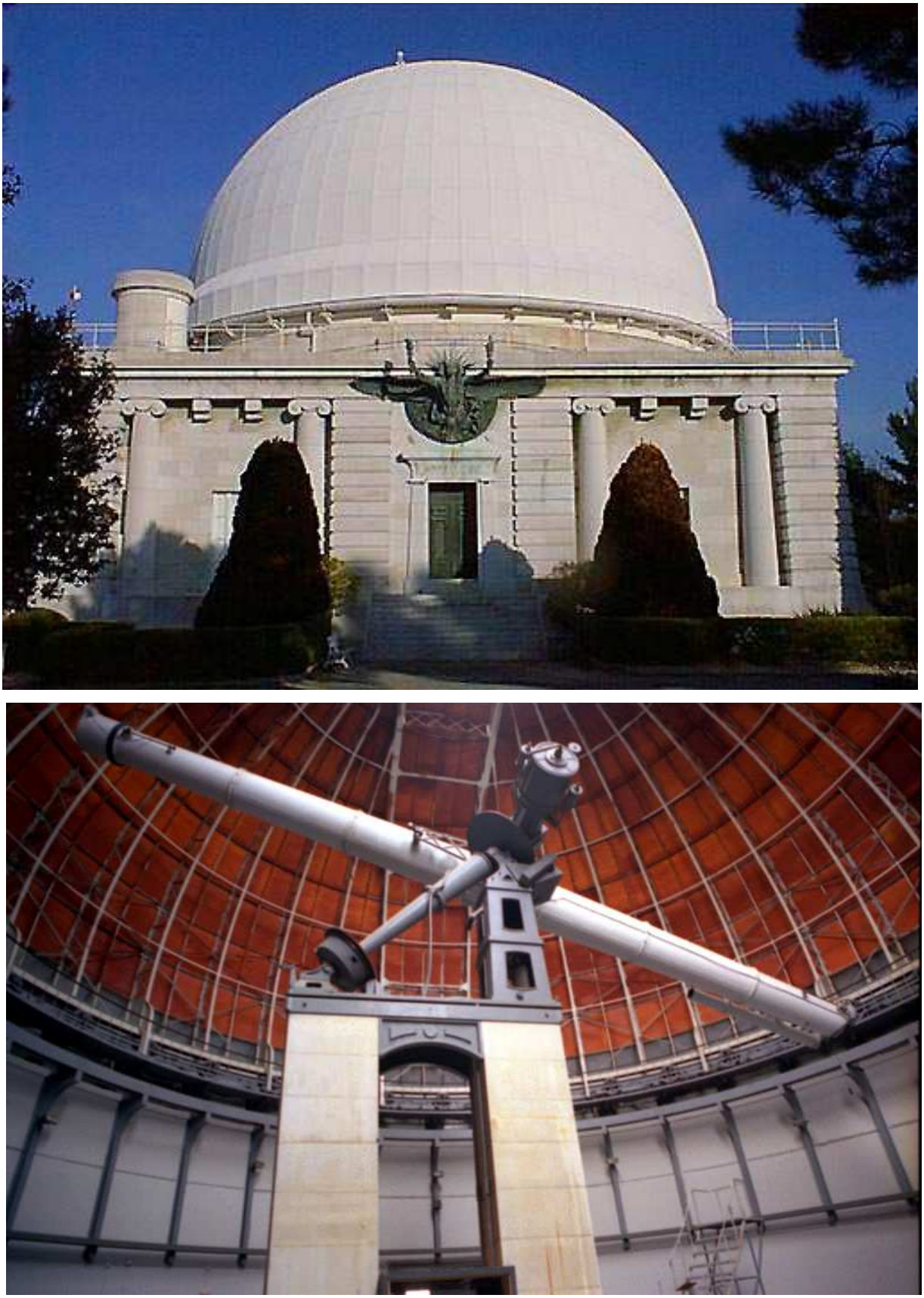

Figure 21.1: *Large refractor, Observatoire de Nice, donated by Raphaël Bischoffsheim (1823–1906) in 1887*

21. Astronomical Heritage Sites: Two Early "Mountain" Observatories on the Mediterranean Coast

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Abstract

The number of French observatories increased significantly during the 1880s. Among the ten establishments in activity at that time, eight were on sites chosen because of their proximity with a faculté des sciences or with Paris, while the remaining two, Nice and Algiers, were installed on hills carefully chosen for their quality as astronomical sites.

We shall compare the scientific and political environments leading to the creation of these two observatories and describe their astronomical equipment and architectural designs. Since in both cases the original astronomical sites are still in activity as research institutes, we shall also evoke the present use of their astronomical heritage.

21.1 French Institutional Astronomy around 1880

At the death of Urbain Leverrier in 1877, French institutional astronomy consisted of only four establishments. Erected in 1667 at a small elevation just south of the city, the Paris observatory's monumental building had been criticised for its inconvenience by Cassini, its first director. Two centuries later, the surrounding land had been progressively built upon and observations were menaced by the industrial development of the city. The observatory of Marseilles, installed just above the port, had been officially founded in 1702. When in 1863 Paris Observatory received the first large mirror glass telescope ever made, the famous 80 cm Foucault telescope, Leverrier decided to install it under better skies and had it transferred to Marseilles after moving the old observatory from the port to a 7 m high flat hill called "plateau Longchamp". In 1841, the old Toulouse observatory had been reorganised by Arago and installed outside the city at an isolated place called Jolimont. In 1875 Jules Janssen had finally obtained from the government the creation of an observatory dedicated to astrophysics, which in 1879 was to be officially set up on a 180 m high hill at Meudon, in an ancient *château* burnt down in 1870 during the war with Prussia.

Soon after Leverrier's death, French institutional astronomy underwent important changes including an efficient policy of decentralisation: in 1878 new observatories were created in three cities having faculties of science – Besançon, Bordeaux and Lyons – bringing the number of institutional French observatories to seven.

A year later a private observatory, owned by the "grand amateur" astronomer Antoine d'Abbadie, was founded in Hendaye, and in the same year another private observatory was programmed on the French Mediterranean coast. For the first time in Europe a search for a site was organised in order to implement this new astronomical observatory. It led to the choice of a 375 m high "mountain" near the city of Nice. A tenth French observatory appeared in the early 1880s in Algiers when the outstation created by Leverrier in 1856 was installed in an excellent site overlooking the city very similar to the one of Nice and equipped with very good instruments.

In order to investigate the foundation of these two early "mountain" observatories, we shall first describe the context of the creation in 1846 of the Algiers meteorological outstation.

21.2 From the Crimean War to an Observatory in Algiers

Invented by Morse in 1838 in the USA, the electric telegraph was introduced in France in 1844. First of all it was reserved for the state, until in March 1851 the Prince-President Louis Napoléon Bonaparte, soon to become Emperor Napoléon III, allowed its public use. In November 1854, the shipwreck of the Henri-IV, one of his majesty's best war ships, occurred during a hurricane while fighting against the Imperial Russian fleet in the Black Sea. This led Leverrier, a friend of the Minister of War, Vaillant, to collect data about this disastrous meteorological phenomenon in order to study it. On February 16, 1855 – a day after another French war ship sank during a terrible storm between Corsica and Sardinia – Leverrier, who had become the director of Paris observatory in 1854, proposed to the Emperor the

setting up a meteorological network based on the use of the telegraph for collecting data. Less than a year later, in January 1856, Leverrier decided to extend his network by creating a meteorological station in the *Lycée* at Algiers. Placed under the responsibility of Charles Simon (1825–1880), professor of mathematics and graduate from the *École normale supérieure*, this annex of Paris observatory was enlarged in December 1858 to include an astronomical station. However, its development was prevented by a few events that occurred between 1859 and 1861, among which the arrival of Charles Bulard (*1825) with a 33 cm Foucault telescope, the origin of which is unclear. Several changes in the Algerian administration led to no decision being taken regarding the choice of an astronomical site for installing the telescope and to the departure of Simon, who did not accept being placed under Bulard's authority. Although in 1861 Bulard obtained a second Foucault telescope, this time a 50 cm one, the French administration never acquired a proper site in Algiers nor did it really fund the astronomical station. As a result, from 1859 onwards Bulard did not achieve much apart from meteorological observations. Changes first occurred after the war with Prussia and the end of Napoleon III's regime. In 1872 a report recommended a professional astronomer to be sent to Algiers and a year later the observatory became administratively a State observatory similar to those of Marseilles and Toulouse.

In 1879, within the frame of the decentralisation of institutional astronomy set up after the death of Leverrier, the Ministry of Education agreed to fund a Southern observatory in order to benefit from a better climate than in Paris and in the other state observatories and also to challenge the British observatory that had been installed in Capetown as early as 1820. In the same year the French State created an *École supérieure des Sciences* at Algiers to which the observatory was attached. So that when in 1880 Charles Trépied (1845–1907), an astronomer trained in Paris by the *Bureau des longitudes*, was sent to Algiers, he became director of the observatory and taught astronomy at the newly founded *École supérieure*. With the help of a just one assistant, Charlemagne Rambaud (1857–1955), Trépied quickly moved Bulard's instruments from *"a hole next to a gasworks"* to a temporary 130 m high site called Kouba, situated North-East of the harbour, where he and Rambaud soon started to observe very actively. Awaiting for a definite site to be chosen and acquired.[1]

21.3 Towards Mountain Observatories

In the winter of 1852–1853, the grand British amateur astronomer William Lassell (1799–1880), discoverer in 1846 of Triton, the first satellite of Neptune, transferred his excellent self-built 24-inch (61 cm) reflecting telescope from Liverpool to Malta. As Allan Chapman puts it "Lassell's Malta expedition not only demonstrated the lavishness with which the Grand Amateurs went about their astronomy, but also opened the eyes of north European astronomers to what we now call 'prime sky locations' for big telescopes."[2] In 1856 Charles Piazzi-Smyth (1819–1900), Astronomer Royal for Scotland, made experimental observations with a 71-inch telescope on the Peak of Tenerife in order to test the astronomical advantages of a mountain station. The upshot of the expedition was to verify Newton's surmise, that "a serene and quiet air, pre-eminently-fit for astronomical observations, exist[ed] on the tops of the highest mountains above the grosser clouds."[3] Although Smyth did show the importance of suitable mountain sites for large instruments, his experiment was not followed up until 1868 when the AAAS meeting in Chicago took a resolution *"On the establishment of an Observatory on the Line of the Union Pacific Railroad"* which recommended *"to the attention of those who would make intelligent and munificent endowments of scientific institutions, the importance of an Astronomical Observatory at some point on the Pacific Railroad between Nebraska and the Pacific Coast, and at as high an altitude as possible, where the clearness of the atmosphere, and the great number of cloudless days, would ensure remarkable and unsurpassed opportunities for astronomical observations"*.[4] The first concrete attempt to follow the AAAS recommendations – the search for mountain sites with a clear atmosphere and many cloudless days – took place in the early 1870s when the Italian astronomer Pietro Tacchini (1838–1905), director of Palermo observatory and great observer of the Sun, suggested erecting an observatory on Mount Etna. Decided upon in 1876 and completed in 1882, the 2942 m high Mount Etna observatory could not however be used during the winter.[5]

The second attempt to follow these recommendations took place in 1875, when the summit of Mount Hamilton (1280 m) near San José (California) was recommended to James Lick (1796–1876) for implementing what was going to be the first permanent mountain observatory. Constructed between 1876 and 1887, it was also going to be equipped with *"the largest refractor in the world"*, superseding the one installed a few months earlier in Nice.

21.4 "Mountain" Observatories on the Mediterranean Coast

When at the beginning of 1879 Raphaël Bischoffsheim (1823–1906) let the *Bureau des longitudes* know about his wish to offer an astronomical observatory to French science, he mentioned immediately that it was to be installed on the Mediterranean coast, but did not say anything about altitude. Although not a scientist himself but the son of a successful banker, Bischoffsheim had during the previous years become acquainted with many scientists, especially with astronomers at Paris observatory and *Bureau des longitudes*. This was probably the result of his own tastes – born in Amsterdam in 1839, he had been sent to Paris to attend the *École Supérieure*

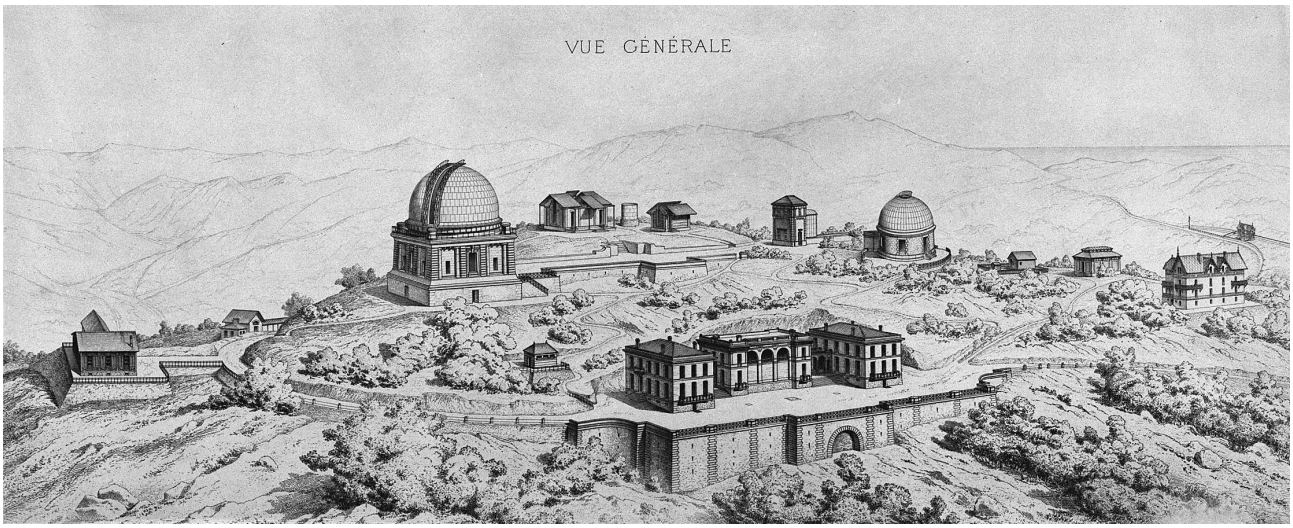

Figure 21.2: *Nice mountain observatory (1888) with the large dome by Gustave Eiffel. (Garnier, Charles: Monographie de l'Observatoire de Nice, 1892)*

des Arts et Métiers – and of the death of his father which occurred in 1872 and made him an extremely wealthy man. Already a patron for the observatories of Paris and Lyons, in 1879 Bischoffsheim was well aware of the situation of French astronomy and knew of the Lick project at Mount Hamilton.

Although the French State owned three historical observatories (Paris, Marseilles, Toulouse) as well as three new ones (Besançon, Bordeaux, Lyons), none of these was located under particularly clear skies. Furthermore, Janssen's astrophysical observatory, hardly out of limbo, was to be installed in Meudon in the vicinity of Paris and the new d'Abbadie's private observatory, intended for meridian observations only, in Hendaye on the Atlantic Coast, suffered from a fairly wet climate. As for the Southern observatory solicited from the Minister in Algiers, it still had no funding, no site and no astronomers.

Not only did French astronomy remain without good astronomical sites, but it also lacked large instruments, even at Paris observatory, which instrument-wise could no longer be considered a first class observatory. Despite Leverrier's long lasting efforts, the 74 cm (29-inch) refractor programmed as early as 1855 was far from being ready (it was going to be definitely abandoned in 1884)[6] and the 120 cm Foucault telescope that was installed in 1875 had a defective glass mirror.[7] The only large operational instrument was an excellent Eichens-Martin meridian circle, funded with Bischoffsheim's support, that had been installed in 1877 in the observatory gardens.

Meanwhile, in Europe and in the USA, a race to build *"the largest refractor in the world"* had begun. In 1869, Robert Newall (1812–1889), a Scottish manufacturer who successfully developed transatlantic telegraph cables, ordered from the York instrument maker Thomas Cooke (1807–1868) a 25-inch refractor which he installed in 1869 in his property at Gateshead (Durham). Not used very much by Newall, this magnificent instrument was given by his son to Cambridge university in 1889 and from then to Athens observatory in the 1955. In 1873 the US national observatory (USNO), settled in Foggy Bottom district near the Potomac river in 1844, installed the *"largest refractor in the world"*, a 26-inch (66 cm) by Clark that was moved to the USNO new location on Massachusetts Avenue in 1893 and is still in use today.[8] In 1875 the Austro-Hungarian Government ordered from Grubb in Dublin a 27-inch refractor (69 cm): completed in 1881 it was to be installed at the new Vienna observatory in 1882. Meanwhile, in 1879, the new Strasbourg German observatory installed a 19-inch refractor ordered from Repsold (Hamburg) and Merz (Munich) that, though not the largest in the world, was the largest in the German Empire.

When in February 1879 Bischoffsheim made his offer to the *Bureau des longitudes*, he knew that the new observatory he proposed was to be installed under clear skies and equipped with an instrument at least as powerful as the largest ones just mentioned.[9] Once the three scientists who were quickly sent by the *Bureau des longitudes* to search for a site on the Mediterranean coast had proposed the top of a 375 m high hill near Nice called Mont-Gros, Bischoffsheim's observatory would be the first permanent " mountain" observatory in Europe. And when in the early 1880s, Trépied looked for a permanent place in Algiers for setting up the French Southern observatory, he led the Ministry of Education to acquire the top of an almost 400 m high "mountain" west of the city.

21.5 The Nice Astronomical Adventure

Although the new observatory would never have existed had it not been for its rich patron Bischoffsheim, son of a banker and friend of scientists, another person played a very important role in its creation: Bischoffsheim's "messenger", the French-Austrian astronomer Maurice Lœwy (1833–1907), who was born in Vienna and studied

at the Polytechnisches Institut before taking a position in 1856 as assistant at the Imperial observatory. Brilliant but prevented from entering an academic career in Vienna because of the regulations applied to Jewish people at that time, he accepted the invitation from the Paris observatory director, Leverrier. He arrived in 1860, acquired French nationality in 1867 and spent the rest of his life at Paris observatory, where he ended his career as its director. Having invented a new instrument in 1871 – the coudé refractor – he had obtained Bischoffsheim's financial support to build a prototype, but due to extreme turmoil within the national observatory, the making of this first coudé had been postponed. When, after the death of Leverrier, Mouchez (1821–1892) became director with Lœwy as *directeur-adjoint* and official representative of astronomy with the Ministry, scientific projects with Bischoffsheim's support were (re)activated: the patron offered the new Lyons observatory its first instrument, a good Eichens meridian circle similar to the Parisian one although with a slightly smaller objective lens, and the making of the coudé prototype was finally launched. At the same time Bischoffsheim asked Lœwy to be his messenger at the Bureau des longitudes where it is recorded that on 12 February 1879:
"Mr Lœwy informs the Board that Mr Bischoffsheim intends to found an observatory on the border of France near Menton and that he wishes this establishment to be put under the patronage of the Board of Longitudes."[10]

Meant to be a model, the new French observatory was to be directly inspired by the observatory that the famous German astronomer Wilhelm Struve (1793–1864) had set up for the Russian tsar Nicholas I forty years earlier. As in Pulkovo, an elevated and isolated site was to be carefully chosen, the commission for a monumental architecture was to be given to a famous architect, the scientific and the non scientific buildings were to be organised separately, the best available instruments were to be ordered, the library was to be richly funded and the new observatory was to be equipped with *"the largest refractor in the world"*. While Struve had had a very limited choice of elevated places in the vicinity of Saint-Petersburg – the Pulkovo 75 m high hill was the only one in the South of the city – Lœwy and his Parisian colleagues launched a real astronomical site search on the Mediterranean coast before selecting an excellent 375 m high "mountain" in the vicinity of Nice, a city with clear skies annexed to France in 1860.

As regards the architect, Bischoffsheim chose Charles Garnier (1825–1898), whose Opera house in Paris had been inaugurated in 1875 and from whom Bischoffsheim had ordered a prestigious house in Bordighera.[11] Famous since 1861, the year he won the competition for the new Paris Opera house, Garnier received from Bischoffsheim the exceptional commission of conceiving and realizing a model observatory for French astronomers[12].

As regards the instruments, their specifications were established by the Parisian astronomers and Henri Perrotin (1845–1904) – an astronomer trained at Toulouse observatory under the young and brilliant Félix Tisserand (1845–1896) who, after having passed his PhD in Paris in 1879, had accepted to become Nice observatory first director – and Bischoffsheim ordered them from the best makers of the time: the Henry brothers for the optical parts, Paul Gautier and the Brunners for the mechanical parts.

21.6 A Twin Observatory at Algiers

Work on the Mont-Gros started in 1881, the year the Algiers observatory – mainly devoted to observations because placed under more Southern skies and a more favourable climate than any other French observatory – started to be funded by the Ministry of Education. Naturally, this second "mountain" observatory was greatly inspired by the "model" observatory being erected at the same time on the northern side of the Mediterranean Sea. Although it was funded by the State and not by a rich patron, not only was it situatd like the one at Nice in an excellent "mountain"-like site, but its was commissioned to Jules Voinot (∼1855–1913), architect for the Government, who with Trépied visited several times the Garnier building site in Nice. No wonder that the design of the astronomical site and the architecture of the main building – hosting a rich library and accommodation for the director – are very similar on both sides of the Mediterranean coast.

As regards the astronomical instruments, Algiers observatory was better endowed than any of the other French State observatories and – apart from a giant refractor – it had no need to envy any of Nice's equipment. While Nice was to be equipped with a large meridian circle, a portable one, a 15-inch refractor, a coudé (Lœwy system) refractor, Algiers was to going to acquire a large meridian circle, a coudé refractor, a *Carte du ciel* astrograph, as well as a horizontal refractor for spectroscopy. Moreover, not only did Trépied move from the previous setting a small portable meridian circle, but also the famous 50 cm Foucault telescope that Bulard had obtained. This most powerful instrument was going to be housed under an elegant dome built at the centre of the domain while in Nice the *"largest refractor in the world"* was to be sheltered within Garnier's monumental Egyptian base, on top of which was placed a 24 m floating dome – *"the largest rotating dome that had ever been constructed"*.[13] – conceived by Gustave Eiffel (1832–1823) a few years before his famous tower was erected.[14]

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1. See Le Guet Tully, Sadsaoud and Heller: "La création de l'observatoire d'Alger." In: *La Revue, Musée des Arts et Métiers* n° 38 (2003), p. 26–35.
2. `http://www.mikeoates.org/lassell/lassell\_by\_a\_chapman.htm` (Nov. 2009).
3. `http://books.google.fr/books?id=TmsPAAAAYAAJ\&printsec=frontcover\&dq=piazzi+smyth+t\`

'{e}n\'{e}riffe\#v=onepage\&q=newton\&f=false, p. 436.

4. http://archives.aaas.org/docs/resolutions.php?doc_id=444.
5. This led to the creation in 1880 in Catania of a *succursale cittadina* that, due to the working difficulties on Mount Etna and the bad choice of its location near the central crater, became within a few years the main station and the first Italian astrophysical observatory.
6. Firstly its construction suffered from a succession of delays, then it was found out that Paris observatory had been built on ancient careers that prevented the installation of the solid foundations necessitated by such a large instrument.
7. Foucault had not been able to achieve it before his premature death at 48 in 1868.
8. Built by Alvan Clark & Sons, an establishment founded in 1846.
9. That same year, Otto Struve (1819–1905) ordered a 30-inch lens from Clark in order to equip for Pulkovo observatory once again with the *"largest refractor in the world"*. As a result, Nice large instrument was to be also a 30-inch, but a with a focal length of 18 m instead of the 16 m of the Pulkovo objective lens.
10. "M. Lœwy fait part au Bureau que M. Bischoffsheim a l'intention de fonder un observatoire sur la frontière de France près de Menton et témoigne le désir que cet établissement soit mis sous les auspices du Bureau des Longitudes."
11. A small village on the Italian Riviera, not far from the French border, where Garnier himself spent part of the winters with his family and artist friends in a villa he had built in 1873.
12. State or private observatories were usually commissioned to renowned architects: in the 1860s, Henri Espérandieu at Marseilles, in the 1870s, Hermann Eggert at Strasbourg (Germany), Abraham Hirsch at Lyons, Eugène Viollet-le-Duc (1814–1879) at Hendaye (for d'Abbadie), Léon Ferrand at Bordeaux, in the 1880s, Etienne-Bernard Saint-Ginest at Besançon, Jules Voinot at Algiers, Thomas Fitte at Toulouse.
13. http://adsabs.harvard.edu/full/1886AReg...24..279.
14. Garnier, who sat on many official committees, took part at the beginning of the 1880s in the one examining the competitive tenders made for the making of an unusually large dome for housing the large refractor planned at Paris observatory. He got to know about the very original proposition of the not yet famous engineer Gustave Eiffel: to house the instrument under a dome made to float in order to ease its rotation. Eiffel's proposition was rejected by the Parisian committee, but Garnier, who had been in favour of it, suggested Bischoffsheim to adopt it for housing the Nice 30-inch refractor.

21.7 Bibliography

Le Guet-Tully, Françoise; Sadsaoud, Hamid and Marc Heller: "La création de l'observatoire d'Alger." In: *Musée des Artes et Métiers, La revue* **38** (2003), p. 26–35.

Le Guet-Tully, Françoise: "The Nice Observatory – An Exceptional Commission." In: Jean-Lucien Bonillo et al.: *Charles Garnier and Gustave Eiffel on the French and Italian Rivieras – The Dream of Reason.* Marseille: Editions Imbernon 2004, p. 15–42.

Le Guet-Tully, Françoise and Jean Davoigneau: "The 19th-century observatory today. From astronomical instrument to cultural and scientific symbol." In: Grob, Bart and Hans Hooijmaijers (eds.): *Who needs Scientific Instruments.* Leiden: Museum Boerhaave 2005, pp. 57–64.

Le Guet Tully, Françoise: Raphaël Bischoffsheim und die Gründung eines astronomischen Observatoriums an der französischen Riviera. In: Wolfschmidt, Gudrun (ed.): *Astronomisches Mäzenatentum.* Proceedings des Symposiums in der Kuffner-Sternwarte in Wien, 7.–9. Oktober 2004: "Astronomisches Mäzenatentum in Europa". Norderstedt: Books on Demand (Nuncius Hamburgensis – Beiträge zur Geschichte der Naturwissenschaften; Band 11) 2008, p. 111–129.

Observatoires astronomiques Provence – Alpes – Côte d'Azur: http://www.culture.gouv.fr/documentation/memoire/VISITES/obspaca.htm