

The Carte du Ciel and the Latin American Observatories

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Abstract. 2017 marked the 130th anniversary of the start of the *Carte du Ciel* project, an ambitious proposal by the Paris Observatory to map the entire sky using photography, which required the joint work of numerous observatories in the world. For this endeavour, an impressive organization was designed that included congresses, commissions and publications, which lasted through many years. The *Carte du Ciel* finally became one of the immediate antecedents of the International Astronomical Union, which in 2019 celebrates its first century. In Latin America, the observatories of Santiago de Chile, La Plata and Rio de Janeiro, the Argentine National Observatory and the Tacubaya Observatory, in Mexico, were involved in the project. In this presentation, we present part of the history of the failures and successes of one of the most important collaborative astronomical projects on the planet.

Keywords. History of Astronomy, Collaborative astronomical projects, Carte du Ciel

1. Introduction

In April 1887 the first meeting of the *Carte du Ciel* programme was held in Paris, promoted by Ernest Mouchez, director of the Paris Observatory and sponsored by the French Academy of Sciences. The proposal consisted in measuring the positions of all the stars up to the magnitude 11, to form an “Astrographic Catalogue”, and to map each star up to the magnitude 14, using in both cases photographic plates. Achieving these objectives involved the acquisition of more than 30 000 plates, a task that would be distributed among a score of observatories, which would use similar instruments and techniques to ensure the uniformity of the results. Each institution would be in charge of an area of the sky delimited in declination, obtaining the necessary plates and making the measurements, and would take charge of all the costs, including the publication of the catalogue and the maps.

This programme had as its main background, the first systematic astronomical work made using the photographic technique: on the one hand, the astrometry of the stars of the austral open clusters carried forward in the Argentine National Observatory between 1872 and 1884, and later published with the name of “Fotografías Cordobesas”, and on the other, what was done at the Cape of Good Hope Observatory that began to be published in 1885 and that became the renowned “*Cape Photographic Durchmusterung*”.

Covering the Southern Hemisphere was especially problematic due to the scarcity of astronomical institutions (Mouchez to A. Blest Gana, 9/5/1887 in [Chinnici 1999](#), 336). The observatories of Santiago de Chile (Chile), La Plata (Buenos Aires, Argentina) and Rio de Janeiro (Brazil) were invited and immediately accepted to participate. However, despite having acquired the necessary equipment, none of the three establishments could start the work on time. The Observatory of Tacubaya (Mexico) entered after the first Congress was held, that same year of 1887. It was able to make the commitment for



Figure 1. Imperial Observatory of Río de Janeiro in 1882, Morro do Castelo. (Liais 1882).
Córdoba Astronomical Observatory (OAC) Library

the Astrographic Catalogue, demanding huge efforts over several decades until the mid-twentieth century. The Argentine National Observatory (now Observatorio Astronómico), in spite of having been invited from the beginning, only joined the enterprise in 1900. After 26 uninterrupted years of work, all the required plates and measurements were achieved, and the results were also published. In the next section, we summarize the work made in each Observatory and in each country, which converged to produce the magnificent product, known as the *Carte du Ciel*.

2. Observatorio Imperial de Río de Janeiro

The director of the Astronomical Observatory of Rio de Janeiro, the Belgian Luiz Cruls, was interested and actively participated in the proposal, and immediately managed the purchase of the Astrographic Observatory in Paris (Cruls and Mouchez, 25/8/1885 in Chinnici 1999, 319). Cruls attended the congress in 1887, in which he joined the Standing Committee. By 1891, the construction of the new headquarters of the observatory (Fig. 1) delayed the construction of the shelter for the telescope. From the following year, the studies to delimit the location of the new capital and the illness of the director, which forced him temporarily to leave his post (Videira 2007), meant as a result that the work did not start. Finally, in 1899, the institution withdrew from continuing in the programme (*Carte Photographique du Ciel* 1900, 24–25). The astrographic telescope was never mounted (Videira 2011).

3. Observatorio Astronómico de La Plata

The Astronomical Observatory of La Plata, inaugurated in 1883 and directed by the retired French naval Lieutenant, Francisco Bœuf, was equipped with instruments bought in France, as supervised by Mouchez. An astrograph was acquired, thinking of the future participation in the *Carte du Ciel* (letter from Gonnet to Bœuf, 21/6/1886 Museo de Astronomía y Geofísica 2011), which would position the young observatory at an international level. Bœuf participated in the meeting of 1887 and was appointed a member of the Standing Committee, a position in which he worked very actively. He also attended the congresses of 1889 and 1891. The area between declination -24° and -31° was assigned to La Plata.

Although the astrographic telescope was already installed in his dome in 1890 (Hussey et al, 1914, Fig. 2), the following year the tasks were postponed (*Carte Photographique du Ciel* 1900, 11), as a result of the financial and political crisis suffered by Buenos Aires

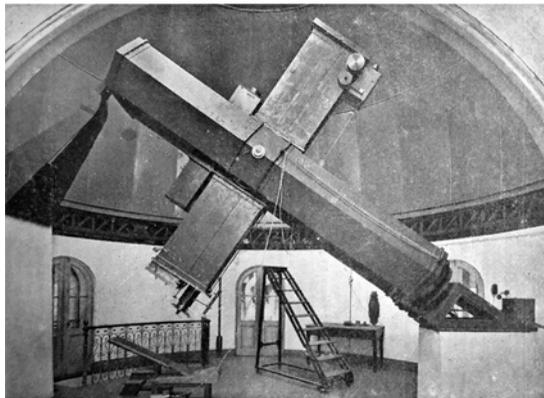


Figure 2. La Plata Astrographic Telescope.
(<http://museo.fcaglp.unlp.edu.ar/galeria/sala15/astrografico.htm>).

province, and also because a long illness suffered by Bœuf until his death, which occurred in 1899. During that time, the instrument's objective was damaged in an accident, rendering it useless (Paolantonio & Minniti 2009). As a result, in the Congress of 1900, the area assigned to La Plata was entrusted to the Argentine National Observatory. In 1906, the La Plata Observatory director at that time, Francesco Porro de Somenzi, tried to participate again in the project (Porro de Somenzi 1907), but again the proposal was frustrated when he had to resign his position.

4. Observatorio Nacional de Chile

The invitation to participate in the photographic *Carte du Ciel* meeting arrived at the astronomical observatory in Santiago de Chile very late, so a delegate could not travel to France. Despite this, the director, José Vergara, agreed to participate in the project. In 1887, the astrographic telescope was commissioned in Paris (letter from Blest Gana to Mouchez, 23/5/1887 in Chinnici 1999, 338) and a French astronomer was hired to take on the tasks (Mouchez to Blest Gana, 7/30/1889 in Chinnici 1999, 344). In 1891 a civil war broke out in the country, a circumstance that strongly impacted on the observatory, causing repeated delays in the realization of the project (Paolantonio & Minniti 2009). In 1891 the construction of the astrographic shelter was completed (Fig. 3), and the astrograph was set up at the beginning of 1894. However, the photographic exposures could not be started, and given the prolonged delay, in 1899 the Committee declared the declination zone to be vacant. In 1908, another attempt was made by Chile to participate in the project (Ristenpart to Baillaund 6/9/1908 in Chinnici 1999, 346), but despite the effort made, the tasks could not be carried out and the area was taken over from 1912 by the Nizamiah Observatory of Hyderabad, India.

5. Observatorio Nacional Argentino

The astronomical observatory of Córdoba, invited to the meeting of 1887, did not accept to participate in the project at this time. The causes of this procedure were linked to professional and personal differences between the directors of the Paris and La Plata observatories, and Benjamin Gould, director of the National Observatory. But the main cause was connected to the competition between the French and North Americans for being recognized as pioneers in astronomical photographic works (Paolantonio 2011).

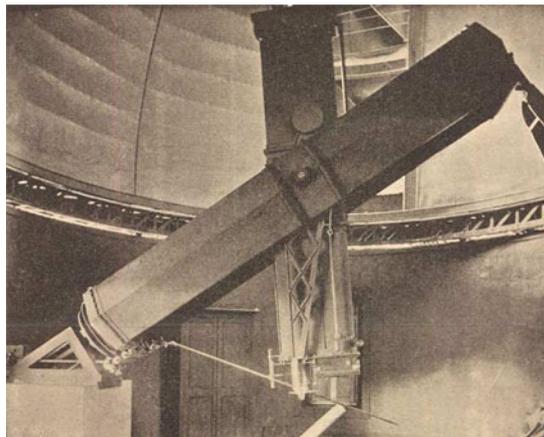


Figure 3. Astrographic Telescope, installed at the “Quinta Normal”, Santiago de Chile (Talius 1897).

In 1899, given the evidence that the areas assigned to the three South American observatories had not been completed, the Committee managed the incorporation of the Argentine National Observatory (Paolantonio & Minniti 2009). The director of the institution was Juan M. Thome (both Gould and Mouchez had died). With the authorization of the National Government, Thome attended the meeting in 1900, where he accepted to take care of the area left vacant by La Plata Observatory (declination -24° to -31°). The reason for the request to take over this zone and not the one assigned to Chile was related to the fact that at the time, Argentina was in negotiation with Chile because of a border dispute which nearly led to war (Paolantonio & Minniti 2009).

Since it was more economical to acquire a new astrographic telescope than to repair and move the existing one in La Plata, it was entrusted to Paris to supply the instrument at a cost of 40 000 francs (Thome to Fraissinet, December 1902). The instrument, with a mount that could be modified in order to mount it in an existing dome, arrived in Argentina in December 1901 and during the following year it was assembled and was available to begin the task of observing. The first photographic plate for the Astrographic Catalogue was exposed on August 25, 1902 (Fig. 4).

Until the death of Thome in 1908, 600 plates were produced. The new director, Charles D. Perrine, made a detailed revision of the plates, finding that the half of them were inadequate, so they had to be taken again. The acquisitions for the Astrographic Catalogue ended on December 29, 1913, with a total of 1360 plates. Immediately the corresponding ones for the *Carte du Ciel* were begun, and at the same time, the measurements for the Catalogue were initiated.

It took 12 years and 8 months to complete this part of the work, and to produce 1,110 plates of which 680 were selected. In total, the acquisition of the photographs and the measurements of the plates demanded 26 years. Although it was not the fastest, the National Observatory carried out its commitment in a reasonable time, taking into account the magnitude of the work. The publication of the results required almost a decade and 10 volumes of the *Resultados del Observatorio Nacional Argentino*. The reproduction of the plates of the *Carte du Ciel* turned out to be very expensive, which is the reason why only the zone corresponding to declination -25° was printed (Paolantonio & Minniti 2009) (Minniti & Paolantonio 2009).

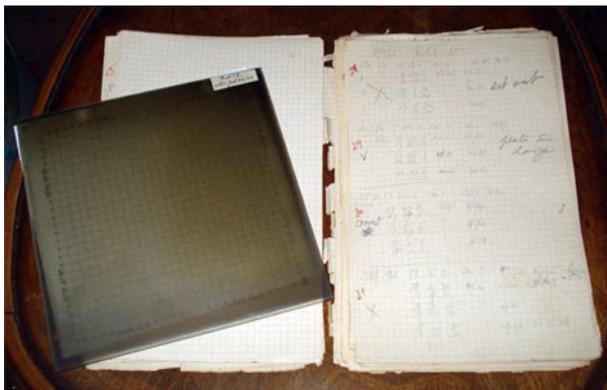


Figure 4. First plate obtained for the Astrographic Catalog (25/8/1902) and observations notebook (OAC archives).

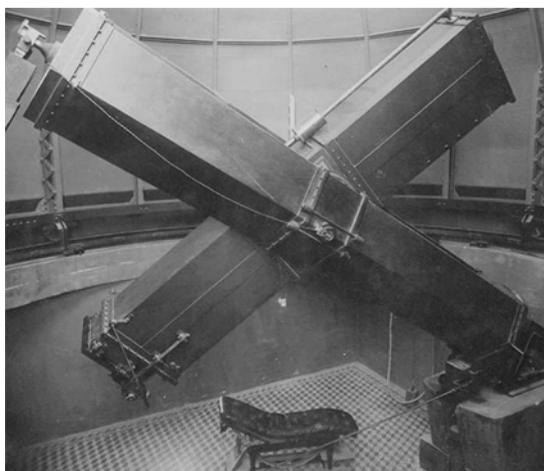


Figure 5. Astrographic telescope of the Argentine National Observatory in the current dome (circa 1914). The mount manufactured by P. Gautier is of the English type. (OAC archives).

The first photographs taken showed that the astrographic objective suffered from very important residual aberrations. In 1909 it was verified that it was due to defective support of the lenses, which was modified in the workshops of the Observatory. The same happened with the clock system that had an irregular operation (like that existing in La Plata), so it was also repaired in the same institution successfully. The mount was also improved, including the bearings in the polar axis support (Fig. 5) (Paolantonio 2011).

6. Observatorio de Tacubaya, México

The Tacubaya Observatory was invited to participate in the project on May 10, after the 1887 meeting. The assigned zone corresponded to declination -10° to -16° . The director, Teodoro Quintana, unlike the rest of the Latin American observatories, chose to acquire the astrographic telescope from Howard Grubb of Dublin, Ireland (Fig. 6). The instrument was installed in 1890 and the acquisition of plates was begun in 1892. There were problems with the objective of the telescope, which were not solved until 1900. In 1906 the plates were obtained, a total of 1255, which were measured until 1913. The



Figure 6. Observatory of Tacubaya astrographic telescope, manufactured by H. Grubb (Institute of Astronomy of the National Autonomous University of Mexico).

publication of the results took several decades, ending in 1962, being delayed in principle by the Mexican revolution (Bartolucci 2000; Universidad Nacional 2012).

7. Conclusion

From the first approach to the *Carte du Ciel*, at the beginning of the 20th century, until the end of the photographic exposures and the measurements of the plates, the work covered several decades. The publication of the results continued until the 1970s. This great project suffered the consequences of the increasingly rapid technological development, especially in optics, which almost all major scientific undertakings had to face. Expectations in the discipline had also changed, so by the middle of the twentieth century the work undertaken had already been rendered largely obsolete.

On the one hand, the acquisition of the plates proved to be very difficult and their reproduction, very expensive, so many institutions did not finish printing them. Some authors argue that the enormous efforts that many of the participating observatories attempted to fulfil with the *Carte du Ciel* led to great delays in the realization of other plans, especially in Astrophysics, as is the case for Tacubaya (Bartolucci 2000). This does not seem to be the case for the Argentine National Observatory, since there is no evidence that it was considered an excessive effort for the institution, and other important jobs were performed simultaneously. If the subject is analysed with the perspective of almost a century, perhaps, it would have been more scientifically profitable for observatories in Latin America to have devoted this effort to astrophysical works that marked astronomy since the beginning of the 20th century.

The Committee for the *Carte du Ciel* became one of the antecedents of the International Union of Astronomy. In 1925, Commission 23 was created to organize the *Carte du Ciel*. It survived until 1970, when it was merged with the Stellar Parallax Commission, constituting Commission 24, called Photographic Astrometry. In 1964, this organization announced the achievement of the Astrographic Catalogue. In 1970 the 14th

General Assembly held in Brighton, United Kingdom, acknowledged that the *Carte du Ciel* enterprise was still not finished.

Today, this unique global work in astronomy regained importance due to the accuracy of the records. In some countries the works are continued and the plates are digitized for a better and current use. In Córdoba, this work is being addressed by the Research Group on Teaching, History and Dissemination of Astronomy, with the collaboration of technicians from the La Plata Observatory. The information in the plates provides an important time base to determine stellar proper motions, used for satellites and asteroid detection, and the digitization constitutes a positive effort with non-negligible projections. It is also important to mention, that in the Córdoba Observatory all the original materials, such as plates and documents, are still available, which constitutes a huge historical legacy.

8. Discussion

DE ALBA-MARTÍNEZ: Concerning astronomical heritage, perhaps the plates could be considered as *Mémoire du Monde* by UNESCO, as *Tonantzintla Observatory* plates are included as *Mémoire du Monde*, but not, as it happens, those of the *Carte du Ciel*.

GARCÍA: About the UNESCO Memory of the World Program, set up in 1992, I think that the preservation and conservation of important collections (mainly documents) around the world is a very valuable task. If the *Carte du Ciel* material in general is included as part of this programme, then we must support this. Anyway, I think that the *Carte du Ciel* is more than the printed products such as charts, maps and photographs; it is also instruments, tools and devices built to complete the work.

ALVES-BRITO: You quickly mentioned that the *Carte du Ciel* was considered a negative adventure in Mexico. Do you know why?

GARCÍA: Some Mexican authors (see Bartolucci, 2000) argue that the enormous efforts to fulfil the commitment assumed with this task was against other plans, especially in Astrophysics, which at the beginning of 20th century was a very promising and more scientifically profitable activity.

MONTMERLE: How good are the Córdoba plates today? Are the measurements homogeneous and scientifically still usable today (i.e., to study/detect variable objects)?

GARCÍA: The Research Group on Teaching, History and Dissemination of Astronomy of Córdoba Observatory with the collaboration of technicians from the La Plata Observatory, digitized all the plates for a current use. The available information provides a time base usable not only to detect variable objects, but also asteroids and to determine stellar proper motions. It is important to mention, that in Córdoba Observatory all the original plates are available.

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