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Behind the Scenes

The 1919 Total Solar Eclipse and the Invisible Labor of the Portuguese and Brazilian Observatories

▼ **ABSTRACT** This paper discusses the politics of invisibility involved in the expeditions to observe the May 29 1919 total solar eclipse, during which two British teams confirmed the light-bending prediction made by Albert Einstein: Charles R. Davidson and Andrew C. C. Crommelin in Sobral, Brazil, and Arthur S. Eddington and Edwin T. Cottingham on the African island of Príncipe, then part of the Portuguese empire. Historians have extensively discussed the different dimensions of this famous historical event, from its role in substantiating Einstein's theory of relativity to the widespread impact it had in local press around the world. Nevertheless, the success of the 1919 eclipse expeditions relied to a great extent on a network of Brazilian and Portuguese laborers who organized, managed, and made those expeditions possible, and whose work often passed unnoticed. This paper explores the sources of such an invisibility. It argues that the production of invisibility was twofold: on the one hand, it derived from Brazilian and Portuguese astronomers' own choice to eschew credit for the comprehensive logistical activities they carried out. On the other hand, the different geo-political contexts of Brazil and Portugal accounted for the visibility of Brazil *vis-à-vis* the invisibility of Portugal in this celebrated historical episode. By 1919, Brazil was preparing to celebrate the 100th anniversary of its independence in a phase of economic expansion, urban development, and the increasing application of techno-scientific

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solutions of societal problems, while Portugal was going through a very unstable political situation due to both internal and external factors, tied to the recent change of regime, World War I, and the clashes of European powers over their African colonial possessions.

▼ **KEYWORDS** Politics of Invisibility in Science; Albert Einstein's Theory of Relativity; Total Solar Eclipse of May 29 1919; Charles R. Davidson, Andrew C. C. Crommelin, and Arthur S. Eddington; Henrique Morize and Frederico Oom

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Introduction

On November 6, 1919, the representatives of the Joint Permanent Eclipse Committee met in a crowded room of Burlington House in London, where a joint meeting of the Royal Astronomical Society and the Royal Society was taking place. They presented the results of the eclipse expeditions organized to observe the May 29 total solar eclipse and to test Einstein's theory of general relativity in Príncipe, then a Portuguese colony, now part of the Republic of São Tomé e Príncipe, and in the city of Sobral in north-eastern Brazil. The verdict had long been awaited, and anticipation ran high. After a detailed report of the preparations for the expeditions and a description of their activities in Brazil and Príncipe, along with other technical details, the audience finally learned that the observations carried out by the British astronomers did indeed demonstrate that, during the total solar eclipse, the light of the selected stars had bent in accordance with Einstein's prediction.[1]

In this euphoric moment, the audience certainly paid much less attention to the acknowledgements. Yet, the Astronomer Royal Frank W. Dyson, who presented the overall results, and particularly Andrew C. C. Crommelin and Arthur S. Eddington, who reported on the observations they carried out in Brazil and Príncipe respectively, did not fail to acknowledge the local astronomers' and communities' collaboration, recognizing that they greatly contributed to the success of the enterprise.[2] The few spectators that happened to pay closer attention to the acknowledgements would have noticed that there was an asymmetry in the British teams' expressions of gratitude. The Brazilian government, astronomical and political communities were profusely thanked, while only scant words were reserved for the owner and the manager of the plantation (*roça*) Sundy, where the eclipse was observed in Príncipe. No thanks were given to the Portuguese government. Portuguese astronomers who

1 Dyson, Eddington, & Davidson (1920, pp. 331–332). As the paper reveals on its front page, it was communicated by the Joint Permanent Eclipse Committee and "read November 6, 1919." For the acceptance of Einstein's ideas in what has been recently dubbed as the "Einstein War," see Stanley (2019); Gates & Pelletier (2019).

2 Kennefick (2019, pp. 222–223); Stanley (2019, p. 286). Interestingly, Crommelin presented the results from Sobral but did not author the paper read at the meeting and published a few months later.

helped the British team organize the expedition to Príncipe were mentioned, but not in the final acknowledgements, just in the section on Príncipe.

Nevertheless, the British astronomers relied on the aid provided by local astronomers, communities, and workers in Príncipe as much as in Sobral. Portuguese and Brazilian astronomers provided a variety of information that proved crucial for the success of the observations; local authorities and individuals offered the best facilities available for the astronomers to stay during their sojourn in the tropics and ensured the success of their travels; local workers provided manpower to transport the equipment, and to build supports for the instruments or protective structures for all the equipment. Additionally, as recently revealed, members of local elite not only provided the materials necessary to build the structures and successfully develop the photographic plates—clay pots and ice—but also participated in the observations.[3] All these actors became invisible in the official narratives of the eclipse expeditions as well as in the standard historiography.[4]

In a recent paper grounded in subaltern studies and studies of knowledge construction in the peripheries, Ana Simões has retrieved some of these invisible participants from the shadow of the eclipse. Based on a plethora of different sources, from scientific reports and publications to personal letters, she shows how local actors, events, and sites shaped the scientific expeditions to Brazil and Príncipe. Critical choices depended on the knowledge of local individuals, material conditions, and geopolitical contexts. They later shaped the way in which the eclipse was appropriated and perceived by the international community. The oral report of the British Joint Permanent Eclipse Committee, followed by the 1920 paper authored by Dyson, Eddington, and Charles R. Davidson, epitomized this set of conditions. The disproportionate recognition of support from Brazilian and Portuguese sources revealed the geopolitical asymmetry of the two sites of observations located in the two Portuguese-speaking nations of the time—Portugal and Brazil. On the one hand, Príncipe was a small island with poor infrastructure situated in the Gulf of Guinea on the periphery of a then-decaying Portuguese empire, a place so far away that only Eddington's Quakerism could perceive it as appropriate to test his observational expertise as well as his self-abnegation. On the other hand, Sobral was the second most important city of the state of Ceará in north-eastern Brazil, a massive country that was then preparing to celebrate the 100th centenary of its independence from Portugal, boosted by the economic growth of São Paulo and Minas Gerais and increasing immigration from Europe and Asia. Furthermore, the Portuguese colony of São Tomé and

3 Simões (2022).

4 On the politics of invisibility, see Kuchinskaya (2012; 2014). Olga Kuchinskaya uses the expression "politics of invisibility" in the sense of explicit or implicit actions of erasure, up to the total expungement associated with specific scientific effects or processes, as was the case with the risks associated with radioactivity released following the Chernobyl disaster. Her analysis can be extended to the case of scientific minorities, anonymous actors and go-betweens who were necessary actors in the processes of construction and circulation of scientific practices. We further argue that it should also be extended to an analysis of the reasons why, even today, many of these actors remain forgotten by historians of science despite decades of emphasis on the diversity of the scientific enterprise and its workers.

Príncipe had become notorious in the international political arena for accusations over the use of enslaved and/or forced labor at the turn of the 20th century. Backed by the influential industrialist family Cadbury, Príncipe's largest international cocoa buyers, this accusation had led to a confrontation between the British and Portuguese governments. Dyson and the members of the British expedition certainly did not ignore that accusation and its connection to Portugal's status as a colonial power and the broader geopolitical situation.[5]

In this paper, we explore a different instance of invisibility: the logistics that the Brazilian and Portuguese astronomers carried out to prepare the ground for the British expeditions. Although the British astronomers alluded to them in their reports' acknowledgements, their Brazilian and Portuguese colleagues explicitly omitted any reference to the arrangements they brought about in their own official reports. Nevertheless, the letters exchanged between the Joint Permanent Eclipse Committee and the national astronomical observatories of Rio de Janeiro and Lisbon, the reports written by the director of the Brazilian observatory, and a variety of different letters, telegrams, and brief notes—now held in the observatories' historical archives—offer a glimpse into the key role played by these individuals in preparing the British eclipse expeditions. Despite extensive scholarship on the 1919 total solar eclipse and its contribution to proving Einstein's theory of relativity, the agency of the participants from the periphery remains absent in standard narratives, in part because of their own decisions. This paper shows how these experts played a crucial role in the twisted process of knowledge construction. The knowledge from the periphery thus ought to be considered in order to produce a more comprehensive narrative of the 1919 total solar eclipse.[6]

This paper seeks to explore the nature of labor in science by highlighting the agency of previously overlooked experts from the periphery. Historians have traditionally equated labor in science with intellectual work, often neglecting the contributions of those who work behind the scenes. Steve Shapin has already drawn attention to the crucial yet often ignored role of "invisible technicians," whose contributions were vital but largely unrecognized by both historical figures and historians themselves.[7] More recently, scholars such as Lissa Roberts, Alexandra Hui, Seth Rockman, and others have urged historians to look beyond the conventional focus on the intellectual work of white male elites from the Global North.[8] In this paper, we examine the boundaries of scientific work itself. We argue that logistics activities, often dismissed as unimportant, were central to what science was (and is) at the turn of the 20th century. Despite their importance, not only were these activities overlooked by the scientists of the time—in this case Morize and Oom—but the contributions of other key players in this area were also disregarded. Jenny Bangham, Xan Chacko, and Judith Kaplan have recently emphasized that many workers accepted invisibility

5 Simões (2022).

6 On the role of periphery in knowledge construction, see Gavroglu et al. (2008); Diogo, Gavroglu, & Simões (2016).

7 Shapin (1989).

8 Hui, Roberts, & Rockman (2023).

as part of their roles.[9] Logistical work and the technical activities in which it was grounded provide a clear example of this phenomenon. This paper further elaborates on this notion, shedding light on those who played a critical role in the success of the eclipse expedition yet failed to receive recognition, either by erasing themselves out of the picture as in the case of the directors of the observatories of Rio de Janeiro and Lisbon, by being rendered invisible by contemporary scientists, or by the omission of their authorship, awards, or other public acknowledgments from historical narratives. By bringing these characters and activities to the forefront of historical analysis, we aim to offer a broader understanding of how science works and of its inherently collective nature.

In the first section of this paper, we address the plan devised by Henrique Morize, the director of the National Observatory (ON) of Rio de Janeiro, to make the eclipse observation in Brazil not only a key event in the history of eclipse observations but also a pivotal opportunity to project, both nationally and internationally, an image of Brazil as a modern country and showcase the merits of its scientific community. In the second section, we take a similar look at the Portuguese case, and particularly to the astronomer Frederico Tomás Oom, deputy director of the Observatory of Lisbon, who was responsible for laying the groundwork for the British team's observation on the Island of Príncipe. Public support for the eclipse preparations in Brazil and the fact that a Brazilian team also observed the eclipse, contrary to what happened in Portugal, account for the fact that Morize, unlike Oom, had great success in engaging with the public dimension of the event. This is the subject of the third section. The paper finishes by contrasting the Portuguese and Brazilian cases, and analyzing the reasons for Brazil's visibility in the reports elaborated in the aftermath of the eclipse and in subsequent historiography, as compared with Portugal's invisibility.

Behind the Scenes I: Morize Places Sobral in the Astronomical International Arena

On March 9, 1917, roughly 2 years before the celebrated eclipse, the fellows of the Royal Astronomical Society met, and among the topics discussed, Dyson presented his considerations on the opportunities afforded by the eclipse of May 29, 1919 to verify light bending, one of the predictions of Einstein's recent theory of gravitation. After introducing the topic, he gave the floor to the astronomer Robert Hinks, then President of the Geographical Society of London, to list and comment on the various possible locations for the observations to take place, with the path of totality passing from the Amazon basin across the Atlantic to the Congo basin. Seven places were suggested, including Sobral, Brazil, and Príncipe, the two finally selected by May 1918. The other places included St. Paul's Rocks in the Atlantic, Cape Palmas in Liberia, Libreville in the then French Congo, the west shore of Lake Tanganyika, and the White Fathers at Lusaka. Concerning Sobral, a city in the Brazilian state of

9 Bangham, Chacko, & Kaplan (2022, p. 5).

Ceará, connected to the port of Camocim by train, Hinks considered it "to be the best" location, and declared that his information had been provided by an Institute at Fortaleza, the capital city of Ceará. He stated that Príncipe was "a well-developed Portuguese island which became celebrated a short time ago owing to the politicians" interest in "slave cocoa," and that it appeared to be "an agreeable place for an eclipse expedition," but that he still lacked information on its meteorological conditions.[10]

Just 3 months later, at the beginning of June 1917, Morize, who had joined the National Observatory of Rio de Janeiro in 1884 and become its director in 1908, was contacted by Charles Perrine, the director of the Argentine National Observatory, one of the first astronomers to attempt to use the eclipse to measure light deflection.[11] Morize was certainly not familiar with Einstein's theory of gravity, when Perrine sent him a letter calling attention to the forthcoming eclipse and stressing the central role that the National Observatory of Rio de Janeiro could play on that occasion.[12] As Perrine informed his Brazilian confrère,

> The expeditions that will be sent from all parts of the world, war permitting, will have to depend on your Observatory for almost all kinds of information, such as the kind of weather that is usual at that time of the year, the number of clouds, rainfall, and so forth, the exact position of the villages on the line of the eclipse's totality that can be used as observation stations: the method of transportation and whether there are hotels, warehouses, and so forth.[13]

Perrine also announced in the same letter that he intended to send a team to observe the eclipse in Brazil.

In late June 1917, Alberto Loefgren (Johan Albert Löfgren), the Swedish-born Brazilian botanist of Rio de Janeiro's Botanical Garden, also addressed a letter to Morize asking for information on the eclipse path in the north-eastern state of Ceará.[14] Loefgren had been contacted by John Christopher Willis, who had served for years as director of Rio de Janeiro's Botanical Garden, where he met Loefgren and invited him to direct the Garden's botanical section.[15] Aware that Loefgren had travelled around Ceará state in the past, Willis did not hesitate to ask him for information for London on Ceará's topography and on prospective sites well-suited for astronomical observations. Loefgren did not wish to disappoint his British former colleague, and immediately urged Morize to supply a map showing the path of the

10 [Report on session of March 9] (1917). The section discussing the upcoming total solar eclipse of May 29 1919 covers pp. 153–157, citations on pp. 154–155.

11 On the important role played by Perrine in testing Einstein's theory, see Crelinsten (2006, pp. 57–61); Kennefick (2019, pp. 29, 97, 113–114); Paolantonio (2019).

12 For a biography of Morize, see Videira (2003).

13 Perrine to Morize [Letter] (1917, Jun. 1), Museu de Astronomia e Ciências Afins Archive, Rio de Janeiro, Brazil. Our translation.

14 We thank Alda Heizer for helping us identifying Loefgren's signature.

15 On Willis and Loefgren, see Casazza (2012); Heizer (2018). Willis was about to become a Fellow of the Royal Society, and was registered as one on May 15, 1919: Royal Society (1940, p. 506).

eclipse in Brazil. He ended his letter by attempting to stir Morize's nationalistic sentiments: "It would be a shame if Brazil were not the first on this occasion."[16]

On the other side of the Atlantic, in Lisbon, the same nationalistic mood prevailed. After the eclipse, the elderly director of the Astronomical Observatory of Lisbon, César Augusto de Campos Rodrigues, signed a letter of appreciation most likely written by the Observatory's deputy director, Frederico Tomás Oom, in which he thanked the Colonial Centre and the representative of the Colonial Agricultural Society for all the support they had provided to Eddington and Andrew T. Cottingham in their astronomical observations on Príncipe Island. In his words, "I am pleased to see once again demonstrated to the scientific world the high sympathy that the Portuguese, everywhere and always, demonstrate towards hospitality [duties] and the importance of science."[17]

In Europe, nationalistic sentiments swelled during the First World War, with scientists expelled from the scientific societies of countries that happened to be on opposite sides of the battlefield, leading academic figures on both sides of the conflict signing formal declarations supporting the war effort, and promising young scientists sent to the warfront.[18] Nevertheless, there was still room for an agenda of scientific internationalism. The total solar eclipse of 1919 offered a unique instance of what we might call informal science diplomacy, as its preparations took place in a context of warfare—and lingering hostility after the war—between the countries of the astronomers who wished to measure deflection and the physicist who predicted it.[19]

As the eclipse path happened to cross northeast Brazil and the tiny island of Príncipe in the Gulf of Guinea, on the periphery of the Portuguese empire, a role was reserved for the astronomical communities of these two Portuguese-speaking countries. In Rio de Janeiro and Lisbon, scientific internationalism was not regarded as being opposed to strong nationalistic pride. They were instead complementary. As Loefgren's and Rodrigues and Oom's words reveal, science diplomacy was perceived as an instrumental means to project an image of national magnificence abroad.

Reacting to these initial contacts, Morize did his best to take advantage of this unusual opportunity and immediately took action. In December 1917, he wrote to the chief of the Meteorological Section asking for precise information on the rainfall and cloud cover data from the region of Caxias and Teresina, on the border of Maranhão and Piauí states, west of Ceará (see Figure 1).[20] At this time Morize was considering the possibility of observing the eclipse in that remote area of northeastern Brazil. Nevertheless, access to these two towns was undoubtedly more difficult than to Sobral,

16 Loefgren to Morize [Letter] (1917, Jun. 26), ON Historical Archive, Rio de Janeiro, Brazil. Our translation.

17 Eddington to the President of Colonial Centre [Letter] (1919, Jul. 4), Arquivo Histórico dos Museus da Universidade de Lisboa, Observatório Astronómico de Lisboa (OAL), Lisboa, Portugal (hereafter AHMUL-OAL). Our translation.

18 Crelinsten (2006); Kennefick (2019); Stanley (2019).

19 The study of science diplomacy is blossoming. Among various references, see for example Davis & Patman (2015).

20 Morize to the Chief of the Secção Meteorológica [Letter] (1917, Jul. 7), ON Historical Archive.

Figure 1. Map of Brazil, 1927. From *Novo Atlas de Geographia* by J. Monteiro & F. d'Oliveira (1927), Lisbon, Portugal: Livraria Aillaud & Lellos (http://www.mapas-historicos.com/atlas-monteiro/atlas.htm).

in Ceará, as he learned from the extensive report that he received in the meantime from Benjamin de Oliveira, a telegraph engineer who had previously worked at the Astronomical Observatory. In this report, written during the second half of 1917, Oliveira described the accessibility and the conditions offered by the prospective sites of observation in Piauí and Ceará states, namely Teresina and Sobral.[21]

As far as Piauí was concerned, it was a long way to Teresina from either the coastal port of Amarração, Piauí, or Tutoia, Maranhão. From there, after a 12-hour journey, it was possible to reach the Parnaíba River and navigate down to Teresina in a very small and uncomfortable boat—aptly called a *gaiola* ("cage"). As Oliveira explained, "it can take either 4 or 20 days to Teresina." Furthermore, Teresina was an under-resourced city with "terrible hotels and sweltering heat." Sobral emerged as a much better option. It could be accessed via a train from the port city of Camocim, traversing 130 km in a journey that would take 5 hours, according to Oliveira's calculations.[22] It did not seem like it would be difficult to unload the instruments from

21 de Oliveira, B. (n.d.), "Apontamentos sobre a zona do eclipse" [Report], ON Historical Archive.

22 Morize would add one more hour in his "Informations sur la zône bresilieen de l'eclipse total du 28/29 Mai 1919." Our translation.

the boat in Camocim and transfer them to the train (Figure 2). Additionally, there were plenty of regular hotels in both Camocim and Sobral.[23] Sobral was, by then, the second city of Ceará state with about 30,000–35,000 inhabitants.[24]

With all this information available, sometime between the end of 1917 and the start of 1918, Morize decided that Sobral was the most appropriate place from which to observe the eclipse in Brazil, and immediately contacted the foreign astronomers who sought to travel to Brazil to observe the eclipse. Once again, Perrine was to play an important role. Based on Oliveira's report, Morize wrote a three-page account in French "Informations sur la zone brésilienne de l'éclipse totale du 28/29 mai 1919," probably on March 7, 1918.[25] Crommelin, secretary of the Royal Astronomical Society; Edward C. Pickering, director of Harvard College Observatory; and Count Aymar E. de la Baume Pluvinel, then president of the Société Astronomique de France and former participant on several French eclipse expeditions, were among those who received a copy of Morize's "Informations."[26] In the brief letter accompanying Morize's account, these leading astronomers could recognize the role of go-between being taken up by the director of the Argentine National Observatory:"At the request of Professor C. D. Perrine, I have the honor of transmitting to you some information I have gathered concerning the solar eclipse of May 28/29, 1919."[27]

By May 10, 1918, 2 months after Morize's "Informations" was sent to major observatories, the unpublished minutes of the Joint Permanent Eclipse Committee show that the initial seven locations had been narrowed down to three, including Sobral and Príncipe.[28]

The minutes of the sub-committee of the Joint Permanent Eclipse Committee of December 17, 1918 also inform us about the care taken to contact authorities in both countries. Eddington announced that he had recently initiated correspondence with the National Observatory of Lisbon, and that all possible assistance would be given. He further reported that he had obtained the necessary leave of absence from the university's authorities. In turn, Dyson stated that "in reply to a communication to the Brazilian Legation in London, he was informed that the Brazilian Government had been requested to afford every possible assistance and facility to the party of observers going to Brazil."[29] Thus, unlike Príncipe, where Eddington was free to choose his observational spot, in Brazil, the selection of the place depended ultimately on the knowledge of local individuals. Behind the scenes, Morize, as detailed in what follows,

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23 de Oliveira, B. (n.d.), "Apontamentos sobre a zona do eclipse" [Report], ON Historical Archive.

24 Morize (1920, p. 71) claimed 30,000 in his report on the Brazilian expedition.

25 The ON Historical Archive preserves two undated copies of this account. A draft titled "Informations sur la zone brésilienne de l'éclipse totale du 28/29 mai 1919," which has in the top left-hand corner the handwritten phrase in pencil in Portuguese, "5 exemplares" (5 copies); and a clean copy of the document sent with no title, addressed to "Monsieur et Honoré Confrère."

26 Letter signed by Morize (1918, Mar. 7), ON Historical Archive. The three names are identified in a handwritten note at the bottom.

27 Letter signed by Morize (1918, Mar. 7), ON Historical Archive. The original is in French. Our translation.

28 The unpublished minutes of the Joint Permanent Eclipse Committee show that on November 10, 1917 a sub-committee, including Dyson and Eddington, was appointed to handle the May 1919 eclipse.

29 Minutes of JPEC (1918, Dec. 14), Royal Astronomical Society, London, UK.

Figure 2. Map of Brazil showing the railways in 1913: Detail of Ceará and Piauí states. From *Carta da Viação Ferrea do Brasil* by M. Calmon et al. (1910), Library of Congress Geography and Map Division, Washington, DC (http://hdl.loc.gov/loc.gmd/g5401 p.br000060).

had been crucial for the successful involvement of the Brazilian government. If not for Morize, Sobral could have become known on the international astronomical stage for the wrong reasons.

In fact, after sending the information on Sobral's conditions in relation to the eclipse to the major observatories, Morize focused on making it a successful episode in the international history of eclipse observations. He therefore turned his attention to the scientific community in Brazil and on securing political support, in light of his experience of the 1912 solar eclipse observed in Minas Gerais state.[30] Morize did his best to engage the Brazilian powers that be, from local authorities to federal politicians and even the country's president.

In July 1918, Morize addressed a document to the Minister of Agriculture, Industry and Commerce, João G. Pereira Lima (the ON was under his purview), requesting extraordinary funding to prepare for the eclipse observation and the reception of the foreign astronomers who were expected to visit the country on that occasion. He emphasized the superb conditions for observing the eclipse in Brazil in comparison to the far worse circumstances expected, according to him, on the west coast of Africa. He put pressure on the minister by claiming that, because of Brazil's excellent conditions, he had already been contacted by astronomers from a variety of countries, including Argentina, Spain, the United States of America, France, and the United Kingdom. The leading astronomers of the time would thus rely on Brazilian expertise

30 Barboza (2019, p. 24). A survey of the eclipse observations in Brazil can be found in Barboza (2010).

and ability for their reception and support. Morize asked for 50 *contos de réis* in funding: 40 for the transportation and accommodation of the foreign astronomical committees, and 10 to account for the expenses of preparing the Observatory's instruments and other equipment, "so as not to be in a position of inferiority to foreign astronomers who will come equipped with the best instruments." The sum of 50 *contos de réis* corresponded at the time to just over £8,100, which was a considerable sum if we consider that, in May 1918, the Joint Permanent Eclipse Committee was offered £11,000 by the British government to finance the expeditions to both Brazil and Príncipe.[31] The minister accepted the request and sent it up to the president. On October 9, 1918, President Wenceslau Braz P. Gomes submitted the bill of 50 *contos de réis* to the National Congress of Brazil.[32]

Provided with such a budget and, more importantly, with the authority it afforded —we will see that the money took long to make its way to the National Observatory —Morize mobilized the local politicians in Sobral and Ceará's representatives in the Brazilian Congress's Chamber of Deputies. On November 13, 1918, he was already writing to the federal deputy of Ceará, Ildefonso Albano, calling his attention to the prospective eclipse that was going to be observed in *his* state, the observation of which was being prepared with the help of 50 *contos de réis* granted by the National Congress of Brazil.[33]

The logistics also included inquiring into the means of transport to access the area of eclipse totality. The report elaborated by Benjamin de Oliveira had informed the director of the National Observatory that Camocim could be reached from Fortaleza, the state's capital city, using steamboats of the Lloyd Brasileiro company. From Camocim the Viação Cearense railway allowed smooth travel to Sobral in the heart of Ceará (Figure 2). Morize contacted these companies' boards of directors and secured passage for the astronomical teams.

But Morize was still not content. To ensure that the observations would be successful, Morize decided to pay a last-minute visit to Sobral in the beginning of 1919. Together with his assistant Domingos Fernandes Costa, he departed from Rio de Janeiro on February 21 and returned on April 3, 1919.

The support of Ceará's politicians proved also crucial when, one month before the eclipse, there was an outbreak of yellow fever around Sobral. By that time, the British team was already in Pará, preparing to board their ship to Ceará, as soon as the final details had been settled by Morize with the directors of Lloyd Brasileiro, the steamboat company.

In that pressing moment of public health turmoil, Morize turned to Vicente Saboya de Albuquerque, a Ceará's federal deputy, native from Sobral. Albuquerque, in addition to offering the British team one of his comfortable houses in Sobral on the "government's behalf," urged the Internal Affairs minister (Ministro do Interior) to send a team to Sobral to administer insecticide to the houses and surrounding area.

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31 Kennefick (2019, p. 110).

32 "Actos do Poder Executivo" (1918).

33 Morize to Ildefonso Albano [Letter] (1918, Nov. 13), ON Historical Archive.

He also suggested some other measures that could mitigate the risk of infection. The most radical one involved buying an automobile—something that did not exist in Sobral—to transport the British team whenever possible to a more remote location on a mountain near the city, which was less affected by yellow fever mosquitoes. This car was to be purchased with the funds provided by the National Congress, and subsequently transferred or sold to the government of the state of Ceará. In the end, it was decided that some areas of the house where the British would be staying in Sobral would be covered with large textiles for protection. This measure required assistance, a workforce, and materials that Morize obtained by directly contacting the governor of Ceará and the mayor ("prefeito") of Sobral.[34] Everything was finally ready.

Upon his return to Rio de Janeiro, Morize named the Observatory staff who were to travel with him to Sobral. The Brazilian eclipse team, which was to make astrophysical observations was to comprise, besides himself, two assistant astronomers, one "calculator," one meteorologist, and one mechanical technician.[35] One further expert from the Geological and Mineralogic Service was to join the team, the chemist Theofilo Lee, who "because of his knowledge of the English language, will be of great service vis-à-vis the English and American Commissions."[36] This *official* team was accompanied by a variety of volunteers. "Because of their education and intelligence" these unpaid personnel were expected to assist the astronomers during the observations. Finally, in Morize's words, "It will also be necessary to hire subaltern staff such as carpenters, guards, servants, etc."[37] Most of these workers' names and roles were not listed in later reports, becoming invisible in the standard histories of the 1919 eclipse.

The British team was ultimately comprised of the reputed astronomers from Greenwich Observatory, Davidson and Crommelin.[38] In Sobral, they were joined by a team of observers from the Carnegie Institution of Washington, led by Daniel M.

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34 Morize to the Ministry of Agriculture, Industry and Commerce [Letters] (1919, Apr. 11, 12), ON Historical Archive.

35 They were, respectively, Domingos Fernandes Costa, Allyrio Hugueney de Matos, Lelio Itapuambyra Gama, Luiz Rodrigues, and Arthur de Castro Almeida.

36 Nevertheless, as one learns from the report on the Sobral expedition elaborated by Crommelin and Davidson, it was Leocádio Araújo who worked as a translator for the British (and presumably American) team. Dyson, Eddington, & Davidson (1920, p. 297).

37 Morize to the Ministry of Agriculture, Industry and Commerce [Letter] (1919, Apr. 8), ON Historical Archive. Our translation.

38 At the June 14, 1918 meeting of the sub-committee of the Joint Permanent Eclipse Committee, it was provisionally agreed that Eddington and Cottingham would go to Príncipe and that the Greenwich Observatory astronomer Charles R. Davidson and the experienced Jesuit astronomer Father Aloysius Cortie would go to Sobral: Minutes of JPEC (1918, Jun. 14), Royal Astronomical Society, London, UK. But by the meeting of December 14, 1918, Cortie announced that he failed to obtain a leave of absence from Stonyhurst College in Lancashire, where he was a professor of astronomy, "due to the absence of many of his colleagues in connection to the war": Minutes of JPEC (1918, Dec. 14), Royal Astronomical Society. Later, at the meeting of February 14, 1919, a letter from Cortie was read stating that "the Portuguese Provincial, Father Pinto, had requested to superiors in Brazil to welcome the members of the Brazilian expedition," evidencing the role of the Jesuit network in the preparatory work: Minutes of JPEC (1919, Feb. 14), Royal Astronomical Society. Dyson immediately suggested Crommelin, another experienced astronomer from Greenwich Observatory, to replace him.

Wise, who studied terrestrial magnetism, and including Andrew Thomson, who was responsible for observing the meteorological effects of the eclipse.[39] The war ultimately prevented the participation of the team from the Paris Astronomical Observatory, which was to include the secretary of the Eclipse Commission of the International Union for Cooperation in Solar Research; Perrine and the Argentine National Observatory's team also did not make it to Brazil.[40]

Behind the Scenes II: Oom and Logistical Support for the British Expedition to the Island Of Príncipe

While Morize in Rio de Janeiro was having great success in preparing to receive the foreign astronomers, in Lisbon, Frederico Tomás Oom, the deputy-director of the Lisbon Astronomical Observatory, faced similar challenges, but was subject to greater constraints.[41] But unlike Morize, Oom only responded to the British astronomers' requests, and did not attempt proactively to convince them of Príncipe's suitability as an observation site.

On November 11, 1918, the day the armistice was signed, a letter written by Eddington on behalf of the Joint Permanent Eclipse Committee arrived at the Astronomical Observatory of Lisbon. In this letter, the British astronomer presented the mission's goal: "We shall devote ourselves to measuring the deflection of light (if any) by the sun's gravitational field with a view to testing Einstein's theory of gravitation."[42] For that to happen, he asked his Portuguese colleagues for information on prospective accommodation and facilities on Príncipe and about transportation to this island under Portuguese sovereignty in the Gulf of Guinea. In the letter, Eddington referred to the geographer and astronomer Hinks, who, in his capacity of secretary of the Royal Geographical Society, had contacted the Lisbon Society of Geography in early 1917 to request additional information about Príncipe.[43] The letter concluded by stating that Dyson fondly remembered the welcome he and his British team had received when they travelled to Portugal to observe the total solar eclipse of May 28, 1900. Back then, the Lisbon astronomers—and Oom in particular

39 A description of the reception and the observations carried out by the British and the American teams in Sobral can be found in Crispino & Lima (2018); Rodrigues (2019); Videira (2019a; 2019b; 2020).

40 A. E. de la Baume Pluvinel to Morize [Letter] (1918, Apr. 22); Perrine to Morize [Letter] (1919, Apr. 5), Museu de Astronomia e Ciências Afins, Rio de Janeiro, Brazil.

41 On Oom's role in help preparing Eddington's expedition to Príncipe, see in particular Simões (2019).

42 Eddington to Astronomical Observatory of Lisbon [Letter] (1919, Nov. 11), Correspondence Eddington, AHMUL-OAL.

43 On this occasion, the Society of Geography of Lisbon asked the Colonial Agriculture Society for accommodation on Príncipe Island. As the director of its board would later report to the director of the Lisbon Astronomical Observatory, the Colonial Agriculture Society answered on April 13, 1917 that "This Society will be pleased to receive in its properties on the Island of Príncipe the English astronomical mission that will observe the solar eclipse due to take place in 1919 and to install it properly with its resources on the island." For some unknown reason, the Society of Geography of Lisbon's role as a go-between with the colonial institutions on the island of Príncipe turned out to be fruitless. J. Olivares Marin and P. de Gusmão to the Director of Lisbon Astronomical Observatory [Letter] (1918, Dec. 17), Eclipse Total do Sol, 1919 Maio 29, AHMUL-OAL.

—had provided excellent logistical, material, and scientific support to all the teams of foreign astronomers, whether professional or amateur, in the process adeptly seizing the opportunity to secure greater scientific and social relevance for astronomy in Portugal.[44]

Campos Rodrigues, the director of the Astronomical Observatory of Lisbon, addressed a warm reply to Eddington congratulating himself "not only on account of the scientific importance of the subject" but also for "the opportunity of being of some use to you and to Sir Frank Dyson." He regretted that he was not available to take care of the issue himself, but promptly indicated his right-hand man, Frederico Tomás Oom, to the job: "As I am not able now to take the matter into hands myself, I have intrusted [*sic.*] my assistant F. Oom to do it for me. Inclosed [*sic.*] you shall find his answer."[45]

Campos Rodrigues, known for his research in the field of stellar astronomy and the refinement of instruments, and recipient of the 1904 Vals prize, had been director of the Lisbon Astronomical Observatory since 1890, when the first director, Frederico Augusto Oom, committed suicide. In Lisbon, Campos Rodrigues has a reputation for self-effacement and simplicity, as he always avoided participating in public and even academic ceremonies. Therefore, Frederico Tomás Oom, son of the first director, began to assist Campos Rodrigues, as soon as he joined the Observatory staff in 1891, not only in astronomical work but also in the more bureaucratic activities related to directing the institution. Oom would replace Campos Rodrigues as director when the latter died on Christmas Eve, 1919.[46] It will come, then, as no surprise that Oom was given the task of making all the necessary arrangements for the British astronomers' trip to the island of Príncipe. A flow of correspondence between Oom and Eddington followed. Their letters almost exclusively covered logistical issues.[47] Only once did Oom timidly ask his British colleague: "Do you really think this would mean 'no deflection'?"[48]

In the first letter, Oom straightforwardly addressed the two issues that most concerned the British astronomer. He informed Eddington that the steamer company Empresa Nacional de Navegação continued to operate regularly during the war. Thus, two steamers regularly departed from Lisbon to the island of *São* Tomé each month, although not all stopped at Príncipe. Oom managed to arrange with the Company

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44 Carolino & Simões (2012; 2019).

45 Campos Rodrigues to Eddington [Letter] (n.d.), Eclipse Total do Sol, 1919 Maio 29, AHMUL-OAL. In fact, this letter may well have been written by Oom. Although he had a good command of the English language, this letter contains a spelling mistake that Oom repeated in other letters: "intrusted" instead of "entrusted."

46 A comprehensive biography of Campos Rodrigues, with rich insights into the astronomical community of the Lisbon Astronomical Observatory in the 19th and early 20th centuries, can be found in Raposo (2018).

47 Oom was also contacted by F. Brown from the Department of Research in Terrestrial Magnetism at the Carnegie Institution of Washington, who initially wished to carry out magnetic observations in Príncipe. Yet, in the end, Brown decided to go to Douala, on the west coast of Africa, now Cameroon. Brown to the Director of Lisbon Astronomical Observatory [Letters] (1919, Feb. 24; Mar. 24; Apr. 24), AHMUL-OAL; Director of LAO to Brown (1919, Mar. 13; Apr. 4), AHMUL-OAL; Oom to Eddington [Letter] (n.d.), Eclipse Total do Sol, 1919 Maio 29, AHMUL-OAL.

48 Oom to Eddington [Letter] (n.d.), Eclipse Total do Sol, 1919 Maio 29, AHMUL-OAL.

that, if necessary, the Empresa's steamboat could make an extraordinary stop at Príncipe island without extra charge. The plan was then to board the steamboat in Lisbon bound for Funchal, on Madeira Island, and then leave for *São* Tomé and thence to Príncipe.[49] On December 21, 1918, Eddington addressed a letter to Oom, thanking him for all the information and letting him know that "We shall certainly take the route you suggest by the Empreza Nacional de Navegação. I think we shall join it at Lisbon, coming to Lisbon by sea, probably early in March."[50] The accommodations on Príncipe remained an open issue. Eddington anticipated being on this island from the "latter half of April to the middle of June."[51]

In the following weeks, Oom contacted the Colonial Center (Centro Colonial), a private association of planters headquartered in Lisbon. Through the Colonial Agriculture Society (Sociedade de Agricultura Colonial) he managed to find a solution regarding accommodation. Jerónimo Carneiro, the largest landowner on Príncipe, offered his property on the island to be used by the British team of astronomers. One week later, in a letter dated December 28, 1918, Oom was proud to inform Eddington that he had just received news from Mr. Jerónimo Carneiro informing him that "for accomodation [*sic.*] my lodgings are at your disposal to use them as you may please, assuring you that the [British] astronomers shall be received in the best possible manner."[52]

There were, however, additional matters worrying Eddington. The observation location remained one of his foremost issues of concern. He wanted a place that was sheltered from the wind, if possible, and where they could safely leave the equipment protected from dust. Most importantly, it needed to have the highest likelihood of a clear sky. Unlike what happened in Brazil, Eddington would need to choose the proper place to observe the eclipse after his arrival on Príncipe. Additionally, the British team would need local labor to build a pillar for the coelostat and to transport the approximately 1–2 tons of material that Eddington expected to bring with him.[53] Once he reached Príncipe, Eddington realized that Carneiro's plantation Sundy fulfilled all these requirements. There was no lack of ready workers at Sundy. Oom managed to obtain from the transport company all possible guarantees that the equipment would be transshipped carefully and without customs examination. Finally, there was the no-less-important issue of language. In Eddington's words: "I suppose it is unlikely that our hosts would speak English. We are neither of us good French scholars, but could probably manage to speak it sufficiently, if they understand French."[54] This was the easiest challenge for Oom as there was a team of British

49 Oom to Eddington [Letter] (n.d.), Eclipse Total do Sol, 1919 Maio 29, AHMUL-OAL.
50 Eddington to Oom [Letter] (1918, Dec. 21), Correspondence Eddington, AHMUL-OAL.
51 Eddington to Oom [Letter] (1918, Nov. 11), "Memoranda," Correspondence Eddington, AHMUL-OAL.
52 Oom to Eddington [Letter] (1918, Dec. 28), Eclipse Total do Sol, 1919 Maio 29, AHMUL-OAL.
53 Eddington to Oom [Letter] (1918, Nov. 11), "Memoranda," Correspondence Eddington, AHMUL-OAL: there is a reference to 2 tons of material. In the letter of February 8, 1919, written by Eddington from Greenwich, it is specified that "we have rather more than a ton of baggage."
54 Eddington to Oom [Letter] (1918, Nov. 11), "Memoranda"; Eddington to Oom [Letter] (1919, Jan. 14), Correspondence Eddington, AHMUL-OAL.

technicians in Príncipe responsible for communications via submarine cable, who "because of their long and intimate contact with our [compatriots] are very familiar with the Portuguese language, and will therefore be the best interpreters for Your Excellencies."[55]

So, after last-minute difficulties with the shipping company in London, the British astronomers left Liverpool for Lisbon aboard the steamer *Anselm*. In Lisbon, Eddington, Cottingham, Davidson, and Crommelin had the opportunity to meet Oom in person. On their arrival on March 12, Oom gave them a tour of Lisbon in a cab hired for that express purpose. In addition to the city's most famous historical spots, the tour included the obligatory visit to the Astronomical Observatory of Lisbon.[56] The British astronomers then embarked for Funchal, Madeira, from which Eddington and Cottingham departed to West Africa on the ship *Portugal*, landing on Príncipe island on April 23. On May 4, Eddington wrote to Oom from the plantation Sundy, acknowledging all the support they had received on the island:

> We are being most kindly entertained by Mr.Carneiro, and have everything we could possibly desire. Everyone has received us most kindly and has given us every assistance. … This is a beautiful island, and besides making good progress with our work we are thoroughly enjoying our experiences.

Eddington's unfailing optimism led him to conclude, "All we need now is a fine day for the eclipse."[57]

Morize's Report on the Brazilian Mission to Sobral

On May 29, nature did not fully cooperate with the British astronomers in Príncipe. It was nevertheless possible to take at least six photographs, whose quality encouraged Eddington to write to his mother, "I hope they will give us what we need."[58] In Sobral, the eclipse observation was a success. Despite the overheating of the coelostat, which created problems with the focus, Crommelin and Davidson managed to obtain a few photos that, together with those taken in Príncipe, proved Einstein right. In neither case was observing the eclipse a solitary experience. In Príncipe, a group of local witnesses, which included Carneiro, the curator, one judge, three doctors, and Wright —one of the British Black technicians who worked at the cable station—observed the eclipse alongside Eddington and Cottingham.[59] Nevertheless, no Portuguese astronomical team took part in the observations. Manuel Peres, at that time director of the Observatory Campos Rodrigues in Lourenço Marques (now Maputo), Mozambique,

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55 Centro Colonial to Campos Rodrigues [Letter] (1919, Feb. 17), Eclipse Total do Sol, 1919 Maio 29, AHMUL-OAL.

56 Debt note of 24$00 from the Observatory to Frederico Oom "for the payment of the rental of a cab to drive the 4 astronomers of the official English missions destined to observe the eclipse of May 29, 1919, in Príncipe Island and Pará, on the day of their stay in Lisbon, March 12, 1919." Eclipse Total do Sol, 1919 Maio 29, AHMUL-OAL.

57 Eddington to Oom [Letter] (1919, May 4), Correspondence Eddington, AHMUL-OAL.

58 Quoted in Simões (2022, p. 593).

59 Simões (2022, p. 594).

tried to join the British team but did not make it.[60] In Sobral, Crommelin and Davidson's visit was a quasi-social event.[61] Ceará's political and social elites and the lower and illiterate classes all shared the professional astronomers' enthusiasm for the eclipse. These included not only Crommelin and Davidson, Thomson, and Wise, but also the team of Brazilian astronomers led by Morize.

One year after the eclipse, Morize published his report on the Brazilian mission to Ceará. It built on a conference report he delivered in February 1920 at the Brazilian Academy of Sciences (Sociedade Brasileira de Ciências), an institution founded in 1916. Morize served as its first director. This report is a very interesting document for several reasons. It describes the three teams of astronomers that observed the total solar eclipse in Sobral, identifying their respective elements and research goals, and sets out Einstein's theory of gravitation and the aims of the British astronomers in some detail.[62]

Unsurprisingly, the focus of the talk/report was on the Brazilian team. It includes, among others, a photo of the National Observatory personnel appointed by Morize to go with him to Sobral. The Brazilian team aimed to study the shape and composition of the solar corona, by photographing the corona and its spectrum during the total eclipse.[63] The growth of astrophysics in the last decades of the 19th century made this a particularly relevant area of research. With this goal in mind, the ON team transported to Sobral two photographic telescopes, one coelostat, and spectrographs, instruments extensively described by Morize in his report. These instruments and, above all, the expertise of the Brazilian team—the reader is supposed to learn from the report—allowed them to obtain a set of photographs that Morize considered to be of superlative quality.

Once again, Perrine was to play an instrumental role in Morize's efforts to credit the Brazilian astronomers in the national and international scientific arena. As Morize informed the audience that attended his conference at the Brazilian Academy of Sciences:

> Regarding them [the photographs taken by the Brazilian team] I consulted one of the world's leading authorities on eclipses, Prof. Charles D. Perrine, now Director of the Cordoba Observatory in the Republic of Argentina, whose government called him from the Lick Observatory, where his numerous and remarkable works had earned him well-deserved celebrity. I sent him some of our photographs and had the satisfaction of knowing that they were considered "splendid" and that the spectrum reproduced in them was admirable, and to quote the own words of my eminent colleague "*the most wonderful, I think, in my experience*," words that greatly honor Dr. Allyrio de Mattos to whom these plates are due.[64]

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60 For an analysis of why there was not a Portuguese team of professional astronomers observing the 1919 eclipse in Príncipe, see Mota, Crawford, & Simoɒes (2009).

61 In addition to the astronomical observations, carried out with the necessary professionalism, there were social receptions and parties, as was abundantly described in the Brazilian press. On this issue, see Rodrigues (2019).

62 Morize (1920); Videira (2019b).

63 Morize (1920, p. 70).

64 Morize (1920, p. 77). Our translation; italics in the original.

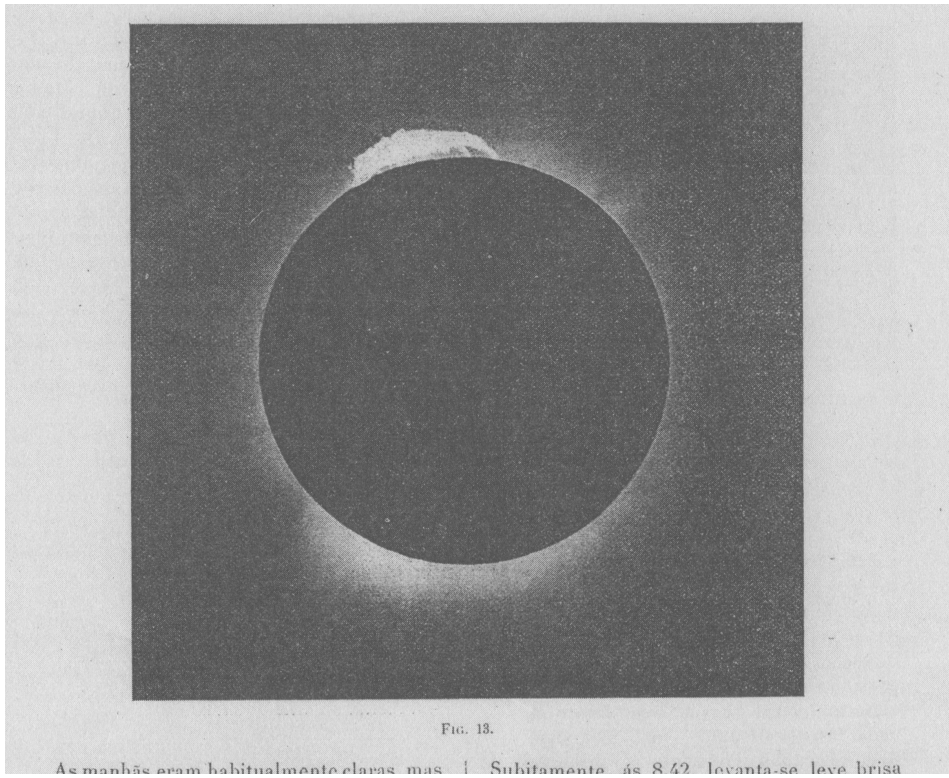

Figure 3. A photograph of the 1919 total solar eclipse taken by the Brazilian team in Sobral. From "Resultados Obtidos pela Comissão Brasileira do Eclipse de 29 de Maio de 1919" by H. Morize (1920), *Revista de Sciencias*, *4*(3), 75.

There was, however, one major omission from Morize's narrative: himself, or rather a description of the logistical activities he carried out prior to the eclipse. His involvement in preparing the reception of the British and American teams and his organization of the National Observatory team therefore passed unnoticed, except for the direct reference to the foreign expeditions observing in Sobral, which pointed indirectly to his action behind the scenes. Morize finished his talk (and his report) by quickly thanking his colleagues and collaborators for their commitment to making such a "hard task" a success, but named only one of those collaborators, the "preparator of physics" ("preparador de physica") at the Polytechnic School of Rio de Janeiro who had developed the photographs exhibited during the conference.[65] No further thanks were given to his team members. Nor was any mention made of the *crème de la crème* of Brazilian politics.

The omission was intentional. Like the great majority of astronomers active at the turn of the 20th century, Morize held an idealized belief in separation between

65 Morize (1920, p. 81). This was engineer Eugénio Hime.

science and the broader society in which it operated. Astronomers constantly claimed that science was universal in scope and should be pursued regardless of the political and economic constraints each state faced. This image of science led Eddington to remain silent regarding the use of a forced workforce in Príncipe's cocoa plantations.[66] In Brazil, Morize repeatedly described the scientist as someone driven exclusively by the "noble cult of truth" ("o nobre culto da verdade"), rather than by its practical applications, though recognizing their value.[67] On September 28, 1913, at the groundbreaking ceremony of what was intended to become the new building of the National Observatory in São Cristóvão, Rio de Janeiro (which today houses the Museum of Astronomy and Related Sciences), Morize made clear his vision of science and the role of the scientist in society:

> It can be confidently asserted that almost all the positive and material progresses, and even those able to become profitable are derived from purely theoretical work undertaken by disinterested researchers who considered themselves sufficiently rewarded for their efforts by the discovery of some new truth.[68]

For those who cherished this *ideal* conception of the scientist as someone who worked at the antipode of society and its economic needs, there was no room for a scientist-clerk who spent countless hours writing to the ministry and the ministry officials, addressing official letters to travel companies, and investigating the best possible ways and material conditions to receive his foreign colleagues in Brazil. This was exactly what Morize did for months, if not years. No wonder, thus, that he omitted all these logistical activities from his report on the achievements of Brazilian astronomers in the total solar eclipse of 1919. By doing so, these activities were eclipsed from the standard narrative. As a sign of its time, such invisibility reflects the mythologies constructed by the scientific community itself.

Brazilian Visibility Versus Portuguese Invisibility

While Morize in Rio de Janeiro, then the capital city of Brazil, seemed so reluctant to recognize the roles played by a plethora of local politicians, civil servants, and scientists, in far-away London, Dyson and Davidson did not hesitate to do so. They knew that those local individuals had been instrumental to the success of their scientific expedition to Sobral. Accordingly, they enthusiastically acknowledged Morize for the logistics support, Leocádio Araújo for his translation services and help during the observations, the civil and religious authorities of Sobral for their warm welcome, and above all, "the Brazilian Government for the hospitality and facilities accorded to the

66 Simões (2022, p. 591).
67 Morize (1917/2012b, p. 5).
68 Morize (1913/2012a, p. 6). Our translation.

observers in Sobral. They were made guests of the Government, who provided them with transport, accommodation, and labour."[69]

As guests of the Brazilian government, the English astronomers might have noticed that Brazil was a country in the making. With the institution of the Republic in 1889, new political players had taken the stage. After a few years dominated by the rule of military autocrats, elections were held, paving the way for a democratic regime with restrictions typical of the 19th and early 20th centuries. In the following decades, control of the Federal government was shared between the political oligarchies of São Paulo and Minas Gerais states, whose wealth and power were based on the growing economy of coffee and cattle (the so-called "milk-and-coffee republic"). Cities and local industry also expanded, animated by the never-ceasing arrival of European and Asian immigrants and by the restrictions imposed on manufactured imported goods during World War I.[70] With the rapid growth of cities, new problems were added to the older ones. This was very much the case for public health, with Brazil being regularly hit by a series of epidemic diseases. At the turn of the 20th century, there was the perception among the medical elite that "Brazil is still an immense hospital."[71] This gave rise to public health policies enforced by federal and state authorities, and soon materialized in the transformation of cities and the creation of medical and scientific institutions. Two examples were the Instituto Oswaldo Cruz, founded in Rio de Janeiro in 1900, which became famous for spreading hygienist policies from the coast to the hinterlands of Brazil, and the Instituto Butantan, established in São Paulo in 1901. Nevertheless, techno-scientific policy was in no way limited to public health. A significant number of new research institutions emerged in Brazil, while others got a new lease on life.[72] The National Observatory is a case in point. Inaugurated in 1827 by Pedro I, the "emperor of Brazil," the Observatory finally received proper facilities in 1922 when it was transferred from the city center (the morro do Castelo) to a new and proper building in São Cristóvão. Morize was its director. It was against this backdrop of scientific optimism, economic growth, and consolidation of the Brazilian political system that the observation of the total solar eclipse took place in May 1919.

Eddington did not thank the Portuguese government for its support as there was nothing to be thanked. Unlike the total solar eclipse of May 1900, when the Portuguese government set up a commission that was responsible, among other

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69 Dyson, Eddington, & Davidson (1920, pp. 296–297, 332–333. Here pp. 332–333). On November 14, 1919, 8 days later, the minutes of the Annual Meeting of the Joint Permanent Eclipse Committee explicitly mentioned: "It was resolved that the President of the Royal Society be requested to send a letter of thanks to the Brazilian Government, and to the Administrator of Príncipe, for the generous assistance which had been rendered to the Sobral and the Príncipe expeditions. The Chairman was requested to send letters of thanks to Dr. Morize, Director of the National Observatory at Rio, Dr. Jacome de Oliveira, Prefect of Sobral and Sr. Jerónimo Carneiro of Príncipe." This is the first and only time that in the minutes the name of Morize was mentioned. Minutes of JPEC (1919, Nov. 14), Royal Astronomical Society, London, UK.

70 There are several histories of Brazil in English that offer a sound description of these changes, from Burns (1970) to Schwartz & Starling (2019).

71 Quoted in Schwartz & Starling (2015, p. 333).

72 See, among many others, Heizer & Videira (2010).

Figure 4. Participants from the Brazilian, British, and American teams in Sobral in 1919: (from left to right) Luiz Rodrigues, Theophilo Lee, Daniel Wise, Henrique Morize, Charles Davidson, Andrew Crommelin, Allyrio de Mattos, Andrew Thomson, Domingos Costa, Lelio Gama, Antonio Lima, and Primo Flores. From "Eclipse de Sobral" by C. H. Veiga et al. (2017), *Observatório Nacional* (https://daed.on.br/sobral/).

duties, for the reception of the foreign astronomers who observe the eclipse in the north of Portugal, in 1919, there was no governmental involvement. Not only would the 1919 eclipse be observed on a very distant periphery of the Portuguese empire, but the country itself was undergoing a severe period of crisis. After its initial impetus, marked by a very progressive social reform policy, the Republican system, established in 1910, became increasingly embroiled in a tangle of problems dating back to the late 19th century: political instability, weak economic growth, and severe social tension. Portugal's intervention in World War I made matters worse. In 1917, a revolution led by the mathematician and military officer Sidónio Pais established a dictatorial regime that lasted until December 1918, when Pais was assassinated. A period of intense political conflict followed, pitting monarchists against republicans from different political backgrounds, with ex-King Manuel II waiting for the results in exile in Britain.[73]

Eddington was aware of the difficult period in Portuguese politics. Writing on February 8 1919, he seemed preoccupied by the prospect of having to postpone his

73 Marques (1976, Vol. 2, pp. 119–175); Schwartzman (1989).

departure from Britain because of the political turmoil. In his words: "We find that all sailings of boats to Lisbon have been cancelled for the present—I suppose owing to the revolution. I trust that you and the Observatory are unharmed."[74] The team of the Astronomical Observatory of Lisbon was safe, but with no prospect of participating in the eclipse observations as Morize did in Brazil. The absence of government support and of Portuguese involvement in the astronomical observation of an eclipse whose totality path crossed a distant region under Portuguese rule, a region notorious for the accusations of forced labor, all account for the fact that Oom's activities in preparing for the eclipse were rendered invisible in the published reports, and that they therefore passed unnoticed in future narratives of the eclipse observations.

In Brazil, Morize managed to contribute to the final decision of the Joint Permanent Eclipse Committee to opt for Sobral and also to obtain government support, which allowed him not only to assemble a team to observe the eclipse but furthermore to suitably receive the foreign teams. Additionally, Morize made use of other means to garner further visibility for science and the scientific community in Brazil. He made sure to engage a photographer to secure a visual record of the event, including pictures of the Brazilian team with the foreign observers, in a clear demonstration of transfer of authority from the latter to the former (Figure 4).[75]

Morize also aptly used the local press to his advantage. For example, while paying a last-minute visit to Ceará to check if everything was duly prepared for the great scientific event, Morize strove to establish a close relationship with Ceará's local press. In early March 1919, the local newspaper of Camocim, *A Folha do Littoral*, noticed that Morize stopped at the city on his way to Sobral.[76] On his way back to Rio de Janeiro later that month, Morize paid a visit to the newspaper's headquarters in gratitude for the news of his passage through Camocim. On that occasion, he offered to write an article about the eclipse of May 29, 1919, "specially written for the *Folha do Litoral*," as the newspaper proudly announced. This article was published on the front page of the March 23 edition (Figure 5).[77]

Morize also established a fruitful relationship with the local press in Sobral. He gave an interview to Sobral's newspaper *A Ordem*, in which he set out the fundamentals of an eclipse and explained why the 1919 eclipse was so important. He also briefly discussed the pressing question of dryness and the advantages of establishing a weather forecast network in Ceará's state. Furthermore, he used the occasion to promote the image of the scientist as someone friendly and unpretentious, inspired to widen public awareness of science. As the journalist reported,

74 Eddington to Oom [Letter] (1919, Feb. 8), Correspondence Eddington, AHMUL-OAL.

75 The photographer was most likely Mr. Pirajá, a local photographer identified by Morize in his report on the Brazilian mission: Morize (1920, p. 74).

76 "Dr. Henrique Morize" (1919).

77 Morize (1919).

Folha do Littoral

Orgão commercial e de informações geraes

ANNO II | CAMOCIM—DOMINGO, 23 DE MARÇO DE 1919 | NUM. 41

EXPEDIENTE

A «Folha do Littoral» é impressa em officinas proprias e publica-se aos domingos.

Não se acceitarão autographos que não estejam legalmente responsabilisados.

ASSIGNATURA ANNUAL 10$000
" SEMESTRAL 6$000
NUMERO AVULSO $200
" ATRAZADO $500

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—Em Sobral, Everaldo Porto.
—Em Granja, Cualter Porto
—Em Fortaleza, J. Ribeiro Soares.
— No Parazinho, Antonio S. Rodrigues
—Em Viçosa, Aderson Cavalcante.
Massapê: João Lyra Cavalcante.
S. Cruz: Antonio Theodoro Soares.
Ipú: Edgard Corrêa
Ipueiras: Hermogenes R. Moreira.
Nova Russas: Leonardo Araujo.
Pinheiro: Primilau Camerino.
—Hubatuba: Francisco Gregorio Veras

PAGAMENTO ADEANTADO

Redacção e Officinas—Rua da Estação
End. teleg. LITTORAL

O Eclipse de 29 de Maio de 1919

(Especialmente escripto para a «Folha do Littoral».)

DISSE Aug. Comte que o gráo de perfeição alcançado por uma sciencia se podia medir pela faculdade de emittir prophecias e pelo gráo de exactidão com o qual fossem estas realisadas.

Assim sendo, considerava elle a Astronomia como a primeira e a mais perfeita das sciencias, porque as prophecias por ella formuladas com grande antecedencia, se realisam com exactidão tal, que causa a admiração d'aquelles que não estão a par de seus methodos.

Entre os phenomenos astronomicos susceptiveis de serem previstos com larga antecedencia e consideravel rigor, se acham os eclipses. Os eclipses são phenomenos que se dão quando um astro penetra no cone de sombra projectado por outro e pelo Sól.

Distinguem-se na Terra, os eclipses do Sol e os da Lua. Os primeiros se dão quando a Terra, em seu movimento de revolução ao redor do Sol, atravessa o cone de sombra projectado pela Lua. Em outras palavras, quando a Lua vem collocar-se entre a Terra e o Sól, quasi em linha recta. No caso do eclipse de Lua, é pelo contrario, a Terra que fica interposta entre o Sol e a Lua, de maneira que é esta que penetra na sombra da primeira.

Os eclipses de Sol podem ser parciaes, annulares ou totaes, conforme a Lua, na sua passagem pelo disco solar, o obtura parcialmente, ou deixa um anel não encoberto, ou o esconde por completo. Os ultimos eclipses, os totaes, são os mais interessantes e, não sendo muito communs, são observados com bastante attenção pelos physicos e pelos astronomos.

A razão desse interesse reside na falta de conhecimentos exactos em que ainda estamos actualmente quanto á natureza do Sol, á sua composição, e á maneira pela qual pode irradiar constantemente calor, sem que sua temperatura pareça diminuir sensivelmente. O problema do Sól é pois de grande importancia para nosso planeta, porquanto tudo que se passa neste depende da actividade solar.

O Sol é formado por uma immensa esphera incandescente, cujo raio é 109 vezes maior que o da Terra, e dista de nós, em media, de 150000 milhões de kilometros.

A face do Sol dirigida para a Terra se denomina *disco solar*. Examinado este com uma lineta provida com vidros corados destinados a attenuar o seu brilho, notam-se partes relativamente escuras que são chamadas *manchas*. O contorno destas é habitualmente irregular e orlado por bordas mais brilhantes que formam as penumbras.

Na margem do disco, e mediante certos processos instrumentaes, longos de explicação, vêm-se jactes de chammas avermelhadas, denominadas protuberancias.

Nas condições habituaes, essas protuberancias não são visiveis, por serem muito menos luminosas que o disco, que forma a *photosphera*.

Quando o disco solar fica encoberto pelo da Lua, como é o caso nos eclipses totaes, a luz da photosphera desapparece, e pudem ser vistas as protuberancias ao redor do Sol, assim como delgada camada de gazes incandescentes, pouco luminosos e de côr avermelhada. A esphera desses gazes recebeu, em virtude dessa coloração, o nome de *chromosphera*. No seio desta se passam phenomenos interessantes que somente, por occasião dos eclipses podem ser estudados. Os dous methodos usados para isto são o espectroscopio e o photographico, habitualmente empregados em conjuncto.

Quando uma substancia gazosa, suficientemente aquecida, ou submetida a acção de um campo electrico, se torna luminosa, a sua luz, examinada ao espectroscopio fornece um espectro, ou faixa colorida, discontinua, em que se encontram raias ou linhas brilhantes caracteristicas das substancias em estado de vapor luminoso.

Se pelo contrario esses mesmos gazes ou vapores estiverem interpostos no caminho dos raios luminosos emittidos pelo nucleo do Sol, ou pela photosphera, elles produzem raias escuras que podem ser vistas no espectro solar, observavel nas condições habituaes.

A chromosphera constitue o assumpto dos trabalhos executados durante a totalidade, e, conjunctamente com ella, uma especie de resplendor, de forma variavel que cerca o disco, e se chama corôa.

O conjuncto do eclipse reveste aspecto imponente. No centro, o disco negro da Lua é orlado pela chromosphera rubra e pelas faixas da corôa, de cor cambiante.

O ceu fica escuro como se fôra noite, e apparecem as estrellas e os planetas. Na superficie da Terra, nota-se a diminuição da luz, sómente depois de 3/4 do disco solar estarem encobertos, mas de então em diante, a escuridão cresce rapidamente e quando começa a totalidade, é geralmente necessario accender lanternas para se poder tomar notas.

Antes da totalidade, as sombras projectadas pelo Sol parcialmente encoberto, através das folhas de arvore, se parecem com pequenos crescentes lunares.

Vêem-se muitas vezes, passarem pelo solo e as paredes de edificios, franjas alternadamente luminosas e escuras que se deslocam em certa direcção, e são chamadas sombras volantes.

Quando a totalidade se avisinha, os animaes domesticos dão signaes de inquietação, como se sentissem confusamente que se passa alguma cousa anomala. As gallinhas vão para seus poleiros, o gado se recolhe aos estabulos e os animaes selvagens se refugiam nos seus asylos habituaes. Certas plantas, como as sensitivas, por exemplo, e as suas congeneres da familia das leguminosas, tomam a posição de somno, em que as folhas se dobram e se juntam aos pedunculos.

Quanto aos homens ignorantes das regiões selvagens, produz-se entre elles verdadeiro panico. Pensam que as divindades infernaes vão destruir o deus bemfazejo do Sol, e procuram se oppor a isto fazendo toda a especie de ruido, como o rufar de tambores, o bater de latas e o clangor das trombetas. O homem verdadeiramente civilisado, porém não commette nenhum desses absurdos. Sabe elle que se trata de um phenomeno natural, obedecendo as leis eternas traçadas pela Providencia, e cujo conhecimento habilita os homens de sciencia a prever com todas as minudencias, aquillo que parece ao vulgo, mysterioso prodigio.

O eclipse futuro será caracterisado por excepcional duração da totalidade que alcançará 5m 12s em Sobral, e 5m 14s em Massapê. Em Camocim, que se acha muito ao lado da zona de totalidade, a duração será muito menor, e não foi calculada.

A totalidade se produzirá approximadamente ás 9 h 0 m, hora legal.

H. MORIZE

Perda sensivel

O Brazil acaba de perder um filho distincto com a morte do illustre sr. Conselheiro João Alfredo Correia de Oliveira, occorrido no dia 12 do corrente, no Rio de Janeiro.

O eminente estadista que tem o nome ligado aos feitos gloriosos da Monarchia brazileira, no segundo reinado, occupou logar saliente nos ministerios da publica administração, tornando-se uma verdadeira notabilidade entre os mais insignes homens publicos que se distinguiram como prestigiosos politicos e habeis estadistas no supremo governo do magnanimo Imperador D. Pedro d'Alcantara, de respeitosa e veneravel memoria.

O sr. Conselheiro João Alfredo nasceu na Ilha de Itamaracá, (Pernambuco) em 1835 e doutorou-se em direito em 1858, na tradicional Academia de Olinda, tendo deixado nesse estabelecimento juridico rastros inapagaveis de um bello talento, e sua these para o doutoramento é um attestado veridico de seu brilhante espirito vastamente illuminado por uma intellectualidade de escol.

A vida publica desse preclaro extincto está vinculada aos mais importantes successos que resultaram para a nossa historia a exterminação desse hediondo crime que tanto aviltava a querida patria brazileira—a Escravidão—sendo considerado o principal fautor desse feito nobilitante que apagou esse borrão negro no conspicuo céu deste Brazil amado.

Contando apenas 25 annos de idade foi eleito deputado geral por Pernambuco, e no desempenho desta representação firmou-se como um orador correcto e eloquente, chamando a attenção da assistencia daquelle tempo pelos monumentaes discursos que pronunciou sempre ouvido com profunda attenção o geral applauso.

Em outras legislaturas representou distinctamente Pernambuco na Assembléa monarchica até que foi escolhido Senador em 1876, na vaga occasionada pela morte do conspicuo estadista do Imperio o Visconde de Camaragibe.

Foi director da Faculdade de Direito do Recife, em substituição ao venerando Sr. Visconde de Camaragibe, que votava ao pranteado morto protectora estima e acendrada consideração.

Em 1870, no gabinete do Marquez de S. Vicente occupou a pasta do Imperio, continuando ainda no gabinete do inclito Visconde do Rio Branco que encontrou em João Alfredo um elemento poderoso para o combate franco ao elemento servil. Neste gabinete foi votada a humanitaria lei da libertação do ventre escravo.

O Conselheiro João Alfredo foi sempre um adepto decisivo da exterminação da escravatura, não somente na tribuna como na imprensa foi um pugnador sincero e abnegado, tornando-se um verdadeiro apostolo do abolicionismo.

Em 1888 chamado a organisar o Ministerio, acercou-se João Alfredo de homens que se notabilisavam pela sua illustração e civismo como fossem Thomaz Coelho, Antonio Prado, Vieira da Silva, Ferreira Vianna, Pereira Junior e Rodrigo Silva, e logo trataram de confeccionar a lei que devia ser sancionada pela excelsa Princeza Imperial Regente D. Isabel, —a Redemptora—que, em feliz momento, assignou o decreto que extinguia para todo sempre a escravidão no Brazil.

Ficou então cognominada a —Lei João Alfredo—a que deu liberdade a milhares de seres que viviam agrilhoados ao jugo nefando de um senhor despotico, quasi sem noção alguma de humanidade.

O illustre extincto presidiu as então provincias do Pará e de S. Paulo, em 1869 e 1885, respectivamente.

Com a queda da Monarchia, o egregio brazileiro afastou-se da vida politica, vivendo exclusivamente da advocacia, e só a muitos rogos do então presidente Marechal Hermes, foi que se resolveu a acceitar o elevado cargo de presidente do Banco do Brazil, em que se manteve com muita distincção.

Registrando o necrologio do sr. Conselheiro João Alfredo, deixamos nestes obscuros periodos registrada a nossa veneração á sua respeitavel memoria como de um dos mais beneméritos brazileiros.

Drs. Henrique Morize E Domingos Fernandes Costa

Devem hoje embarcar a bordo do paquete BAHIA que vem especialmente buscar por ordem do illmo. sr. director do Lloyd Brazileiro, na barra de Camocim, os exmos. srs. drs. Henrique Morize, illustre director do Observatorio Nacional e Domingos Fernandes Costa, assistente desse departamento astronomico que em missão especial vieram ao norte deste Estado escolher os pontos adequados a observação do eclypse solar em Maio proximo.

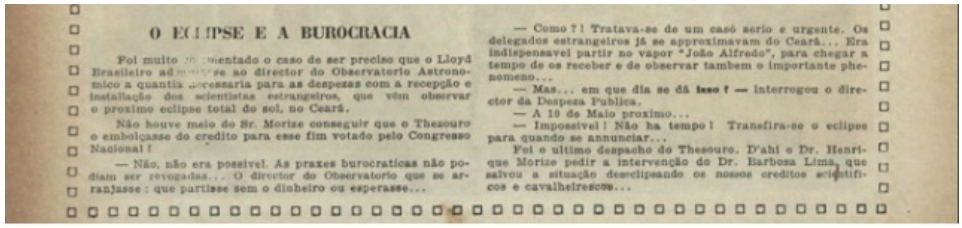
Os notaveis viajantes vieram visitar a redacção da «Folha» e agradecer a noticia que demos da passagem de suas excellencias por esta cidade, e, nesta occasião, tivemos a honra de solicitar do habilissimo sr. dr. Morize o artigo que vae incerido na primeira columna deste jornal, sobre o palpitante assumpto que tanta attenção tem dispertado aos scientistas e ao povo que deseja se orientar a respeito dos pormenores do interessante phenomeno solar.

Os distinctos viajantes devem estar de volta para a observação do curioso eclypse em Sobral em meiado de Maio, juntamente com diversas commissões scientificas extrangeiras que vêm especialmente examinal-o.

Auguramos aos illustres scientistas magnifica viagem e feliz regresso as nossas plagas.

ILEGIVEL

Figure 5. Front page of the March 23, 1919 edition of *Folha do Litoral*. From Hemeroteca Digital, BNDigital, Fundação Biblioteca Nacional, Brazil (http://memoria.bn.gov.br/DocReader/800198/156).



O ECLIPSE E A BUROCRACIA

Foi muito comentado o caso de ser preciso que o Lloyd Brasileiro ad[illegible]se ao director do Observatorio Astronomico a quantia necessaria para as despezas com a recepção e installação dos scientistas estrangeiros, que vêm observar o proximo eclipse total do sol, no Ceará.

Não houve meio do Sr. Morize conseguir que o Thesouro o embolçasse do credito para esse fim votado pelo Congresso Nacional!

— Não, não era possivel. As praxes burocraticas não podiam ser revogadas... O director do Observatorio que se arranjasse: que partisse sem o dinheiro ou esperasse...

— Como?! Tratava-se de um caso serio e urgente. Os delegados estrangeiros já se approximavam do Ceará... Era indispensavel partir no vapor "João Alfredo", para chegar a tempo de os receber e de observar tambem o importante phenomeno...

— Mas... em que dia se dá isso? — interrogou o director da Despeza Publica.

— A 10 de Maio proximo...

— Impossivel! Não ha tempo! Transfira-se o eclipse para quando se annunciar...

Foi o ultimo despacho do Thesouro. D'ahi o Dr. Henrique Morize pedir a intervenção do Dr. Barbosa Lima, que salvou a situação desculpando os nossos creditos scientificos e cavalheirescos...

Figure 6. "The eclipse bureaucracy" according to the Rio de Janeiro newspaper *O Malho*: 1919, April 24 (extract). From Hemeroteca Digital, BNDigital, Fundação Biblioteca Nacional, Brazil (http://memoria.bn.gov.br/DocReader/116300/39306).

> Dr. Henrique Morize, during the few days he stayed here, won a great number of friends not only for his straightforward and simple treatment, completely devoid of the vanity that is almost always associated with celebrities, but also for his enviable qualities as a fine "causer" [that is, motivator or talkative person].[78]

Obviously, there were newspaper reports that Morize did not control. One of them concerned the delay in the transfer of public funds to the Brazilian commission in charge of organizing the reception of foreign teams and observation of the eclipse in Sobral. It was in this context that the Rio de Janeiro newspaper *O Malho* ironically announced that the head of Brazilian public finances had suggested that Morize "postpone the eclipse!"[79]

The eclipse was intensively covered by the Brazilian press, and Morize emerged as a popular and celebrated figure in Brazilian newspapers.[80] What's more, through his efforts, Brazilian astronomy gained a prominent position on the international scene.

Conclusion

The ways in which the scientific communities in Brazil and Portugal embraced the 1919 total solar eclipse were very different. In Brazil, Morize used it to enlist governmental and federal support, to advocate a view of "pure" science not restricted to practical applications, and to increase the national and international visibility of Brazilian astronomy. He did so not only by organizing an expedition of his team of astronomers and disseminating its results through the press and appropriate forums, including scientific ones, but also by calling international attention to the good observational conditions afforded by Sobral and by providing all the logistical support to the British (and American) observers. In Portugal, despite a strong agenda of national and international affirmation and popularization of Portuguese astronomy implemented for at least two decades by Oom, he was mostly limited to responding to

78 "*A Ordem* Ouve o Dr. Morize" (1919). Our translation.
79 "O Eclipse e a Burocracia" (1919). Our translation.
80 For the newspaper coverage of the 1919 eclipse in Brazil, see Crispino & Lima (2016); Moreira (2019).

Eddington's correspondence in the most professional and efficient way. His depleted observatory, partly due to the war, could not participate in the observations, and the ultra-peripheral location of Príncipe, the unstable political situation, and the recent accusations of forced labor in its cocoa plantations, reduced his actions to the provision of logistical support to turn the British expedition into a success. As such, he directly contacted steamer companies and private and colonial institutions in Príncipe, and made himself available to all Eddington's requests. His scientific *ethos* demanded such a response.

By deliberately effacing from the written records their active role in the logistics of the expeditions, which were crucial to their success, Morize and Oom reinforced a view of the astronomers' role as detached from mundane practicalities, however important. Despite its intentionally omission, logistics was at the core of professional astronomers' work. Astronomers routinely spent part of their working time addressing letters to scientific and non-scientific institutions alike and coaxing ministries to provide them with better equipment, facilities, and conditions for their observatories.

Morize and Oom were also influenced by the political imperatives of the time, regardless of their common and somewhat naïve claim of the separation between scientific and political realms. An analysis of their involvement in the 1919 total solar eclipse shows that the Portuguese and Brazilian astronomers were driven by what they regarded as a "nationalist commitment." Their involvement in the eclipse expeditions' preparations, managing to get transports and the best-suited accommodations for the foreign astronomers, was therefore perceived abroad as projecting an image of modernity. In their native countries, it was a way to secure a central place for science in society.

Finally, a comparative approach to the arrangements made by the Brazilian and Portuguese astronomers for the British observations of the 1919 eclipse sheds important light on another instance of invisibilization, which goes beyond Morize's and Oom's parallel but independent processes of self-effacement concerning their logistical support to the expeditions. Two opposing processes of Brazil's visibilization and Portugal's invisibilization unfolded in tandem, orchestrated by the international community. They stemmed from the different geopolitical conditions of both countries. Brazil, then a recent republic, was preparing to celebrate the 100th anniversary of its independence in a phase of economic expansion, urban development, and the increasing application of techno-scientific solutions to societal problems, including hygiene and public health issues. Portugal, a very old imperial power but an even more recent republic than Brazil, was going through a very unstable political situation, due to both internal and external factors, tied to the recent change of regime, World War I, and the clashes of European powers over their African colonial possessions, recently rekindled by British accusations concerning the practice of slave/forced labor in Príncipe. By decoupling the country from its association to its peripheral colonial island, Portugal vanished from the written records.

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