus included members of the British military who paired colonial voyage with astronomical observation. The minutes of the RAS solar eclipse committee reveal related details.¹⁷ Initially, the RAS would create a new committee for each anticipated eclipse expedition. These committees often involved many of the same people and the RAS established a permanent committee in May 1888. The Eclipse Committee of the Royal Astronomical Society (also referred to as the Total Solar Eclipse Committee or Solar Eclipse Committee) had two aims: 'Bringing into communication with each other gentlemen willing to observe eclipses' and 'Becoming a centre of information for intending observers'.¹⁸

Both willing eclipse observers and related RAS committees often comprised British military personnel. For example, Lieutenant-Colonel George L. Tupman, secretary of the RAS from 1884 to 1889, was involved in forming the eclipse planning committee and had

13 For example, Dane Kennedy, *The last blank spaces: exploring Africa and Australia* (Harvard University Press, Cambridge, MA, 2013).

14 Robin W. Spencer, 'Open innovation in the eighteenth century', *Res.-Tech. Manag.* **55**, 39–43 (2012) (<https://doi.org/10.5437/08956308X5504074>).

15 For a more thorough discussion on this topic, including the role of slavery in longitude measurement, see B. W. Higman, 'Locating the Caribbean: the role of slavery and the slave trade in the search for longitude', *J. Caribbean Hist.* **54**, 296–317 (2020) (<http://doi.org/10.1353/jch.2020.0019>).

16 Rebekah Higgitt, 'Barbados or bust: longitude on trial', *Guardian*, 9 September 2013, <https://www.theguardian.com/science/the-h-word/2013/sep/09/history-science-longitude-maskelyne-barbados> (accessed 17 December 2022).

17 Minutes of the Solar Eclipse Committee of the Royal Astronomical Society, 11 May 1888–12 January 1894, RAS Papers 54/1, Royal Astronomical Society Library, London.

18 *Ibid.*, 11 May 1888 Minutes.

previously made observations of meteors while serving in the Mediterranean.¹⁹ Lieutenant-General James Francis Tennant was likewise an astronomer and military officer who was a member of the Permanent Eclipse Committee from its inception until 1894.²⁰ He was involved in the triangulation of British India and made observations during total solar eclipses in India in both 1868 and 1871. Yet another military member of the Permanent Eclipse Committee was Major Leonard Darwin, son of scientific voyager Charles Darwin. Prior to his involvement with the committee, he observed transits of Venus in the British colony of New Zealand in 1874 and 1882.²¹ He was active on the committee from its inception in 1888 to at least 1899.

THE ECLIPSE EXPEDITIONS OF 1889

On 12 December 1888 the newly formed committee discussed three possible locations for observing the total solar eclipse on 22 December 1889. They considered sending expedition parties to Trinidad, to French Guiana and to São Paulo de Loanda (modern-day Luanda), located in what was then the Portuguese colony of Angola. Five months later, on 10 May 1889, the committee officially recorded its decision to send observers to French Guiana and Luanda. The scientific objectives of these expeditions were to photograph the corona and to determine its photometric intensity. They also wanted to track changes in the corona during the two-and-a-half hours between totality at the two stations. The RAS eclipse committee applied to the Government Grant Committee of the Royal Society and received £400 to fund expedition travel and equipment.²²

The largest expenditure was for 'two first-class instruments' to be used on the expedition.²³ They paid £120 for mounting two silver-on-glass mirrors of 20-inch aperture and 45-inch focus. These mountings were made by Andrew Ainslie Common, a pioneer in astrophotography noted for his early photographs of the Orion nebula.²⁴ The grant stipulated that the instruments became property of the Royal Society after the eclipse. During the expedition, one of these instruments would be used in Luanda by Albert Taylor, an assistant observer to Common.²⁵ The committee negotiated with the steamship company to get Taylor a half-price ticket to help stretch the grant allocated total of £120 for his expedition expenses.

The second Royal Society instrument would be used in French Guiana. The observing party consisted of Jesuit priest and astronomer, Reverend Stephen Joseph Perry, and his Jesuit brother and astronomical assistant, John Rooney.²⁶ Father Perry had previously journeyed to the Kerguelen Islands in the southern Indian Ocean to see the 1874 Transit of Venus and to what is now known as Nosy Ve off the coast of Madagascar for the 1882

19 A. C. D. Crommelin, 'Lieut.-Col. G. L. Tupman', *Nature* **110**, 742 (1922) (<https://doi.org/10.1038/110742a0>).

20 Anonymous, 'Lieutenant-General James Francis Tennant', *Mon. Not. R. Astron. Soc.* **76**, 272–276 (1916) (<https://doi.org/10.1093/mnras/76.4.272>).

21 C. F. Arden-Close and Hugh Robert Mill, 'Major Leonard Darwin', *Geographical J.* **101**, 172–177 (1943).

22 H. H. Turner, 'Report of the Eclipse Committee of the Royal Astronomical Society, 1889 October 3', *Mon. Not. R. Astron. Soc.* **50**, 2–8 (1889) (<https://doi.org/10.1093/mnras/50.1.2>).

23 *Ibid.*, at p. 1.

24 H. H. Turner, 'Obituary: Andrew Ainslie Common', *Observatory* **26**, 304–308 (1903).

25 Stefan Hughes, *Catchers of the light: the forgotten lives of the men and women who first photographed the heavens* (ArtDeCiel Publishing, Cyprus, 2012), p. 460.

26 Augustín Udías, *Jesuit contribution to science: a history* (Springer International Publishing, Cham, 2015), pp. 193–214.

Transit of Venus. He had also been part of an expedition to observe a total solar eclipse in Russia in 1887 and served as the president of the Liverpool Astronomical Society.²⁷ In 1889 the Royal Mail Steamship Company agreed to transport Perry and Rooney as far as Barbados for return fare of £35 each. The Royal Society had granted them a total of £100 for expenses.

There was also, however, a third British observing party that had not been explicitly supported by the RAS. In October of 1889 the *Monthly notices of the Royal Astronomical Society (MNRAS)* mentioned that two women ‘Miss E. Brown and Miss Jefferies are proceeding to Trinidad to observe the eclipse’.²⁸ Brown was a relatively well-known female astronomer at the time, who likely self-funded the trip to Trinidad, as she had her 1887 eclipse expedition to Russia.²⁹ Brown’s companion on both of these journeys was her second cousin, Miss Martha Louis(a/e) Jefferys (b. 1859).³⁰ Brown’s writings anonymize both herself as ‘A Lady Astronomer’ and her cousin as ‘L’. Jefferys’ identity has not been known until now.

In 1887 the pair had been ‘the first British women to be part (though unofficially) in a scientific eclipse team’ when they travelled to Russia to observe totality.³¹ They shared that adventure with Father Perry, with whom Brown was also acquainted through the Liverpool Astronomical Society. The parties all departed Britain on Royal Mail steam ships well in advance of eclipse day to allow time for local observation arrangements on arrival.

On 9 October Taylor left from Liverpool on *Bonny*, owned by the British and African Steam Navigation Company. His report describes the ship stopping at ‘Grand Canary, Sierra Leone and other important places’ before arriving at Luanda on 14 November. Taylor departed more than a month ahead of Perry, Rooney, Brown and Jefferys, who sailed from Southampton on 14 November 1889. They boarded the *Tagus*, bound for Barbados, which was then a British colony. On 26 November they docked in the harbour of Bridgetown, Barbados, where they would part company and continue to French Guiana and Trinidad, respectively. Unbeknownst to the women then, that would be the last time they would ever see the Reverend-astronomer.

27 Sources about Father Perry’s work are: Anonymous, ‘Stephen Joseph Perry’, *Mon. Not. R. Astron. Soc.* **50**, 168–175 (1890) (<https://doi.org/10.1093/mnras/50.4.168>); Anonymous, ‘The British Association’, *Nature* **28**, 516–529 (1883) (<https://doi.org/10.1038/028516b0>); and Peter D. Hingley, ‘The priest and the stuffed penguin: Father Stephen Perry, SJ and the transit of Venus expeditions to Kerguelen Island, 1874, and Madagascar, 1882’, *J. Br. Astron. Assoc.* **115**, 150 (2005).

28 Turner, *op. cit.* (note 22), at p. 8.

29 A Fellow of the Royal Astronomical Society, *English Mechanic and World of Science: No. 1*, 172, 3 September 1889, p. 37, mentions that Brown paid for her 1887 trip to Russia herself. It is therefore reasonable to believe that the 1889 eclipse trip was self-funded as well, especially since she was not part of the official Royal Astronomical Society eclipse team.

30 Alternate spellings for parts of her name can be found. She is called ‘Martha Louisa Jefferys’ in Bernard Thistlethwaite, *The Thistlethwaite family: a study in genealogy* (Headley Brothers, London, 1910), vol. 1, p. 129. However, she is called ‘Louise’ in Brown’s obituary: Anonymous, *The annual monitor for 1900, or obituary of the members of the Society of Friends in Great Britain and Ireland for the year 1899* (London, 1899), pp. 51–57. Her last name has also been spelt as ‘Jeffreys’ and as ‘Jefferies’ in different sources. The last name of Brown’s travelling companion ‘L.’ had previously been noted as ‘Jefferys’ based on readings of Father Perry’s writings in the *MNRAS*; see footnote 12 on p. 197 of M. Creese, ‘Elizabeth Brown (1830–1899), solar astronomer’, *J. Br. Astron. Assoc.* **108**, 193–197 (1998). The current authors obtained knowledge of her first-name initials (‘M. L.’) from newspapers published in Trinidad, then used relevant contextual and genealogical considerations to determine her identity. Evidence of these first-name initials can be found from passenger bookings in: Anonymous, ‘Booked’, *Port-of-Spain Gazette*, 16 November 1889, p. 3, <https://dloc.com/UF00094730/07315/images> (accessed 17 December 2022) and Anonymous, ‘Passengers booked’, *Port-of-Spain Gazette*, 19 October 1889, p. 6, <https://dloc.com/UF00094730/07308/images> (accessed 17 December 2022).

31 Mary Brück, *Women in early British and Irish astronomy: stars and satellites* (Springer Netherlands, Dordrecht, 2009), at p. 155.

ELIZABETH BROWN AND MARTHA LOUISA JEFFERYS IN TRINIDAD, *CAUGHT IN THE TROPICS*

The most substantive source about Brown and Jefferys's eclipse expedition to Trinidad is Brown's 1890 book, *Caught in the tropics*.³² While the account provides valuable details about Brown and Jefferys' expedition, it presents only Brown's voice and privileged perspective on the trip. *Caught in the tropics* nonetheless reveals technical assistance provided to Brown and Jefferys—from being advised about their observing location, to receiving the exact time of eclipse totality from other observers on the island, to help from the head police sergeant for rehearsing their observation protocols on location. Information about more strictly practical aspects of their stay, such as food and transportation, provides insight into the social dynamics of their interactions with the people of Trinidad.

Throughout the text, Brown anonymizes both herself and Jefferys, along with many other individuals with whom they interact. Perry and Rooney are explicitly named. Newspaper sources sometimes reveal other names—as is the case with Jefferys—yet many remain elusive. There is throughout Brown's book an air of secrecy about some aspects of the women's voyage. She reports, for example, that on the boat to Barbados Father Perry spoke of 'our meeting in Russia, and of my present journey to Trinidad, not, of course, mentioning me by name'.³³

Similarly, an article from the *European mail* quoted in Trinidad's *Port-of-Spain gazette* explicitly names Father Perry and Albert Taylor as eclipse expeditioners to French Guiana and Luanda respectively, and says only that another expedition was sent to Trinidad.³⁴ An article titled 'Astronomical expedition to Trinidad' in Trinidad's 16 November *Port-of-Spain gazette* newspaper notes that 'it is strange our Government has been so silent over the matter'.³⁵ A careful read of the same *Port-of-Spain gazette* newspaper reveals that both Brown and Jefferys' names were mentioned two pages earlier as people booked to arrive at the island.³⁶

Once ashore in Barbados on 26 November, Brown and Jefferys stayed at the Marine Hotel, the current site of the PomMarine Hotel. Brown notes that they hired an unnamed Black carriage driver to take them from the Bridgetown harbour to the hotel. She also describes being taken care of by 'servants, all coloured people of course', except for the head waiter who was a White man.³⁷ While Brown and Jefferys refreshed themselves at the hotel, others did the work of transferring their observing equipment onto the naval ship. The next day, the *Esk* transported Brown and Jefferys to the capital of Trinidad, Port-of-Spain, where they arrived on 29 November 1889.

The pair spent their first few days in Trinidad at a hotel where they were served by a man named Henry, whom Brown describes as their 'obliging head-waiter'. Brown and Jefferys then hired the services of an unnamed Black boatman for some sight-seeing. Brown noted

32 A Lady Astronomer, *op. cit.* (note 10).

33 *Ibid.*, at p. 139.

34 The quoted article also interestingly claims that the Royal Astronomical Society was sending all three expeditions. However, no evidence was found in the Eclipse Committee minutes to support the idea that the RAS sent an expedition to Trinidad, beyond the fact that they initially considered it as a potential destination for observing the eclipse in 1888. See Minutes of the Solar Eclipse Committee of the Royal Astronomical Society, *op. cit.* (note 17).

35 Anonymous, 'Astronomical expedition to Trinidad', *Port-of-Spain Gazette*, 16 November 1889, p. 5, <https://dloc.com/UF00094730/07315/images> (accessed 7 March 2023).

36 See Anonymous, 'Booked', *op. cit.* (note 30), at p. 5.

37 A Lady Astronomer, *op. cit.* (note 10), at p. 147.

in her book that the ‘negro talk’ of him and other locals was ‘peculiar’ to her ears. Brown’s perspective on this is clear when she observes how they ‘skip conjunctions and connecting links and keep to the simplest of grammar, making a sort of negro-English, approaching but not exactly represented by the negro-gabble of story books’.³⁸

Although Trinidad had been a British colony since 1802, the year 1889 marked a notable time in its colonial history as the year it was united by Britain with the neighbouring island Tobago to form the single political entity, Trinidad and Tobago. Henry Fowler was the colonial secretary of Trinidad at the time and also served as the administrator of the islands in the absence of the governor of Trinidad and Tobago, Sir William Robinson. Robinson left the island in May, perhaps on administrative duty, and returned on 5 December, just a few weeks before the eclipse.³⁹

Brown had been acquainted with Colonial Secretary Fowler through his brother while she was in England, and this personal connection with high-ranking British officials and affluent British immigrants in Trinidad facilitated smooth travels for Brown and Jefferys. Fowler and his wife invited them to lunch on 1 December. The Fowlers lived at ‘Coblentz’, a distinguished house in which the English princes Albert and George (later King George V) had stayed while visiting Trinidad in 1880. Over lunch there, Fowler recommended Princes Town as an excellent observing location for Brown and Jefferys. The town, which had been named by Princes Albert and George on the 1880 visit,⁴⁰ had a police station with a tower that would provide a good vantage point to view the eclipse.

Two days later, Fowler personally escorted Brown and Jefferys to Princes Town. He brought a party of eight, including several young ladies and a few of his officials, who joined them for the day trip. The local *Port-of-Spain gazette* newspaper featured an article entitled ‘The administrator’s visit to Princes Town’, which explained Brown and Jefferys’ plans to view the eclipse in the tower of the police station and court building. It also discussed details of local hospitality and the visitors’ observation of a local court case. On the day of this visit, they had breakfast at Miller’s Hotel, where the owners had ‘spared no expenses in making comfortable’ according to the local newspaper.⁴¹ This hotel was conveniently located across the street from the tower where Brown and Jefferys planned to view the eclipse. After making arrangements in Princes Town, they briefly returned to Port-of-Spain.

On 9 December 1889 Brown and Jefferys went back to Princes Town, where they would stay at Miller’s Hotel until the day of the eclipse. Brown says they were exceptionally well taken care of there by a ‘tall negro waiter’ named Francis, who she says became ‘quite a protecting friend’ to her and Jefferys.⁴² However, the colonial dynamic between them and Francis can be seen in the way Brown refers to him as ‘a good specimen of the superior educated negro’. Brown says further that, in contrast to the other (non-White) locals she came across, ‘his language and manners were more cultivated and polished than those of

38 *Ibid.*, at p. 156.

39 Anonymous, ‘Return of Governor Sir William Robinson, K.C.M.G.’, *Port-of-Spain Gazette*, 7 December 1889, pp. 4–5, <https://dloc.com/UF00094730/07320/images> (accessed 17 December 2022).

40 Richard Charan, ‘The town of princes’, *Trinidad Express Newspapers*, 21 January 2021, https://trinidadexpress.com/features/local/the-town-of-princes/article_ac78ae46-52e0-11e8-b8b4-cb76cea286dc.html (accessed 20 December 2022).

41 Anonymous, ‘The administrator’s visit to Princes Town’, *Port-of-Spain Gazette*, 7 December 1889, p. 5, <https://dloc.com/UF00094730/07320/images> (accessed 17 December 2022).

42 A Lady Astronomer, *op. cit.* (note 10), at p. 171.

the ordinary [B]lack waiter'.⁴³ She attributes this to the fact that Francis had previously been a servant to the governor.

Caught in the tropics is the only source involving Francis that is known to exist. Hence, everything known about this individual comes through the particular filter of Brown, who centres her experience as part of a colonizing power. According to Brown's report, Francis enjoyed preparing their meals each day and introducing them to a variety of local dishes. During their stay, he badly injured his foot but continued to take great pains to ensure that Brown and Jefferys were comfortable throughout their visit. For Brown, this is evidence of 'his kindness and gentleness [that] seemed also to belong to his native disposition' that 'gave his attentions a touching character of personal interest'.⁴⁴

Relieved of quotidian concerns by Francis, Brown and Jefferys spent many of the days leading up to the eclipse at their leisure. They explored different parts of Princes Town and made social calls on their English neighbours. One of these neighbours, a 'Mr. D-', had also apparently received the British historian Charles Kingsley and the aforementioned Princes Albert and George for visits during their stays in Trinidad. Mr D- offered the women his coach and coachman during their stay in Princes Town so that they could travel more easily.

Brown and Jefferys made daily visits across the street to view the early morning sky from the court tower in Princes Town. Remarkable freedom was afforded to the astronomers to make the police station and court tower suitable for the eclipse observation. Brown explains that they got a carpenter to 'put in screws, set up a hand-rail or do odd jobs' inside of the tower. Additionally, the stipendiary magistrate of the building ordered the head sergeant of police to hold himself at their disposal. Brown and Jefferys enlisted the assistance of the head sergeant when conducting a rehearsal of the eclipse viewing.

On the day of the eclipse, 22 December 1889, the pair left early in the morning for the tower, where Brown set up her telescope and Jefferys prepared her camera. The local newspaper had published beforehand that the eclipse was due to begin at 6:10 a.m. and end at 8:14 a.m.,⁴⁵ but for the exact time of totality, Brown and Jefferys relied on a calculation by a man Brown called only 'Mr. S-'. According to a local newspaper, this seems to be a Mr Smart.⁴⁶ From his nearby observing location, Smart sent the exact time at which totality was predicted to Brown and Jefferys just on the morning of the eclipse when the Moon was already approaching first contact with the Sun.

Brown had tasked the head police sergeant with recording the start time of totality and with timing the duration of the eclipse. The sky was cloudy at the start of the eclipse, but the clouds cleared just before the moment of totality. Brown shouted the time of totality. The sergeant, however, became 'a little confused through excitement' and neglected to record it.⁴⁷ Neither Brown nor Jefferys was able to sketch the corona, as Father Perry had advised them to do. Jefferys was also unable to use her camera. Brown describes being overcome—as first time observers often are—by the experience of eclipse totality, which lasted only one minute and one second.

43 *Ibid.*, at p. 181.

44 *Ibid.*

45 Anonymous, *op. cit.* (note 35), at p. 5.

46 Anonymous, 'The eclipse', *Port-of-Spain Gazette*, 27 December 1889, p. 4, <https://dloc.com/UF00094730/07323/images> (accessed 17 December 2022).

47 A Lady Astronomer, *op. cit.* (note 10), at p. 200.

Brown did, however, record some observations. She described observing the planet Venus ‘shining brightly in a nearly vertical line above the Sun’. She also noted the absence of both ‘streamers projected to a distance’ and any marked solar prominences.⁴⁸ It appears that Brown and Jefferys had useful discussions about the eclipse observation with two men on the island. Immediately after the eclipse, the women compared notes with Mr Smart and a ‘Canon T-’, who had apparently been observing the eclipse totality at a location near the female astronomers. Mr Smart requested that a report of her observations be sent to the local newspaper, which would later be mentioned in a *Port-of-Spain gazette* article on the eclipse dated 27 December.⁴⁹

Despite Brown’s recognition in the Trinidad newspapers, the notes on astronomical progress published in the February 1890 *MNRAS* claim that ‘At Trinidad clouds prevented observation’.⁵⁰ While it is true that the party did not collect much scientific data, this was not caused by clouds, or any other inability to observe. This RAS report clearly was not a complete description of what happened in Trinidad on the day of the eclipse. Whether this lack of recognition was deliberate or inadvertent, it was at the very least a missed opportunity to note general observations from Trinidad that corroborated those of the RAS observers. Such a note was made of comparison with the American observers in French Guiana, but not with results from Brown and Jefferys.⁵¹ The absence of coronal streamers from their astrographic plates was arguably the most significant finding of the British observers.⁵² Brown made this observation without the use of photography.

FATHER PERRY IN FRENCH GUIANA

After the passage from Southampton to Bridgetown, Perry and Rooney parted company with Brown and Jefferys. The British Admiralty ordered two naval ships—the HMS *Comus* and the HMS *Forward*—to transport the men and all their equipment to the Îles du Salut, three small islands about seven miles off the coast of Cayenne, French Guiana. By 7 December they had completed initial scoping work and determined the best site to observe the eclipse would be the Royale Island in the Îles du Salut. Much of the information on their time there comes from Rooney’s eclipse report published in the *MNRAS*.⁵³

The Îles du Salut had been the site of the first notorious French penal settlements in French Guiana, which started in 1852. That year, the first 2000 convicts from shipyard prisons of mainland France had been taken to the Îles du Salut to fulfil their prison sentences. In subsequent years, French Guiana became a place to which convicts from both mainland France and its overseas colonies would be sent. Conditions for the imprisoned were appalling. Violence and brutality combined with diseases such as yellow fever and malaria

48 *Ibid.*, pp. 200–202.

49 Anonymous, *op. cit.* (note 46), at p. 4.

50 Anonymous, ‘Notes on some points connected with the progress of astronomy during the past year’, *Mon. Not. R. Astron. Soc.* **50**, 217–253 (1890) (<https://doi.org/10.1093/mnras/50.4.217>), at p. 220.

51 See ‘Corona American’ telegram comment in H. H. Turner, ‘Report of the Eclipse Committee of the Royal Astronomical Society, 1890 March 14’, *Mon. Not. R. Astron. Soc.* **50**, 265–287 (1890) (<https://doi.org/10.1093/mnras/50.5.265a>), at p. 267.

52 For discussion on the absence of coronal streamers by the other expeditioners, see A. Taylor, ‘The total solar eclipse of December 21–22, 1889’, *Observatory* **13**, 348–351 (1890) and E. S. Holden, ‘Eclipse of December 21, 1889’, *Pub. Astron. Soc. Pacific* **2**, 93 (1890) (<https://dx.doi.org/10.1086/120103>).

53 See Rooney’s report in Turner, *op. cit.* (note 51).

led to alarming death rates. Between 1852 and 1866 around half of the convicts transported to French Guiana died there.⁵⁴ From 1887 all hard labour convicts in mainland France and French territories were transported to French Guiana for excruciating punishment.⁵⁵ The penal system in French Guiana was gradually shut down during the mid twentieth century, with some surviving convicts being repatriated as late as the 1960s.⁵⁶

Rooney reported that there were 700 convicted people on the island when he and Perry arrived at Île Royale in 1889. He also describes the population of the imprisoned, ‘150 being French, the rest Arabs, Mahometans, and Chinese’ who were ‘guarded during the day by 40 wardens, who always carry loaded revolvers, and at night by 60 infantry’.⁵⁷ The French government had ordered the work of the convicted prisoners to be placed at the disposal of the visiting astronomers. Perry and Rooney had chosen a ‘disused garden’ 200 feet above sea level to be their observation site. Convicts assisted the British astronomers in transporting their bulky observation equipment uphill along the rough road to the designated location.

Besides Rooney and Perry, there were other astronomers who had travelled to the Îles du Salut to observe the eclipse. Astronomers Sherburne Wesley Burnham and John Martin Schaeberle of the Lick Observatory had come from the United States.⁵⁸ The experienced eclipse observer, Charles H. Rockwell, joined them independently from New York. Also there was French astronomer Eugène Aymar de la Baume Pluvinel, who had been commissioned by the French government to view the eclipse.⁵⁹ The British expeditioners shared an observation station with de la Baume Pluvinel. The Americans had arrived at French Guiana earlier than the other astronomers and set up at a location in Cayenne rather than the Îles du Salut.

Other manual labour involved in eclipse preparations included setting up tents, readying the foundation for a telescope stand and cementing the legs of observing equipment so that they would be in exact alignment with the desired observing position during the eclipse. In addition to this work, some of the imprisoned people made further contributions to the eclipse observation efforts. The report of de la Baume Pluvinel provides insight on these roles.⁶⁰ He specifically thanks the commander of the penitentiary for placing at his disposal three of the most intelligent convicted prisoners, who helped to both repair and assemble observation equipment in time for the eclipse (see figure 2).

Military personnel also assisted with astronomical adjustments in preparation for eclipse observations. This evidences further collaboration between the British observers and the French colonial leadership. Additionally, a condemned cell had been given to Perry and Rooney to use as a photographic dark room. At the time when the astronomers were there, the Îles du Salut had two hospitals—one for military personnel and one for the

54 Stephen A. Toth, *Beyond Papillon: the French overseas penal colonies, 1854–1952* (University of Nebraska Press, 2006).

55 B. F. Martin, ‘Devil’s island’, in *France and the Americas: culture, politics, and history: a multidisciplinary encyclopedia* (ed. Bill Marshall and Cristina Johnston), p. 372 (ABC-CLIO, Santa Barbara, CA, USA, 2005).

56 Sophie Fuggle, ‘From green hell to grey heritage: ecologies of colour in the penal colony’, *Interventions* 24, 897–916 (2022) (<https://doi.org/10.1080/1369801X.2021.1892507>).

57 See Rooney’s report in Turner, *op. cit.* (note 51), at p. 275.

58 S. Burnham and J. M. Schaeberle, ‘II. Report of S. W. Burnham and J. M. Schaeberle: total solar eclipse of December 21–22, 1889’, *Contrib. Lick Observatory* 2, 1:22–1:46 (1891).

59 John McCaldin Loewenthal, ‘Letter from Trinidad, 7th–14th January 1890’, in *John McCaldin Loewenthal: letters home from a Victorian commercial traveller, 1889–1895* (ed. M. Fink and R. Boyd), pp. 23–26 (Moore & Weinberg, Ann Arbor, MI, 2022).

60 A. de la Baume Pluvinel, ‘L’éclipse totale de soleil du 22 Décembre 1889’, *L’Astronomie* 9, 161–168 (1890).



Figure 2. A sketch of assembled observation apparatus from de la Baume Pluvinel's eclipse report.¹⁰⁰

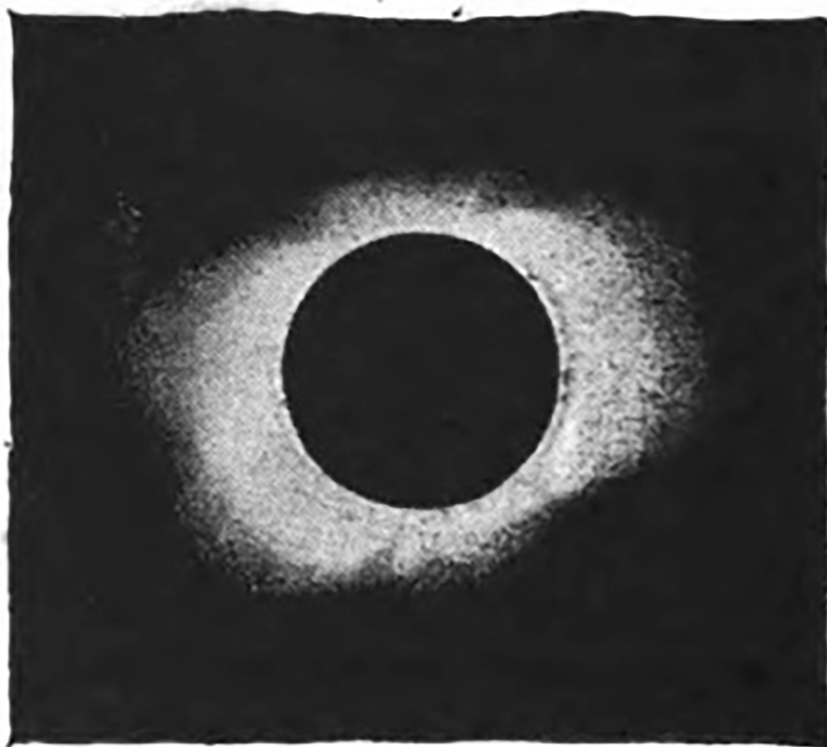
imprisoned. They were provided rooms in the former in which to stay during their time in the French colony.

The British astronomers awoke early on the day of the eclipse. Rooney describes finding Perry in great pain at 3:30 am and administering some medication. Somewhat improved, Perry asked for help from a navy officer to move over to the observing site. Clouds obscured the sky as the time of totality approached, but the skies cleared just a few minutes before totality. Both Rooney and Father Perry were able to successfully observe the eclipse, Father Perry saying 'This is the most successful observation of the kind that I have ever had anything to do with'.⁶¹ They were pleased with their photographs, one of which is reproduced in figure 3.

Although Father Perry persevered through the eclipse observation, shortly thereafter he revealed that he was quite ill. Rooney described the ailment as dysentery. The likely underlying cause of this was malaria, which had plagued the lives of thousands of people imprisoned in the French colony. After observing the eclipse, Perry was seen by the staff surgeon on board the ship *Comus*. A few days later, on Friday 27 December at 4:20 pm, he died on board the ship en route to Demerara, adding a bitter end to what had otherwise been a successful eclipse expedition.

In the final acknowledgements of his French Guiana eclipse report to the RAS, Rooney thanks the crew members of HMS *Comus* and HMS *Forward* for their assistance with the

61 See Rooney's report in Turner, *op. cit.* (note 51), at p. 280.



22 December 1889 (PERRY)
(From photographs)

Figure 3. A reproduction of a photograph taken by Father Perry of the corona during the total solar eclipse on 22 December 1889.¹⁰¹

eclipse observations and their great care for Father Perry during his illness. Captain Atkinson, Lieutenant Thierens and Commander Gray are specifically named in these thanks and throughout the report. There is no acknowledgement of the assistance provided by prison labourers.

ALBERT TAYLOR IN ANGOLA

The second official RAS party went to Angola, led by Albert Taylor. After more than a month of sailing, Taylor landed in the port city of Luanda five weeks in advance of the eclipse. At the time, Angola was a Portuguese colony. It was in fact among the most important coastal holdings during the so-called Scramble for Africa, when formal European control

expanded. By 1914 Liberia and Ethiopia were the only remaining independent African states.⁶²

Portugal's longstanding presence in Angola had begun in the sixteenth century with involvement in the slave trade. People were purchased to work on sugar plantations in other Portuguese territories, such as São Tomé and Príncipe. Although Portugal ended its formal involvement in the slave trade in 1836, systems of labour resembling slavery continued in Angola throughout the late nineteenth century.⁶³

Before arriving in Africa, Taylor had been in communication with the acting British consul in Angola. The British functionary, a Mr Edward Bannister, had 'very kindly offered his services if he could in any way assist in the expedition'.⁶⁴ There seem to be two interventions by Bannister, both of which involved securing support from the Portuguese colonial power. First, Bannister acquired permission to allow Taylor to land his instruments in the country without inspection by custom house authorities. This both expedited Taylor's arrival and reduced the odds of breaking the RAS mirror mounted by Common. Second, it is likely that contact through the British consul gained support for the expedition from the governor general of Angola.

At the time, the governor of Angola was Guilherme Augusto de Brito Capelo (1839–1926), the younger brother of João Carlos de Brito Capelo (1831–1901). João Carlos, a meteorologist and vice-admiral of the Portuguese Navy, had been an observer at the Lisbon observatory who had gone on eclipse expeditions to Spain (18 July 1860) and Tavira, Portugal (22 December 1870).⁶⁵ The Luanda meteorological observatory was for some time named after him. One may perhaps speculate that the governor general's willingness to assist may have been influenced by his familiarity with the elder de Brito Capelo's observational work.

A site at Cape Ledo had been selected for Taylor's observing station. The location was on a small peninsula in the south of Mastote Bay (also known as Baía do Suto) and described as being in an 'unexplored district, where the natives were hostile'.⁶⁶ American astronomers in a nearby camp described Cape Ledo as 'a bold and rocky headland, about 300 feet in height, in parts nearly perpendicular'. They reported the region as 'totally uninhabited', but mentioned 'visits from various cannibal chiefs' of the 'Quissama tribe'.⁶⁷ The people of this region, more commonly spelt as 'Kisama', have a long history of resistance to Portuguese colonization. The Portuguese only gained territorial control of Kisama in the early twentieth century. As such, at the time of the eclipse, Cape Ledo was most likely under the jurisdiction of one of Kisama's

62 Thomas Pakenham, *The scramble for Africa: the white man's conquest of the dark continent from 1876 to 1912* (Random House, New York, 1991).

63 Catherine Higgs, 'Happiness and work: Portuguese peasants, British laborers, African contract workers, and the case of São Tomé and Príncipe, 1901–1909', *Int. Labor Working-Class Hist.* **86**, 55–71 (2014) (<https://doi.org/10.1017/S0147547914000064>).

64 See Taylor's report in Turner, *op. cit.* (note 51), at p. 272.

65 Vitor Bonifácio, Isabel Malaquias and João Fernandes, 'Solar photography in the nineteenth century: the case of the Infante D. Luiz observatory in Lisbon (1871–1880)', *J. Astron. Hist. Heritage* **10**, 101–113 (2007); André Pires Fernandes, 'Biografia de João Carlos de Brito Capelo', MA thesis (Escola Naval, Alfeite, Almada, Portugal, 2017); Susana Lima, *Grandes exploradores Portugueses* (Dom Quixote, Portugal, 2012).

66 See Taylor's report in Turner, *op. cit.* (note 51), at p. 272.

67 Mabel Loomis Todd, *Total eclipses of the Sun* (Roberts Brothers, Boston, 1894), p. 189. Todd's report of cannibalism is likely false and sensationalized, see for instance J. J. Monteiro 'On the Quissama tribe of Angola', *J. Anthropol. Inst. Great Britain & Ireland* **5**, 198–201 (1876) (<https://doi.org/10.2307/2841394>). The Kisama resisted full Portuguese control until the 1920s. This, along with a broader history of Kisama's resistance to colonization, is discussed in depth in Jessica A. Krug, *Fugitive modernities: Kisama and the politics of freedom* (Duke University Press, New York, 2018) (<https://doi.org/10.1515/9781478002628>).

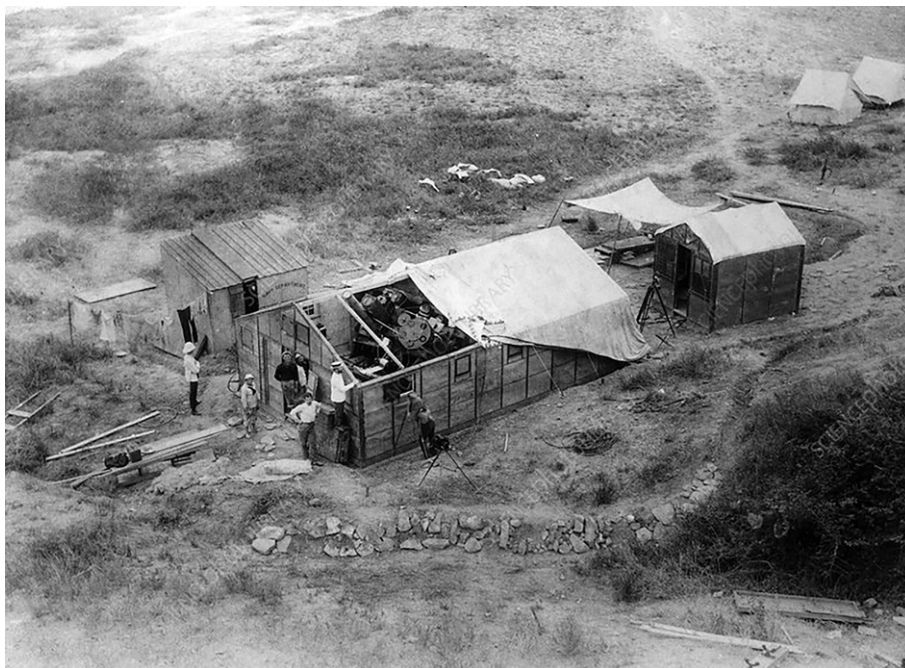


Figure 4. Huts from the 1889 US eclipse expedition to West Africa, led by US astronomer David Peck Todd. This camp in Cape Ledo was near the British observation site.¹⁰²

native leaders, called ‘sobas’. It is worth noting, therefore, that although Taylor describes receiving much assistance from Portuguese administration in his expedition, the observation site was likely not actually under Portuguese control. As described by Americans staying at the camp, in figure 4, there was clearly some interaction between the astronomers and the people of Kisama, but it does not appear that any conflict ensued.

A gunboat, *Bramble*, was sent to the astronomers from Fernando Po (present-day Bioko, an island in northern Equatorial Guinea) and a ship *Archer* with tents and supplies was immediately dispatched from the Cape of Good Hope to assist the expedition. The latter was a ship from the Cape Squadron, which had been established to suppress the Atlantic slave trade.⁶⁸ The governor general also personally provided ‘surf-boat kindly lent to the expedition’ to help cope with the challenges of landing delicate astronomical equipment in the surf at Cape Ledo. It seems that full resources of the British ships were available to the astronomers.

By 10 December all the observing equipment had been carried inland 400 yards (around 370 m) to the observing station. The latitude of the station had been determined, the ground cleared and the sites of the instruments fixed. A few days later the weather was conducive to setting up the photoheliograph and 20-inch reflecting telescope. They tested and adjusted the focus of each instrument by taking some trial star photographs. The party of at least six

⁶⁸ M. Chiswell, ‘The Cape Squadron, Admiral Baldwin Walker and the suppression of the slave trade (1861–4)’, MA thesis, University of Cape Town (2003).

military observers spent four days carefully rehearsing their eclipse protocol. Everything looked very hopeful.

Unfortunately for Taylor, bad weather conditions prevented a successful observation of the eclipse on 22 December. His official report states that 'No trace of the Corona was seen and no exposures were made with either instrument during totality'.⁶⁹ They promptly packed up and sailed off on the *Bramble*, arriving in Luanda the afternoon of 23 December. They departed Luanda just after Christmas and arrived in Liverpool on 20 February.

British eclipse observers did not work in isolation for any part of their expeditions for the total solar eclipse of 22 December 1889. In addition to support with logistics and scientific work on location at the observation sites, the eclipse expeditions also benefited from extensive pre-trip preparations. The planning committees organized independently by the Royal Society and the RAS both did significant advance work for the expeditions. The committees not only secured funding and negotiated with governments, but also discussed scientific objectives, set priorities, provided instruments and procured transportation for observing parties. In 1894 these efforts were formalized into a JPEC tasked with facilitating future British eclipse expeditions, further institutionalizing this work.⁷⁰ The JPEC would go on to play a significant role in arranging the 1919 eclipse.

FREE USE OF 'AMPLE RESOURCES OF LABOUR' IN 1919

In a report on the 1919 expedition, Eddington explained that his Príncipe party had chosen as its base Roça Sundy, the headquarters of a plantation owned by Jerónimo José Carneiro, who had delayed a trip to Europe in order to host the eclipse observers.⁷¹ Eddington reported that he and Cottingham had been 'Sr. Carneiro's guests during our whole visit, and used freely his ample resources of labour and material at Sundy'.⁷² They lived with Sr Atalaya, the plantation manager, for five weeks. The report mentions that 'native carriers' transported the British astronomers' baggage through woods after they were inaccessible by the tram initially carrying the luggage to Sundy. Plantation workers, local mechanics and carpenters were involved in the construction of observing huts and setting up of apparatus used by Eddington and Cottingham.⁷³

Príncipe at the time was a Portuguese colony. As alluded to briefly in the discussion of de Brito Capelo for the 1889 eclipse expedition to Angola, Portugal has a long history of formal involvement in astronomy. The Astronomical Observatory of Lisbon was active from at least the late 1860s.⁷⁴

Brief mention is made of the assistance of 'Vice-Admiral Campos Rodrigues and Dr. F. Oom', distinguished astronomers of the Lisbon observatory, for having given

69 See Taylor's report in Turner, *op. cit.* (note 51), at p. 274.

70 Minutes of the Joint Permanent Eclipse Committee, 2 May 1894, RAS Papers 54/1, Royal Astronomical Society Library, London.

71 Frank Watson Dyson, Arthur Stanley Eddington and C. Davidson, 'IX. A determination of the deflection of light by the Sun's gravitational field, from observations made at the total eclipse of May 29, 1919', *Phil. Trans. R. Soc. Lond. A* **220**, 291–333 (1920) (<https://doi.org/10.1098/rsta.1920.0009>).

72 *Ibid.*, at p. 313.

73 See mention of 'native labourers' in A. S. Eddington, 'Letter from A. S. Eddington to Sarah Ann Eddington, 29 April–2 May 1919', Ref No: EDDN/A/4/7, Trinity College Library, Cambridge.

74 Pedro M. P. Raposo, 'Observatories, instruments and practices in motion: an astronomical journey in the nineteenth-century', *J. Hist. Sci. Technol.* **8**, 69–104 (2013).

Eddington and Cottingham introductions during their expedition to Príncipe.⁷⁵ However, record of the contributions of Portuguese astronomers and governmental administration is muted in Eddington and Cottingham's eclipse report. Recent work by Simões suggests that this is likely due to 'Portugal's status as [a] colonial power and related accusations of slave labor in Príncipe'.⁷⁶

While slavery there had been formally abolished in 1875, the island attracted international criticism for inhumane treatment of labourers into the twentieth century.⁷⁷ The British chocolate company Cadbury Brothers, for example, sourced cocoa from Príncipe and came under intense scrutiny in 1905 for the alleged poor treatment of plantation labourers. It is only within the decade before Eddington's arrival that issues such as improving pay and working conditions were being more seriously addressed.⁷⁸

In addition to the labourers at Roça Sundy, two British 'negro's [sic] from Sierra Leone', identified as Mr Wright and Mr Lewis, also notably assisted Eddington's expedition.⁷⁹ They both worked at the Príncipe cable station and would have therefore assisted with telegraph communication on the island. Wright and Lewis also interpreted for Eddington from Portuguese to English, thus facilitating daily communication. Eddington's writing mentions 'observers' accompanying him during the eclipse. A careful reading of this suggests that Wright may have been involved in more technical aspects of eclipse observation such as deciding on plate changes or noting exposure times.⁸⁰ In a letter to his mother, Eddington credited Wright and Lewis as some of the 'principal people' involved in his work on the island.⁸¹ Eddington also acknowledged the assistance of the pair in his official expedition report.⁸² Still, their participation in the expedition is infrequently identified in relevant modern literature.⁸³

The local logistics for the Crommelin and Davidson expedition to Brazil in some ways parallels those of the Príncipe party. On arrival in Brazil, all their baggage was transported

75 Dyson *et al.*, *op. cit.* (note 71).

76 Ana Simões, 'In the shadow of the 1919 total solar eclipse: the two British expeditions and the politics of invisibility', *Berichte zur Wissenschaftsgeschichte* **45**, 581–601 (2022) (<https://doi.org/10.1002/bewi.202100040>), at p. 44. This paper gives a careful discussion on the invisibility of Portuguese involvement in the 1919 expedition.

77 Richard Ellis, Pedro G. Ferreira, Richard Massey and Gisa Weszkalnys, '90 years on: the 1919 eclipse expedition at Príncipe', *Astron. Geophys.* **50**, 4.12–4.15 (2009) (<https://doi.org/10.1111/j.1468-4004.2009.50412.x>); Gisa Weszkalnys, 'Príncipe eclipsed: commemorating the confirmation of Einstein's theory of general relativity', *Anthrop. Today* **25**, 8–12 (2009) (<https://doi.org/10.1111/j.1467-8322.2009.00686.x>).

78 Gervase Clarence-Smith, 'The hidden costs of labour on the cocoa plantations of São Tomé and Príncipe, 1875–1914', *Portuguese Stud.* **6**, 152–172 (1990).

79 Eddington, *op. cit.* (note 73).

80 Simões, *op. cit.* (note 76).

81 Eddington, *op. cit.* (note 73).

82 Dyson *et al.*, *op. cit.* (note 71), at p. 313.

83 In Elsa Mota, Paulo Crawford and Ana Simões, 'Einstein in Portugal: Eddington's expedition to Príncipe and the reactions of Portuguese astronomers (1917–25)', *Br. J. Hist. Sci.* **42**, 245–273 (2009) (<https://doi.org/10.1017/S0007087408001568>), p. 245, it is only said that Eddington and Cottingham 'thanked two locals, the plantation landowner Jerónimo Carneiro and his foreman, Atalaya'. Lewis and Wright, both of whom Eddington also explicitly thanked, are not mentioned. In Daniel J. Kennefick, *No shadow of a doubt: the 1919 eclipse that confirmed Einstein's theory of relativity* (Princeton University Press, Princeton, 2019) (<https://doi.org/10.1515/9780691190051-010>), pp. 163–164, it is incorrectly claimed that Lewis and Wright were not mentioned by Eddington to his mother. The source only speculates about the possibility that they assisted the eclipse expedition when there is explicit discussion of their support by Eddington: see Eddington, *op. cit.* (note 73) and Dyson *et al.*, *op. cit.* (note 71), at pp. 296–302. Whereas Joshua Roebke, 'The 1919 solar eclipse experiment that confirmed relativity was built with sweat and hard, physical labor', *Massive science*, 29 May 2019, <https://massivesci.com/articles/eddington-solar-eclipse-1919-albert-einstein-general-relativity-principe-sobral-gravity-light/> (accessed 17 December 2022), highlights underrecognized physical labour that supported the eclipse expedition, no mention is made of the assistance provided by Lewis and Wright.

directly to Sobral without examination in customs, courtesy of the Brazilian government.⁸⁴ Crommelin and Davidson benefited throughout their stay from interpreter services provided by Dr Leocadio Araujo of the State Ministry of Agriculture in Brazil. During the actual eclipse, Araujo assisted Crommelin and Davidson with precisely tracking the passage of time while they made their observations. The Brazilian interpreter was the one who alerted them to the exact moment of second contact, i.e. when totality began. Araujo called out every tenth beat of a metronome once the eclipse began, which allowed for the determination of exposure times for the different astrographic plates used by the British astronomers. These exposure times were used to correct for atmospheric differential refraction and astronomical aberration in the analysis of their results. Their official report describes Araujo as having ‘contributed greatly to our success’.⁸⁵

Another contribution came from the deputy of Sobral, Colonel Vicente Saboya. The British observers were hosted in his home, and thus relieved of all details related to local accommodations. Furthermore, permission was arranged for Crommelin and Davidson to locate their eclipse station at a jockey club near Saboya’s house. The huts built on the site were constructed locally, perhaps by government staff or day labourers.

Although Brazil had once been—like Príncipe—a Portuguese colony, it had been recognized as independent since the 1820s. This contributed to a dynamic between the visiting British astronomers and Brazilian astronomers that differed from that in Príncipe. In Brazil there was greater exchange of benefit between the visiting scientists and the local community, while in Príncipe the support flowed primarily in one direction. Although the observatory of Lisbon had been founded in 1860 and there existed a community of established Portuguese astronomers, resources had not been dedicated to the development of astronomy in Príncipe. For Portugal, Príncipe was primarily a peripheral agricultural colony, and one that happened to be located in the path of totality in 1919. Brazil, meanwhile, viewed the eclipse as an opportunity to boost their astronomical profile.

The first emperor of Brazil, Dom Pedro I, had founded a national observatory in Rio de Janeiro in 1827. His successor, Dom Pedro II, likewise maintained a keen interest in astronomy and actively engaged in the affairs of the observatory.⁸⁶ This fostered a local community of astronomers, including Henrique Carlos Morize, a naturalized Brazilian, who served as director of this observatory between 1908 and 1930.⁸⁷ Morize was thus director in 1912, when Brazil proved an unfortunate observing destination for parties hoping to observe a total solar eclipse at Cristina.⁸⁸ American astronomer Charles Dillon Perrine, then director of the Argentine National Observatory, had gathered an Argentinian team to attempt to verify general relativity by observation. They had a plan very similar to what would eventually succeed, but bad weather disappointed them in 1912. The starfield was obscured by clouds.⁸⁹

84 Dyson *et al.*, *op. cit.* (note 71), at pp. 296–302.

85 *Ibid.*, at p. 297.

86 S. O. Kepler, ‘Astronomy in Brazil’, *Proc. Int. Astron. Union* **6**, 18–26 (2010) (<https://doi.org/10.1017/S1743921310004795>).

87 *Ibid.*, at p. 18.

88 For a survey of observations of eclipses in Brazil in the period, see Christina Helena de Motta Barboza, ‘Science and nature in astronomical expeditions to Brazil (1850–1920)’, *Bull. Paraense Museum Emílio Goeldi. Hum. Sci.* **5**, 273–294 (2010) (<https://doi.org/10.1590/S1981-81222010000200006>).

89 Santiago Paolantonio, Leonardo Pelliza, Claudio C. Marambaia, Néstor Camino, Mariana Orellana and Beatriz Garca, ‘The Argentinean attempts to prove the theory of general relativity: the total solar eclipses of 1912, 1914 and 1919’, *Proc. Int. Astron. Union* **13**, 516–519 (2018) (<https://doi.org/10.1017/S174392131900070X>).

Starting in 1917, Morize began a vigorous campaign to promote Brazil as a destination to observe the 1919 eclipse. He hoped to convince international astronomers that there was a better chance of confirming general relativity in Brazil a second time.⁹⁰ If successful, Morize's efforts to recruit observers could communicate to the world that Brazil was a destination for world-class science. Valuable scientific insights generated from eclipse observations had potential, too, to help Morize secure continued funding to improve the national observatory in Brazil.⁹¹

To raise interest, Morize produced a circular advertising Sobral as an ideal destination for viewing the eclipse. The JPEC, in fact, learned of Sobral from this circular, which contained 'copious information of the meteorological conditions, mode of access, &c.'⁹² Morize likewise emphasized in *L'Astronomie* that Sobral was an optimal location from which to confirm Einstein's theory because of excellent climate conditions. He further highlighted the local population as a compelling reason to visit, describing the people as 'douée d'une notable vitalité'.⁹³ To reach a wider audience, Morize also distributed his circular in Portuguese. This was done with the assistance of Lélío Gama, a calculator at the national observatory, who also helped to produce a map of the recommended observing area, pictured in figure 5. Despite the active involvement of these Brazilians in planning the expedition to Sobral, their role is frequently omitted or understated in the literature.⁹⁴

Beyond help in the planning stage, British astronomers also received assistance with other aspects of the expedition in 1919. Simões points out that the resources made available to the astronomers played a role in their success.⁹⁵ For example, Grageira, the representative of the Sociedade d'Agricultura on the island, provided ice in Príncipe so that photographic plates could be developed at the right temperature. In Sobral, Crommelin and Davidson similarly made use of local clay plots (referred to as 'earthen-ware water-coolers'⁹⁶) for temperature regulation during the development of their photographic plates. The results attributed to Einstein and Eddington ultimately depend on these contributions and those of countless unnamed others have been overshadowed by the activities and observations of more prominent people.

RECOGNIZING THE HIDDEN LABOUR BEHIND THE ASTRONOMY

The British eclipse expeditions in 1889 and 1919 respectively mark the start of an RAS standing committee designated to plan British eclipse expeditions, and a landmark eclipse expedition noted for collecting data that verified Einstein's general theory of relativity.

90 The description of the camp in Sobral and emphasis on production of images of the solar corona indicate that the priority of Brazilian astronomers was to study the coronal spectrum. The British, meanwhile, were trying to confirm Einstein's theory. See Renaldo Nicácio da Silva Júnior and Christina Helena de Motta Barboza 'History and memory of glass: Brazilian photographs of the 1919 eclipse in Sobral', *History, Sciences, Health – Manguinhos* 27 983–1000 (2020) (<https://doi.org/10.1590/S0104-59702020000400015>). With Barboza, *op. cit.* (note 88), this helps to clarify the success of scientific collaboration around the 1919 total solar eclipse in Brazil.

91 Antonia Augusto Passos Videira, 'Henrique Morize and the total solar eclipse of May 1919', *Revista Brasileira de Ensino de Física* 41, e20190135 (2019) (<https://doi.org/10.1590/1806-9126-RBEF-2019-0135>).

92 Dyson *et al.*, *op. cit.* (note 71), at pp. 296–302.

93 Videira, *op. cit.* (note 91).

94 For example, in Peter Coles, 'A revolution in science: the eclipse expeditions of 1919', *Contemp. Phys.* 60, 45–59 (2019) (<https://doi.org/10.1080/00107514.2019.1624000>), the involvement of the likes of Gama, or even the national observatory director Morize, is not mentioned. For another example, see Richard Dunn, 'Weighing light in the tropics: the 1919 eclipse', *Astron. Geophys.* 60, 2.30–2.31 (2019) (<https://doi.org/10.1093/astrophys/atz100>). Despite dedicating a section to 'international cooperation', only vague mention is made of 'astronomical colleagues in Brazil', none of whom are named.

95 Simões, *op. cit.* (note 76).

96 Dyson *et al.*, *op. cit.* (note 71).

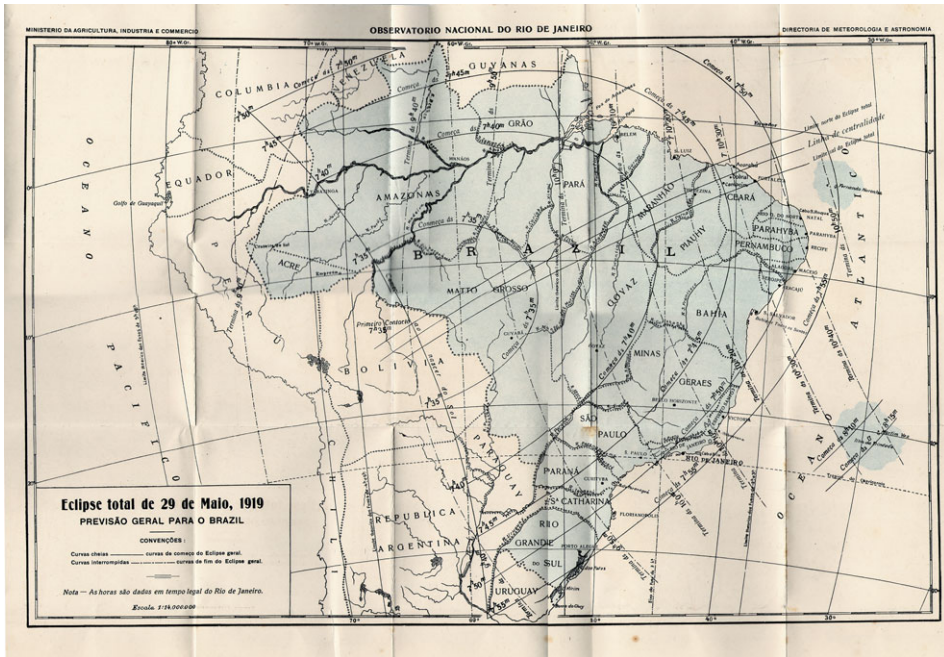


Figure 5. A map of the zone of totality in 1919 prepared by Lélío Gama.¹⁰³

From the selection of sites to arrangement and facilitation of transportation to post-event observation processing, all of these expeditions depended at every stage on help that arose from an invisible infrastructure of personal connections and global dynamics.

Local labourers built or outfitted temporary observatories and set up camp, including unpacking, assembling and calibrating instruments. British eclipse observers further benefited from technical support in determining longitude for observational sites and positioning instruments in advance of the eclipse. Practical assistance provided on location helped visiting observers to navigate customs processes and manage communications—with both translation and telegraph services—as well as to address myriad other details involved in managing daily logistics in unfamiliar places. Observing parties also had help tracking time, making observations and recording results during the event itself. Provision of ice and insulated vessels meant the delicate process of photographic development could be completed to preserve images from the event. Prominent names like Einstein and Eddington nonetheless overshadow existing narratives of eclipse expeditions.

As is evident in Brown's expedition narratives, it can be difficult to invert sources that were generated from the voyager's perspectives, while accounts from or about local participants are often scarce. Accessible sources can thus constrain scholarly efforts to investigate the often uncredited labour foundational to eclipse expedition results. This paper aims to highlight ways that assistance to the 1889 and 1919 eclipse expeditions has been underrecognized. The 1889 expedition clearly illustrates how astronomical work done by women, such as Elizabeth Brown and Martha Louisa Jefferys, was written out of contemporary reports.

It also indicates ways in which these women enjoyed many benefits in the colonial context of Trinidad—residents of African descent described in Brown's account spoke English at a

reasonable level and the women astronomers expressed little fear of experiencing hostility in a British colony where they enjoyed personal connections at senior government levels. In contrast, local workers in Îles du Salut involved with eclipse activity were guarded prisoners, subjugated under strict control by the French government. They likely did not interact with visiting astronomers beyond receiving instructions for eclipse preparation. The situation in Angola was different again. The region that is now known as Angola was culturally heterogeneous, with a variety of indigenous groups experiencing different levels of Portuguese colonial control. Though aided by resources of Portuguese administration, the astronomers in Cape Ledo were in a region of Angola whose locals were particularly defiant to colonization.

Matters of gender, race, nationality and privilege can gain new interpretations through processes of encounter and negotiation that comprise the transformative circulation of science.⁹⁷ Current scholarship is further investigating these matters, though much work remains to provide a truly global perspective on the range and interplay of contributing roles to nineteenth- and early twentieth-century eclipse expeditions.⁹⁸ The 'E3 Global' initiative aims to provide a truly global perspective on all participants in the famous 1919 expeditions. Similar future projects would assist in developing a more comprehensive view of the diffuse and interconnected efforts that contributed to scientific results from nineteenth- and early twentieth-century eclipse expeditions.

DATA ACCESSIBILITY

This article has no additional data.

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97 Kapil Raj, 'Beyond postcolonialism ... and postpositivism: circulation and the global history of science', *Isis* **104**, 337–347 (2013) (<https://doi.org/10.1086/670951>).

98 The 'E3Global' initiative, led by Ana Simões, professor at the University of Lisbon, is a project designed to address this. The initiative aims to provide a truly global perspective on the 1919 eclipse expeditions. See: 'A global history of the total solar eclipse of 1919', *E3Global*, <https://e3global.cihct.org/> (accessed 16 December 2022) and Ana Simões and Ana Matilde de Sousa, *Einstein, Eddington, e o/and the eclipse: impressões de Viagem/travel impressions* (Chile com Carne, Lisbon, 2019), at p. 227.

99 Dyson *et al.*, *op. cit.* (note 71), at p. 293.

100 de la Baume Pluvinel, *op. cit.* (note 60).

101 Todd, *op. cit.* (note 67), at p. 155.

102 Royal Astronomical Society/Science Photo Library.

103 Reprinted with permission from Antonia Augusto Passos Videira, 'A participação brasileira no eclipse solar total de maio de 1919: observando a cora solar para mehor defender a ciência', *Ciência e Cultura* **71**, 23–26 (2019) (<https://dx.doi.org/10.21800/2317-66602019000300008>), at p. 23.