The October 10, 1912 solar eclipse expeditions and the first attempt to measure light-bending by the Sun

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In 1911 Einstein proposed that light-bending by the Sun’s gravitational field could be measured during a total solar eclipse. The first opportunity in which this measurement would be tried, was during the total solar eclipse of October 10, 1912. We report about the expeditions sent to Brazil to observe this eclipse, including the one from the Córdoba Observatory, from Argentina, which aimed to measure this Einstein’s effect.

Keywords: Solar Eclipse; Light Bending; Theory of Relativity.

PACS numbers: 01.65.+g, 01.75.+m, 01.60.+q

During the V Amazonian Symposium in Physics, the centennial of the first experimental test of General Relativity was celebrated, in allusion to the well-known successful measurements performed during the total solar eclipse of May 29, 1919. What is less known is the fact that the first attempt to measure light deflection by the Sun’s gravitational field was organized years before that, to be performed during the total solar eclipse of October 10, 1912. We report on the expeditions sent to Brazil, during this 1912 eclipse, including the one led by the American astronomer Charles Dillon Perrine, who at that time was the director of the Argentinean National Observatory, located in Córdoba, aiming to measure light deflection by the Sun’s gravitational field.

Apart from regions in the Pacific and the Atlantic Oceans, the totality zone of the October 10, 1912 solar eclipse passed close to the border between Colombia, Ecuador and Peru, as well as across Brazil, including the states of Amazonas, Mato Grosso, Goiás, Minas Gerais, São Paulo and Rio de Janeiro.

For the observation of this 1912 total solar eclipse, several expeditions came to Brazil. Apart from the teams of the Brazilian National Observatory, there were commissions from British, French, American, Argentinean and Chilean institutions. All of the foreign commissions arrived in Rio de Janeiro harbor, spent some time in town, and then traveled to the observation sites in the totality zone of the eclipse. The Brazilian Ministry of Finances waived all the custom duties related to the instruments transported by the scientists to observe the eclipse.

The main Brazilian expedition, led by Henry (Henrique) Charles Morize, set camp in the Bella Vista farm (near the railway, surrounded by hills), owned by Rodolpho Hess, distant about one kilometer (km) from the city of Passa Quatro, in the Brazilian state of Minas Gerais. In the same farm stayed the French commission.

The first observer from abroad to arrive in Brazil was the amateur astronomer James Henry Worthington, who reached Rio de Janeiro on September 2nd. Pleased to be known as “eclipse’s hunter”, Worthington came to Brazil in his fourth eclipse expedition, the previous one being on April 17, 1912, in Portugal. In the day after his arrival in Rio, he visited the Brazilian National Observatory, located in Morro do Castelo (Castle Hill), meeting the director Morize. Worthington was a rich man that decided to investigate, at his own expenses, scientific matters. He had special interest in eclipses. The equipment brought by Worthington to Brazil in 1912 included two Steinheil photographic telescopes, also called coronographs, because of their use to take pictures of the solar corona. He also brought a Hilger quartz spectrograph, to analyze the spectrum of the solar corona during the eclipse. The coelostat (an instrument used to compensate Earth’s rotation, keeping a fixed image in the cameras coupled to the instruments) used by Worthington had been constructed according to his own design (having three mirrors, one metallic and two composed of silvered glasses).

The expedition from the Bureau des Longitudes, located in France, was led by Milan Rastislav Stefanik, assisted by Jaromir Králíček. Stefanik and Králíček arrived in Rio de Janeiro on board of the French steamer Amazone, on September 10th. Their packing-cases were immediately liberated by the customs with the authorization of the Brazilian government. Stefanik gently brought with his load an equipment for the Brazilian National Observatory, that Morize had ordered for manufacturers in January 1912, to be used for the eclipse observation by the Brazilian team. This equipment was a Mailhat telescope of 8 meters (m) of focal distance and 15 centimeters (cm) of aperture, coupled to a coelostat of the same manufacturer. The French commission brought its own (bigger)...
Mailhat telescope of 10 m of focal distance, also coupled to a coelostat (cf. Fig. 5), the whole set constituting a load of over two tons \[22, 23\]. Two other equipment brought by Stefanik were a spectrometer and a polarimeter of his own invention \[24\]. Stefanik left Rio on September 11th, to visit the totality zone of the eclipse and to choose the best observation site. The first city he has chosen to visit was Cristina, \[20\] in the Minas Gerais state. After a careful analysis, Stefanik decided to install his equipment in the city of Passa Quatro (cf. Fig. 5), where Morize set the main Brazilian National Observatory camp.

The Greenwich Observatory party arrived in Rio de Janeiro harbor on September 15th, on board of the ship Arlanza, and landed in the following day \[25\]. It was composed by Arthur Stanley Eddington (assistant astronomer of the Greenwich Observatory) and Charles Rundle Davidson (chief computer of the Greenwich Observatory), led by
FIG. 2: Observers in Passa Quatro. From left to right: (i) First (front) row (seated): Gualter Macedo Soares, Carlos Morize, James Henry Worthington, Henrique Charles Morize, Jaromir Kralicek, Mário Rodrigues de Souza e Augusto Soucasaux; (ii) Second row: Domingos Fernandes da Costa, Theofilus Henry Lee, Alix Corrêa de Lemos, Charles Rundle Davidson, Milan Rastislav Stefanik, Arthur Stanley Eddington, John Jepson Atkinson and Antônio Alves Ferreira da Silva; (iii) Third row: Marc Ferrez; (iv) Fourth row: Pierre Seux, Rodolpho Hess, Olyntho Couto de Aguirre e Leslie Andrews [14]. Courtesy of the Biblioteca do Observatório Nacional, Rio de Janeiro, Brazil.

FIG. 3: View of Rodolpho Hess’ farm, in Passa Quatro, where the main 1912 Brazilian eclipse expedition, as well as the British and the French ones, set camp [15]. Courtesy of the Fundação Biblioteca Nacional, Rio de Janeiro, Brazil.

the former (cf. Fig. 2). John Jepson Atkinson joined the Greenwich expedition, accompanying them from England. Morize and the chemist Theofílus Henry Lee (cf. Fig. 2), indicated by the Brazilian government to help the British party, met them in their arrival in the Pharoux quay [28] (cf. Fig. 6).

Eddington, Davidson, Lee and Worthington left Rio in September 21st, taking the São Paulo express train to

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2 J. J. Atkinson accompanied six British eclipse expeditions. The first one was to Vadsö in 1986, and the second one to Ovar, near Oporto, in 1900. The third one was to Sumatra in 1901, and the fourth one was to Tunis in 1905. He participated in two eclipse expeditions in 1912. One was to St. Germains and the other to Brazil. The one in Passa Quatro was his last eclipse expedition. [27]
FIG. 4: General view of Passa Quatro. Photograph taken during the eclipse expedition of 1912. Courtesy of the *Biblioteca do Observatório Nacional* [16], Rio de Janeiro, Brazil.

FIG. 5: French expedition installation in Passa Quatro for the Mailhat telescope, with an objective lens of 10 m of focal distance. The coelostat is covered with canvas, in the right. Inside the hut, in the left, is located the camera that captures the image of the solar corona. Courtesy of the *Biblioteca do Observatório Nacional*, Rio de Janeiro, Brazil.

Cruzeiro (a city in the state of São Paulo). Their instruments had been sent in a previous train. In Cruzeiro the instruments had to be transferred to a narrow-gauge line, along which they were taken, through a 20 miles track, to Passa Quatro, where they arrived after a three-hours journey [30].

The British commission arrived in Passa Quatro on September 22nd. The following days were dedicated to transport the equipment to Rodolpho Hess' farm, erect the huts, mount the instruments (cf. Fig. 7), etc. Two volunteers from
Rio de Janeiro, Olyntho Couto de Aguirre and Leslie Andrews (cf. Fig. 2), joined the Greenwich team on October 3rd (cf. Fig. 8), to assist them in the work. There was a daily transportation (a locomotive engine) from the city of Passa Quatro, where the scientists were lodged, to the Hess’ farm (a distance of about one kilometer), where the instruments were positioned, leaving the city at 8 am and coming back at 11 am, for lunch, returning 1 pm and back again at 6 pm.

The instruments brought by the Greenwich team were (i) a Thompson coronograph (to be operated by Eddington),

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3 Olyntho C. de Aguirre was born in the Brazilian state of Espírito Santo, and obtained his degree in Engineering in England.
to obtain large-scale photographs, with an object-glass of 9 inches (around 23 cm) aperture and 8 feet 6 inches focal length, in combination with a concave telephoto lens of 4 inches aperture and 16 inches focus (the total length of the instrument was 12 feet, with an equivalent focal length of 36 feet, or roughly 11 m), coupled to a 16 inch coelostat to reflect the light to the telescope; (ii) a six-inch refractor telescope (to be operated by Aguirre), of 7 feet focus, with green color filter (to investigate the presumed “coronium”); (iii) a six-inch Cooke triplet (to be operated by Andrews), of 27 inches focus, also with green color filter; (iv) a spectrograph (to be operated by Davidson, assisted by Atkinson), made of quartz (used by Major Hills during the eclipse of 1898, and by Davidson during the eclipses of 1900, 1901, and 1905), coupled to a heliostat, to reflect the light to the spectrograph. The 6-inch telescope and the 6-inch triplet were mounted side by side, and fed by a second 16-inch coelostat. The seconds during totality were supposed to be counted by Pierre Seux (cf. Fig. 2), who volunteered to that task, and did it during the rehearsals, which started on October 7th [18, 25, 26].

On board of the ship Aragon, the team from the Argentinean National Observatory, located at Córdoba, composed by its director Charles Dillon Perrine, the photographer Robert Winter, the engineer James Oliver Mulvey and the astronomer Enrique Chaudet, arrived in Rio de Janeiro on September 18th, bringing with them almost two tons of equipment. In the following day Perrine visited the Brazilian National Observatory [32].

The Córdoba party left Rio to the city of Cristina (located around 350 km away from Rio), on September 20th [33]. In the night before, the Greenwich and the Córdoba commissions dined together (cf. Fig. 9).

The Brazilian National Observatory took charge of the transportation of the Córdoba team instruments from Rio to Cristina, arriving in the destination on September 24th. [34] The site chosen by Perrine in Cristina (cf. Figs. 10 and 11) to install his equipment, were the surroundings of a building (which, until that time, had never been used after its construction) located around one hundred meters away from the train station.

The equipment brought by the Córdoba Observatory team included about ten instruments (cf. Fig. 12). The biggest one was a telescope of 12 m of focal distance. Among the instruments, there were two telescopes, coupled to cameras (the so-called intramercurial cameras), of 3 1/3 m of focal distance (loaned by William Wallace Campbell, director of the Lick Observatory, in the United States) for Perrine to try to measure the bending of the starlight passing close to the eclipsed Sun. This effect, proposed by Albert Einstein in 1911 [35], has been brought to the knowledge of Perrine by Erwin Finlay-Freundlich, assistant astronomer of the Berlin Observatory [11, 36–40].

On September 25th, in the ship Oronza, more scientists from other American institutions arrived in Rio. [41] From the Chilean Observatory, in Santiago, came Friedrich Wilhelm Ristenpart (director), Rómulo Grandón Moreno (4)

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4 Ristenpart was working since 1908 as the director of the Santiago Observatory, had been hired, in Germany, for that purpose by the Chilean government. Already in the year of 1908, Ristenpart observed the Sun’s eclipse in Corrientes [41]. He had been elected Fellow
FIG. 9: Part of a letter from Arthur S. Eddington to his mother, Sarah Ann Eddington (dated from September 26, 1912), in which it is written: “The Argentine & Chilean expeditions were going to Christina about 50 miles further on. The former (Perrine & his 3 assistants) came to dinner with us at our hotel in Rio on the Thursday evening and we had a very jolly time.” [30] Courtesy of the Master and fellows of Trinity College, Cambridge, United Kingdom.

FIG. 10: General view of Cristina, in the Brazilian state of Minas Gerais. Photo taken by the Córdoba Observatory team, during the 1912 eclipse expedition. The Perrine settlement is located in the right, attached to the big white building. Courtesy of the Museo Astronómico del Observatorio Astronómico de Córdoba, Córdoba, Argentina.

of the Royal Astronomical Society on 14th June 1912. [12]
(assistant astronomer) and Richard Wüst (mechanical engineer). From the Chilean Meteorological Institute, also in Santiago, came Walter Alfred Knoche (director) and Waldemar Trollund (mechanical engineer). From the La Plata Geophysics Department, in Argentina, came Jakob Johann Laub, together with his wife Ruth Elisa Wendt Laub. Morize himself went onboard of the *Oronza* to welcome these teams from the Chilean and Argentinean institutions.

The instruments of the Chilean Observatory included a photographic telescope of 16.20 cm (which had been used to observe the transit of Venus in front of the solar disk in 1874), a prismatic camera with a 10.45 cm lens, an equatorial Steinheil telescope of 10 cm aperture, specially bought from Germany for the 1912 eclipse, as well as a two small telescopes, sextants, chronometers and a chronograph. Selenium cells were brought, to be coupled to optical instruments.

Knoche had been requested by Louis Agricola Bauer, director of the Department of Terrestrial Magnetism at the Carnegie Institution of Washington, to perform air-electrical measurements during the 1912 eclipse. Laub joined Knoche to comply with this Carnegie request.

Ristenpart, Knoche and their teams set camp in the farm *Boa Vista* in the surroundings of Cristina. Knoche, Laub and Trollund were assisted in their observation site by Hermann Friedrich Albrecht von Ihering, the director of the *Museu Paulista* (located in the Brazilian city of São Paulo) and his wife Meta Buff; by the senior teacher at the German School in Rio de Janeiro, Dr. Shäfer; as well as by Laub’s wife, Ruth.

It is worth mentioning that Laub was a physicist who co-authored papers with Albert Einstein, about the Theory of Relativity, published in the journal *Annalen der Physik*, in 1908 and 1909 (cf. Fig. 13). It is not clear whether Laub was aware of Einstein’s effect to be measured during the total solar eclipse of 1912.

Another commission from Argentina, from the La Plata Observatory, led by William Joseph Hussey (director), assisted by Henry Julius Colliau and Bernhard Hildebrandt Dawson, arrived in Rio on October 2nd, in the ship *Arlanza*, coming from Buenos Aires. They visited the Brazilian National Observatory in the same day of their arrival.
The La Plata Observatory team went to the city of Alfenas, in the state of Minas Gerais, together with the engineer Carlos Vieira Souto, from the Brazilian Railway Company, who acted as an interpreter of the foreign scientists. They decided to install their equipment in the courtyard of the city school. [52]

The Brazilian National Observatory organized two expeditions to observe the 1912 eclipse in different sites. The main Brazilian team of the Brazilian Observatory, that went to Passa Quatro, was composed by Henrique Morize (director), Domingos Fernandes da Costa (assistant astronomer), Mario Rodrigues de Souza (assistant astronomer), Alix Corrêa de Lemos (chief of the Meteorology section), Alfredo de Castro e Almeida (mechanical), Augusto Sousa de Almeida (photographer), Gualter de Macedo Soares (auxiliar) and, voluntarily, Antônio Alves Ferreira da Silva (cf. Fig. 2) [53]. [6] They were joined by the well-known photographer Marc Ferrez (cf. Fig. 2), who also helped with the

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[6] As a volunteer, went to Passa Quatro captain Antônio Alves Ferreira da Silva (accompanied by his wife), who had been previously in charge of the Time Service provided by the Brazilian National Observatory. In 1912, he was working for the Ministry of Foreign Affairs, as the sub-chief of the Brazilian government commission to determine the limits between Brazil and Bolivia. [23] and obtained
FIG. 14: Marc Ferrez (in the right) helping Milan Stefanik (in the left of Ferrez) during a rehearsal with a photometer [31]. In the back, the mounting of the Mailhat telescope of the French commission, with 10 m of focal distance, can also be seen. Courtesy of the Fundação Biblioteca Nacional, Rio de Janeiro, Brazil.

preparations for the eclipse observation (cf. Fig. 14).

Morize and some of his assistants made a prior trip to Passa Quatro, in the end of September for the installation of the instruments (cf. Figs. 15 and 16) [54].

The main Brazilian equipment were three telescopes, namely the Heyde equatorial (cf. Figs. 17 and 18), the 8 m Mailhat coupled to a coelostat (brought from France by Stefanik), and the Steinheil equatorial photoheliograph, with a double objective of 10 cm, and 1.50 m of focal distance (cf. Figs. 15 and 16). [55] There was also a second Steinheil photoheliograph (cf. Fig. 16 and 18) and a Bardou telescope. Other instruments were a Bendorf’s electrometer (Lord Kelvin type), to measure the air electric potential, variometers, to measure the magnetic declination (cf. Fig. 19), and an Adam Hilger spectrograph, to measure properties of the solar corona. Photometers, barographs, thermographs, hydrographs, anemometers, chronometers, etc., were also brought to Passa Quatro by the Brazilian team. [57, 58]

The operation of the telescopes was programmed as follows. Morize would take care mainly of the Heyde equatorial, assisted by Antônio Ferreira da Silva. The operation of the Mailhat telescope and coelostat was assigned to Mario de Souza. [9] Domingos Costa would operate the main Steinheil equatorial photoheliograph. [57] Alix C. de Lemos and Gualter de M. Soares were in charge of the measurements concerning Earth’s magnetism (cf. Fig. 19).

the necessary license to assist Morize during the eclipse observations.

7 Morize returned to Rio de Janeiro from this visit to Passa Quatro on October 1st. [55]

8 These same Mailhat and the Steinheil telescopes, which could not be properly tested during the 1912 eclipse, were brought by the Brazilian team to the city of Sobral (located in the Brazilian state of Ceará), years later, for the observation of the total solar eclipse of May 29th, 1919.

9 During the tests, the Brazilian team was experiencing difficulties for the adjustment of the Mailhat telescope and there was the suspicion that it was defective. [57]
The other commission of the Brazilian Observatory went to Silveiras, in the state of São Paulo (cf. Fig. 20), led by Julião de Oliveira Lacaille (chief of the Astronomy section), together with Herminio F. Silva (assistant astronomer), Arthur de Castro Almeida (mechanical), Valentim de Magalhães (auxiliar) and Primo Flores (carpenter) [53, 54].

The Observatory of São Paulo, in Brazil, also sent an expedition, which was installed in a camp located in the west side of the city of Cruzeiro. This commission was led by José Nunes Belfort de Mattos (director), with the assistance of Roberto Simon, José Rangel Belfort de Mattos, Armando Fairbanks, together with the mechanical Jacinto Schneck, among other people. The instruments included a magnetometer and an actinometer, as well as a heliograph, one equatorial and two Bardou telescopes, anemometer, barometer, etc. In Cruzeiro, there was also a party from the Cinematography Brazilian International Company, which went there to register the eclipse. [59] This São Paulo commission was joined by Rogerio Fajardo, teacher at the São Paulo Polytechnic School, together with his
FIG. 16: Another view of the Brazilian settlement in Passa Quatro. Morize is standing close to the Steinheil equatorial telescope, which is being adjusted. In this image, apart from the Mailhat and Steinheil telescopes visible in Fig. 15, a second Steinheil telescope (positioned horizontally, without clock drive mechanism), coupled to a camera for 18cmX24cm glass plates, can be seen, in the right. Courtesy of the Biblioteca do Observatório Nacional, Rio de Janeiro, Brazil.

FIG. 17: Morize (in the right) aside of the Heyde equatorial telescope, in the Brazilian observation settlement, in Passa Quatro [31]. Mário R. de Souza, Antônio F. da Silva and Marc Ferrez can also be seen in this photo. Courtesy of the Fundação Biblioteca Nacional, Rio de Janeiro, Brazil.

students, who intended to collaborate with the eclipse measurements. [23, 59] ¹⁰

¹⁰ There was also a team of priests and students, led by the jesuit Justino Maria Lombardi, from Companhia de Jesus; Jean Baptiste du Dréneuf, rector of the School São Luiz, from the city of Itu; and Vicente Prosperi, who thought Astronomy in the School Ancheta,
An investigation about the influence of the eclipse in radio-telegraphic transmissions had also been organized by the Brazilian Government. For this investigation the Ministries of Transport (through the General Directorship of Telegraph) and of the Navy were involved. The engineer Leopoldo Ignacio Weiss and the telegraphist Manuel Soares Pinto Junior were in charge of this investigation. [24]

Dozens of tons of equipment were transported by the Brazilian railway companies to the observation sites. Contributing to this heavy load, the base of the Heyde equatorial telescope of the Brazilian commission (cf. Fig. 21) weighted around eight hundred kilograms. [31]

Morize arrived back in Passa Quatro on October 5th, together with Antônio F. da Silva and with the assistant Gualter M. Soares [61]. During Morize’s absence, the Brazilian party’s arrangements in Passa Quatro were in charge of Mário R. de Souza [30]. Domingos Costa had determined the exact time and latitude of the observation site in Passa Quatro. [57]

To observe the eclipse, even the president and the vice-president of Brazil, Hermes Rodrigues da Fonseca and Venceslau Brás Pereira Gomes, respectively, went to Passa Quatro, together with a group of politicians (some of them accompanied by their family), including the Ministries of Foreign Affairs and of Finances, Lauro Muller and Francisco Salles, respectively, adding up to approximately eighty people [62] (cf. Fig. 22). Along the duration of the eclipse, they stayed in the main house of the Bella Vista farm, owned by Rodolpho Hess, where a nice lunch was served afterwards. The estimations were that nearly a thousand people went to Passa Quatro to observe the phenomenon, including a docent of Astronomy (Gastão Gomes) of the Escola de Minas, an engineering school located in the city of Ouro Preto (in the State of Minas Gerais), who brought some of his students to see the eclipse. [62] The movie company Brazil Films even sent an operator to register the occasion in Passa Quatro.

Stefanik and Kralicek, of the French expedition, were assisted in Passa Quatro by Gerald Waring and his wife, as well as by Barbosa Tigre. Eddington and Davidson, from the Greenwich expedition, were assisted by Atkinson, Aguirre and Andrews. The amateur astronomer Worthington counted with the assistance of John Christopher Willis (director of the Rio de Janeiro Botanical Garden) and his wife, as well as Theophilus Lee. [57]

Unfortunately, heavy clouds covered the sky in Passa Quatro for a couple of days (cf. Fig. 23), including the whole eclipse duration. In the day of the eclipse the astronomers were ready, despite the rain, since there should be a hope that, at least during the totality, the portion of the sky with the eclipsed Sun could be seen, even if through the clouds. Unfortunately, this has not been the case in Passa Quatro, nor in any other observing station in Brazil. In Passa
FIG. 19: Instruments used to measure Earth’s magnetism, in Passa Quatro. Alix C. de Lemos is the first and Gualter de M. Soares is the second, from left to right. Courtesy of the Biblioteca do Observatório Nacional, Rio de Janeiro, Brazil.

FIG. 20: Settlement of the Brazilian National Observatory at Silveiras, in the state of São Paulo. Courtesy of the Biblioteca do Observatório Nacional, Rio de Janeiro, Brazil.
Quatro, the optical instruments were kept covered with canvas during the eclipse and, except for the measurements of the terrestrial magnetism, with the variometer, and of the atmospheric electricity, with the Bendorf’s electrometer, performed by Domingos Costa; and the measurements performed with the polarimeter by Stefanik; basically no other instrumental operations could be done. The camps remained muddy and it was difficult even to walk around.

The following estimations were published by the press: (i) first contact at 08 hours, 56 minutes and 40 seconds (local time), (ii) maximum phase at 10 hours, 16 minutes and 51 seconds, (iii) last contact at 11 hours, 42 minutes and 54 seconds. According to Eddington: “The rapid increase of the darkness a few seconds before totality was very striking, as was also the almost instantaneous brightening when it was over. Probably the state of the atmosphere caused the eclipse to be an unusually dark one.”

Bad weather was faced in all the observation stations organized in Brazil. At Alfenas the weather was basically the same as in Passa Quatro. William Hussey, assisted by the other components of the Argentinean commission of the
La Plata Observatory, tried to perform some light polarization measurements during the eclipse. [60]

In the city of Cristina, where the astronomer Charles D. Perrine was leading the only team aiming to measure the light-bending effect predicted by Albert Einstein, the sky became completely cloudy two days before the eclipse. In the day before the eclipse the rain started and it continued raining without interruption until the day after the eclipse. The only possible measurements were of the light intensity through the clouds surrounding the eclipsed Sun, as well as an estimation of the beginning and end of the eclipse totality. [34] In the nearby Chilean Observatory camp, in Boa Vista farm, the same bad weather was faced. [43]

Although this 1912 eclipse of the Sun would only be visible as a partial one in the city of Rio de Janeiro, the Brazilian National Observatory planned observations at its headquarters, in Morro do Castelo, intending to use, for this purpose, the equatorial telescope available there (cf. Fig. 24). The observations were in charge of Leopoldo Nery Vollú, assistant astronomer of the Observatory (cf. Fig. 25). Other people present in the occasion were Macedo Soares, Sampaio Ferraz Filho, Luiz Rodrigues, Athanagildo Vilhena, Francisco Rodrigues de Souza, Eduardo Avilla, Francisco Goulart, Djalma Figueiredo, Galvão Bueno, Raul Taunay, Euclydes Bontempo, Alarico Militão, Emílio Loureiro e Alcides Carneiro [62]. Due to the presence of heavy clouds during the whole duration the phenomenon, no observation of the (partially) eclipsed Sun could be performed in the city of Rio de Janeiro, although the time of the eclipse could be noticed by the people due to the corresponding darkness.

Soon after the eclipse, the teams with settlements in the zone of the totality started to pack their instruments to go back to their home institutions (cf. Figs. 26 and 27). In the city of Passa Quatro, however, the Brazilian commission decided to keep for some days the equipment for air-electrical and magnetic measurements, in charge of Domingos Costa. Stefanik and Worthington also decided to stay for some more days in the camp. The motivation of Stefanik was to test the polarimeter of his invention. [69] The French commission from the Bureau des Longitudes left Rio de Janeiro to Europe on October 23rd, on board of the ship Atlantique. [70] 11

Perrine, together with the Córdoba party, did a fast packing, leaving to Rio de Janeiro two days after the eclipse. They left Rio de Janeiro on October 15th in the ship Asturias to Buenos Aires, arriving on the 19th. Three days after that, they were back in Córdoba. [34]

The Greenwich commission did not finish packing until October 16th, due to the wet weather, leaving Rio to Europe on October 23rd. Their packing-cases with the instruments did not reach Rio on time to go in the same boat as the commission, and were forwarded later, in another ship. [25]

11 In the minutes of the October 14th meeting of the Bureau des Longitudes it is registered that Stefanik communicated that his observation of the solar eclipse in Brazil was hampered by the clouds, but nevertheless he could obtain some results. [71]
Back in Rio, Ristenpart gave a talk in the Commercial Museum (Museu Comercial), about the results obtained by the Chilean commission during the solar eclipse, to which even the Ministry of Foreign Affairs, Lauro Muller, has been invited. Some days before that, on October 15th, the Chilean authorities, in Rio, offered a banquet in homage to the director of the Brazilian National Observatory. Apart from Morize, the scientists Ristenpart, Knoche, Laub, accompanied by his wife, were present in the occasion the Chilean representatives in Brazil, Samuel de Sousa Leão Gracie (consul), Alfredo Goycoolea Walton, and Raul Cousiño Talavera, as well as Frederico Shafer and Wilhelm Hipp, the latter being the head of Siemens Company in Rio (cf. Fig. 28). On the 22nd of October, Ristenpart (accompanied by Grandón and Wüst) left Rio de Janeiro to Buenos Aires, where he also gave a talk about the eclipse observations, in a session of the São Paulo Scientific Society, on November 14th. Despite the cloudy weather at their observation site in Cruzeiro, he declared to have successfully investigated terrestrial magnetism, as well as actinometry.

José Belfort de Mattos, from the Observatory of São Paulo, also gave a talk about the results obtained by his team during the eclipse observations, in a session of the São Paulo Scientific Society, on November 14th. Despite the cloudy weather at their observation site in Cruzeiro, he declared to have successfully investigated terrestrial magnetism, as well as actinometry.
FIG. 25: Leopoldo Nery Vollú (left) aside of the equatorial telescope of the Brazilian National Observatory, at Morro do Castelo, in the day of the 1912 total solar eclipse. Brothero de Magalhães and Mr. Ballardini appear standing in the right. [67] Courtesy of the Fundação Biblioteca Nacional, Rio de Janeiro, Brazil.

FIG. 26: Left: Dismounting the Mailhat coelostat of the Brazilian commission. Right: General view of the observation camp in Passa Quatro, during the dismounting. [68] Courtesy of the Fundação Biblioteca Nacional, Rio de Janeiro, Brazil.
in Brazil. From Argentina, the Santiago Observatory team went back to Chile. In December 1912, Ristenpart sent to publication from Santiago a report about the activities of the Chilean Observatory team during the eclipse – with special emphasis to the use of one of the selenium cells – which was published in the following year in the journal *Astronomische Nachrichten*.

Before leaving Brazil, Laub (with his wife), Knoche and Trollund went to the state of Espírito Santo to visit the Native Americans, in the margins of the river Doce. They visited Colatina, where they met a group of Krenak. They returned to Rio on October 28th, and in the same day they left, on board of the ship *Avon*, to Buenos Aires. In the following years, Laub and Knoche co-authored three publications about their results related to the meteorological and atmospheric electricity measurements performed at *Boa Vista* farm, in Cristina, during the 1912 total solar eclipse.

Unfortunately, the ship *Oravia*, that was carrying the major part of the instruments of the Chilean commission in the return trip, sank near the Falkland Islands. The Chilean team was not on board of the *Oravia*. Friedrich Wilhelm Ristenpart killed himself on April 9th 1913, after a press campaign against him.
FIG. 28: Banquet in acknowledgement to Morize, offered by the Chilean representatives on October 15th, at the Hotel dos Estrangeiros, in Rio de Janeiro. [75] Courtesy of the Fundação Biblioteca Nacional, Rio de Janeiro, Brazil.

FIG. 29: Left: Charles Dillon Perrine, [32] the leader of the only team aiming to measure the light-deflection effect during the 1912 eclipse. Courtesy of the Fundação Biblioteca Nacional, Rio de Janeiro, Brazil. Center: Intramercurial cameras loaned by the Lick Observatory, and used by Perrine in Passa Quatro, in the attempt to measure light deflection by the Sun, during the October 10, 1912 eclipse. Courtesy of the Museo Astronómico del Observatorio Astronómico de Córdoba, Córdoba, Argentina. Right: Albert Einstein, who proposed in 1911 that light is deflected in a gravitational field, and that the gravitational light-bending by the Sun could be measured during a total solar eclipse. Picture taken during Einstein’s visit to the Brazilian National Observatory, in 1925. Courtesy of Museu de Astronomia e Ciências Afins, Rio de Janeiro, Brazil.

We have reported about the expeditions organized to observe in Brazil the total solar eclipse of October 10, 1912. This has been one of the most expected eclipses visible in the Brazilian territory, but, unfortunately, due to the bad weather, it could not be properly appreciated by any of the observers. Stands out the fact that it has been for this eclipse that the first expedition to verify 1911 Einstein’s prediction of gravitational light bending has been organized and led by the American astronomer Charles D. Perrine, director of the Argentinian National Observatory, located in Córdoba (cf. Fig. 29). [11 37–40] Curiously enough, Einstein’s prediction made in 1911 was not correct, as Einstein himself realized and published in one of his 1915 works [81] that stablished the General Theory of Relativity.

The correct Einstein’s prediction of light deflection by the Sun’s gravitational field was finally verified in 1919, with the analysis of the total solar eclipse observations performed in Brazil, by Andrew Claude de la Cherois Crommelin.
and Davidson, and in Africa, by Eddington and Edwin Turner Cottingham. It is worth emphasizing the fact that Davidson and Eddington met in Rio de Janeiro with Perrine, in 1912. At that occasion, one of the main aims of Perrine expedition was to verify Einstein’s effect of light bending, while the Greenwich expedition was essentially aiming to study properties of the solar corona, and, most probably, Eddington and Davidson were not aware of this Einstein’s effect.

It is also worth noting that, to observe this 1912 eclipse, came to Brazil Jakob J. Laub, an earlier collaborator of Einstein in the Theory of Relativity. No evidence has been found that Laub knew about this Einstein’s effect.

Acknowledgments

I am grateful to (i) Santiago Paolantonio, from Museo Astronómico del Observatorio Astronómico de Córdoba, Córdoba, Argentina; (ii) Fred Espenak and Robert M. Candey, from NASA Goddard Space Flight Center, United States of America (USA); (iii) Luisa Haddad, Joop Rubens and Teresa Mora, from Special Collections and Archives, McHenry Library, University of California, Santa Cruz, USA; (iv) Shaun J. Hardy, from Carnegie Institution, Department of Terrestrial Magnetism, Washington, USA; (v) James Kirwan, from Trinity College Library, Cambridge, United Kingdom (UK); (vi) Adam Perkins and Emma Saunders, from Cambridge University Library, Cambridge, UK; (vii) Melissa Thies, from Leibniz-Institut für Astrophysik, Potsdam, Germany; (viii) Emilie Kaffant, from La Bibliothèque de l’Observatoire de Paris, Paris, France; (ix) Pascale Carpentier, from Bureau des Longitudes, Paris, France; (x) Michael Zeiler, from the Eclipse-Maps Website; (xi) Jorge Antonio Zanelli Iglesias, from Centro de Estudios Científicos, Valdivia, Chile; (xii) David Ázocar, María Teresa Ruiz and Mario Andres Hamuy Wackenhub, from Universidad de Chile, Chile; (xiii) Everaldo Pereira Frade, Luci Meri Guimarães, Maria Celina Soares de Mello e Silva, and Maria Lucia de Niemeyer Matheus Loureiro, from Museu de Astronomia e Ciências Afins (MAST), Rio de Janeiro, Brazil; (xiv) Carlos Henrique Veiga, Jaielson Souza de Alcântara, João Carlos Costa dos Anjos, Kátia Teixeira dos Santos de Oliveira, and Teresinha de Jesus Alvarenga Rodrigues, from Observatório Nacional (ON), Rio de Janeiro, Brazil; (xv) Mônica Velloso Azevedo, from Fundação Biblioteca Nacional, Rio de Janeiro, Brazil; (xvi) Paulo Marques dos Santos, Rosa Maria Silva Santos and Sandra Aparecida Marques dos Santos, from Instituto de Astronomia, Geofísica e Ciências Atmosféricas of the Universidade de São Paulo, São Paulo, Brazil; (xvii) Germana Fernandes Barata and Marcelo Knobel, from Universidade de Campinas, Campinas, Brazil; and (xviii) Diene de Cassia Barros de Oliveira, Leandro Fier Ribeiro and Thiago Kleber Costa dos Santos, from Universidade Federal do Pará, Belém, Brazil. I also acknowledge the partial financial support from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) – Finance Code 001, from Brazil. This research has also received funding from the European Union’s Horizon 2020 research and innovation programme under the H2020-MSCA-RISE-2017 Grant No. FunFiCO-777740.

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Curiously enough, together with the details published in the day of the 1912 eclipse, some of the newspapers in the city of Rio de Janeiro already announced the next total eclipse that could be visible in Brazil in 1919, mainly from the state of Ceará, whose totality would last for many more minutes than the 1912 one. [57, 58]
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