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LIFE AT MEUDON OBSERVATORY, 1876–1963

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Abstract: Meudon Observatory was created for Janssen in 1876 for physical astronomy, as a reaction to the conservative Paris Observatory. It merged in 1927 with this observatory, while keeping in practice some autonomy. It was very well equipped, with a great equatorial, a 1-m reflecting telescope and several novel solar instruments, but except for the latter they were not very much used due to lack of personnel and because of technical deficiencies. A modern equatorial table was installed in 1931 and became the main non-solar instrument. A physics laboratory had been installed from the beginning, producing data useful for astronomy; it was the responsibility of a 'Physicist of the Observatory'. In this paper, I describe the life at Meudon until the arrival of radio astronomers in 1956 and the nomination in 1963 of a radio astronomer as director, events that produced considerable changes in Meudon Observatory.

Keywords: Paris-Meudon Observatory, Mount Blanc Observatory, Antoniadi, Baldet, Bertaud, Danjon, Dauvillier, d'Azambuja, Denisse, Deslandres, Dunoyer de Segonzac, Esclangon, Grenat, Janssen, Lyot, Mărăcineanu, Muller, Perot, Rabourdin, Trouvelot

1 INTRODUCTION

Meudon Observatory near Paris (France) was created in 1876 by the President of the Republic for Jules Janssen (1824–1907; Figure 1). In 1926, it was merged with Paris Observatory, but kept nevertheless some autonomy for a long time. The personnel always remained rather limited until the arrival of radio astronomers in 1956.

In this paper, I aim at describing the evolution of this Observatory and the life of its occupants. For this, several sources are available: the book about Janssen by Françoise Launay (2008); interviews of Marguerite d'Azambuja (1980), Roger Servajean (1978) and Audouin Dollfus (2009), and a text by Gualtiero Olivieri (1993). I have also used the very rich *Dictionnaire des Astronomes Français 1850–1950* by Philippe Véron (n.d.), many reports and journals digitized on gallica.bnf.fr, and various documents and photographs preserved in the Library of Paris Observatory. The scientific results obtained at Meudon Observatory are not described here, with a few exceptions.

Meudon Observatory is located in a vast public domain on a hill south-west of Paris, with a beautiful view on the capital. This was formerly an eighteenth-century château with a park, a large pond, and outbuildings to house the personnel and the horses (see Figure 2).[1]

The château itself was much damaged in 1871 by a fire. For restoration, amenities and instruments, Janssen, who was well connected in the public sphere, managed to obtain from the Government a grant of 1,235,000 francs, which today (2022) is approximately equivalent to 5 M€ or 6 M$.

The château was partially restored; the upper floor disappeared, except the central part where the dome for a great equatorial was installed (Figure 3). The outbuildings were in relatively good condition and were used as lodgings for the Director and some personnel, and for offices, workshops and laboratories.

The Great Equatorial (*grande lunette*), the largest in Europe, and its dome were completed in 1893, but the official reception took place only in 1895 (for details see Dollfus, 2006). A 1-m diameter Newtonian reflecting telescope was installed in 1891, and was replaced in 1971 by a 1-m Cassegrain telescope (see Dollfus, 2000).

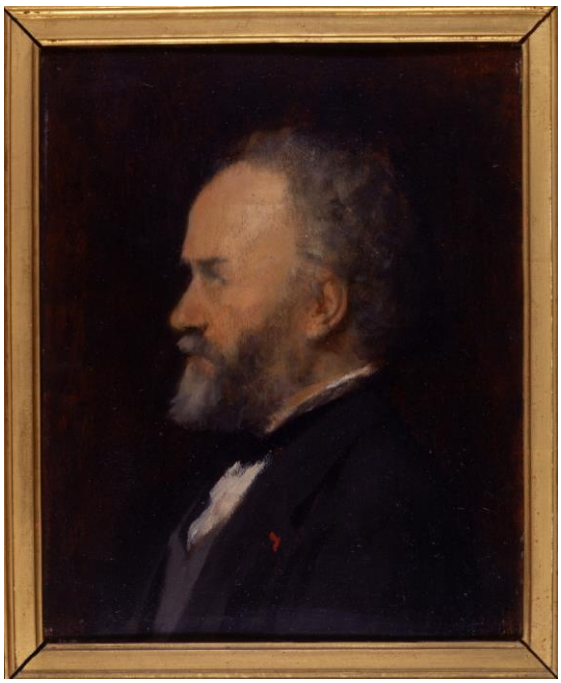

Figure 1: Portrait of Janssen by his friend, the painter Jean-Jacques Henner (1829–1905), ca. 1890 (courtesy: Paris Observatory Library).

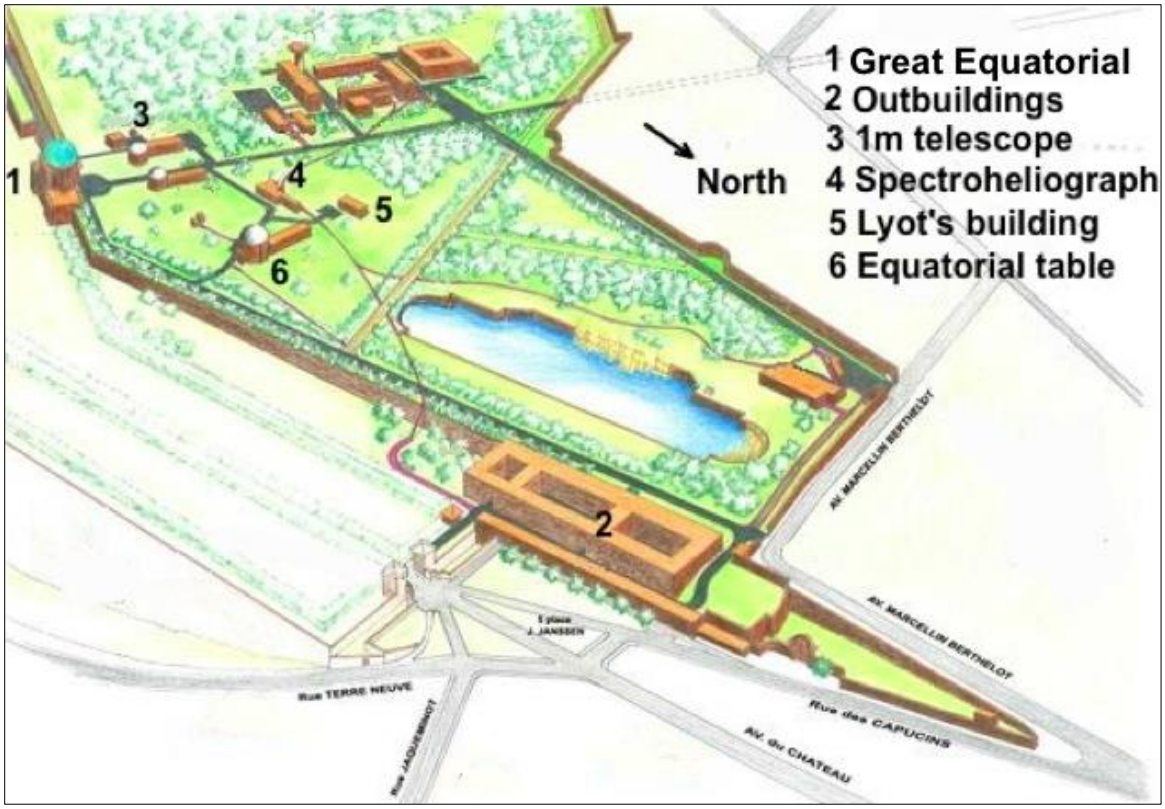

Figure 2: View of Meudon Observatory from the north-east. All the buildings that are unnumbered have been constructed since 1950 (courtesy: Paris Observatory Library).

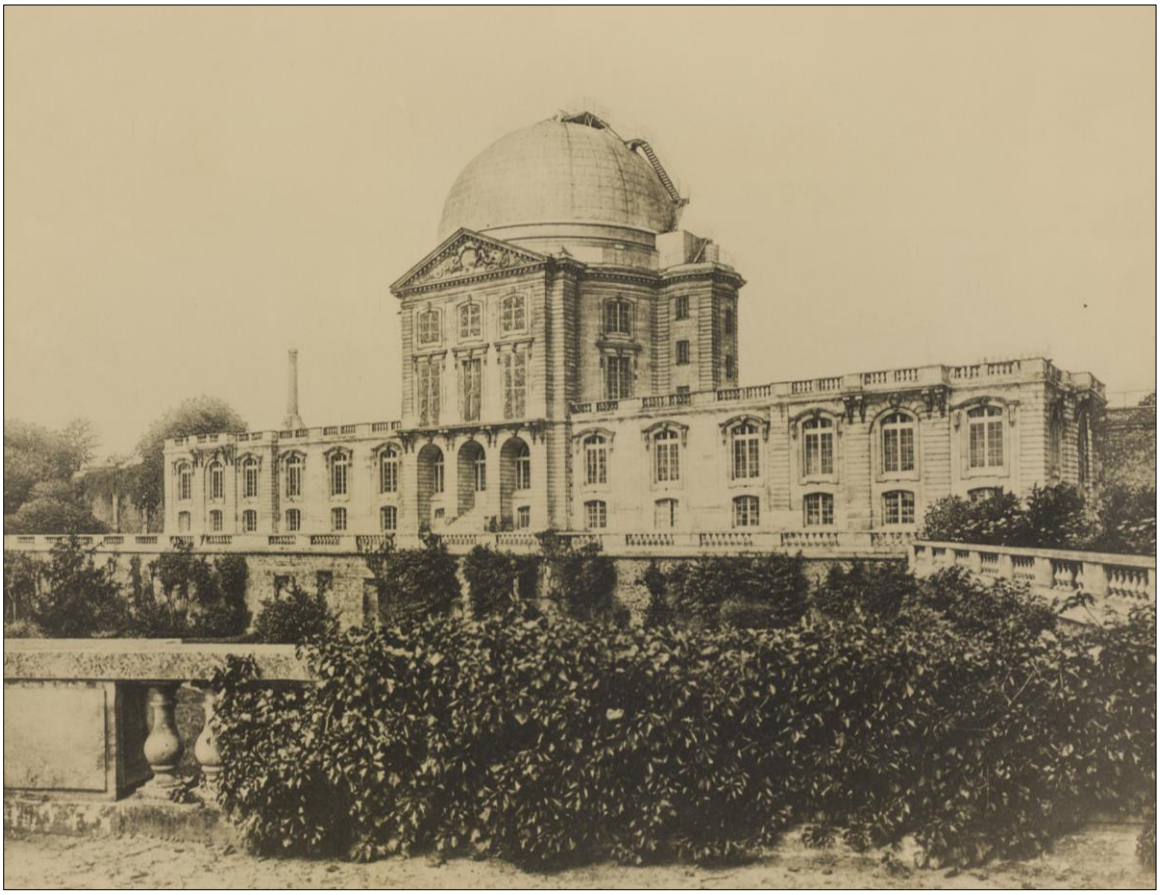

Figure 3: The château, with the dome housing the Great Equatorial (courtesy: Paris Observatory Library).

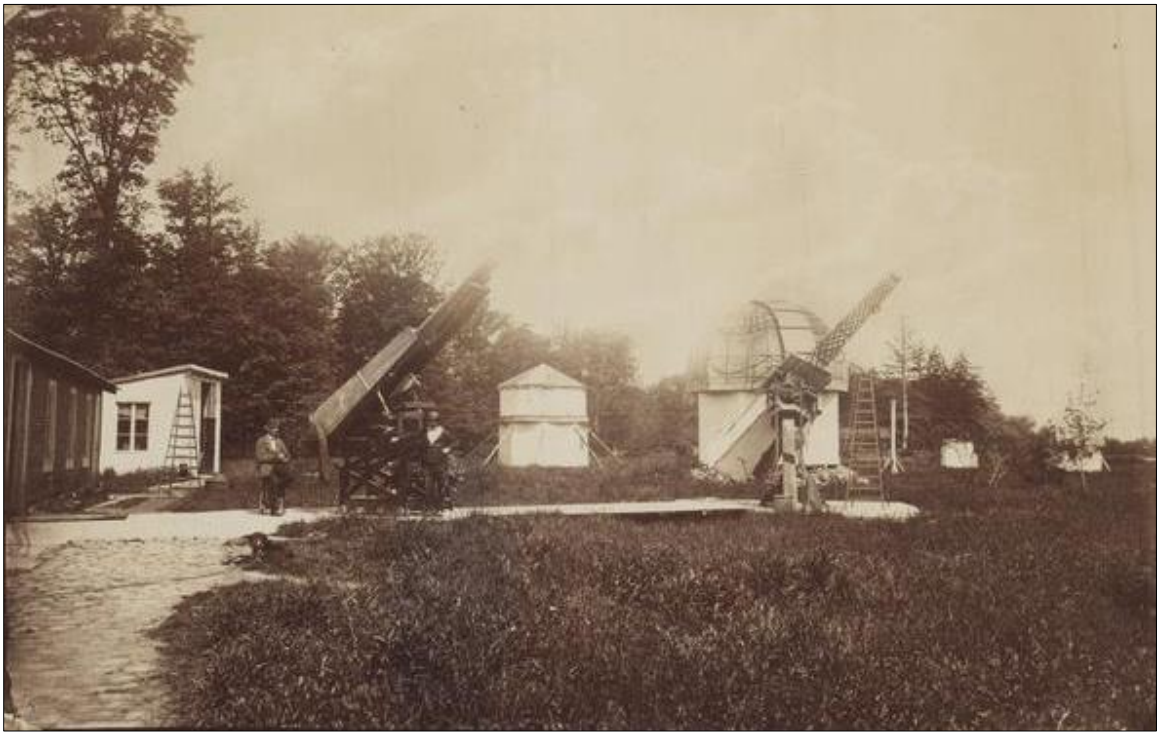

Figure 4: Two solar refracting telescopes and one of the three small domes, ca. 1895 (courtesy: Library of Paris Observatory).

There were also a 15-cm diameter Eichens equatorial, which had been used in Japan to observe the 1874 transit of Venus (Débarbat and Launay, 2006), a smaller equatorial, several refractors to observe the Sun (see Figure 4), a rather strange polar siderostat (Figure 5), a 50-cm diameter reflecting telescope and magnetic instruments. For details of these instruments, see Janssen (1896) and Lequeux and Georgelin (2022).

Other instruments were constructed later: several spectroheliographs between 1902 and 1909, an 'equatorial table' with a rising floor in 1931 (Figure 6), etc. Janssen also organized a laboratory in the outbuildings for spectroscopy of gases of astrophysical importance, with a high-pressure section. This was an excellent idea.

2 THE REIGN OF JANSSEN (1876–1906)

This considerable instrumentation was not used very much, as we shall see. A first problem was with Janssen himself. He was a hyperactive entrepreneur and traveler, and was very often far from Meudon. As if Meudon Observatory was not enough, he took great pains to set up another observatory on the summit of Mont Blanc, at 4807 m elevation (Malherbe, 1987; 2022).[2]

In 1890 Joseph Vallot (1854–1907) had already built an observatory 450-m below the summit, mainly for meteorological and physiological observations, and this is still active today. Janssen ascended Mont Blanc for the first time in October 1888, to the Refuge des Grands Mulets at 3050 m elevation (see Janssen, 1888, which has a vivid description of the

Figure 5: The polar siderostat, for solar observations. The flat mirror has a diameter of 30 cm. It was built for the latitude of Japan where the 1874 Venus transit was observed (courtesy: Paris Observatory Library).

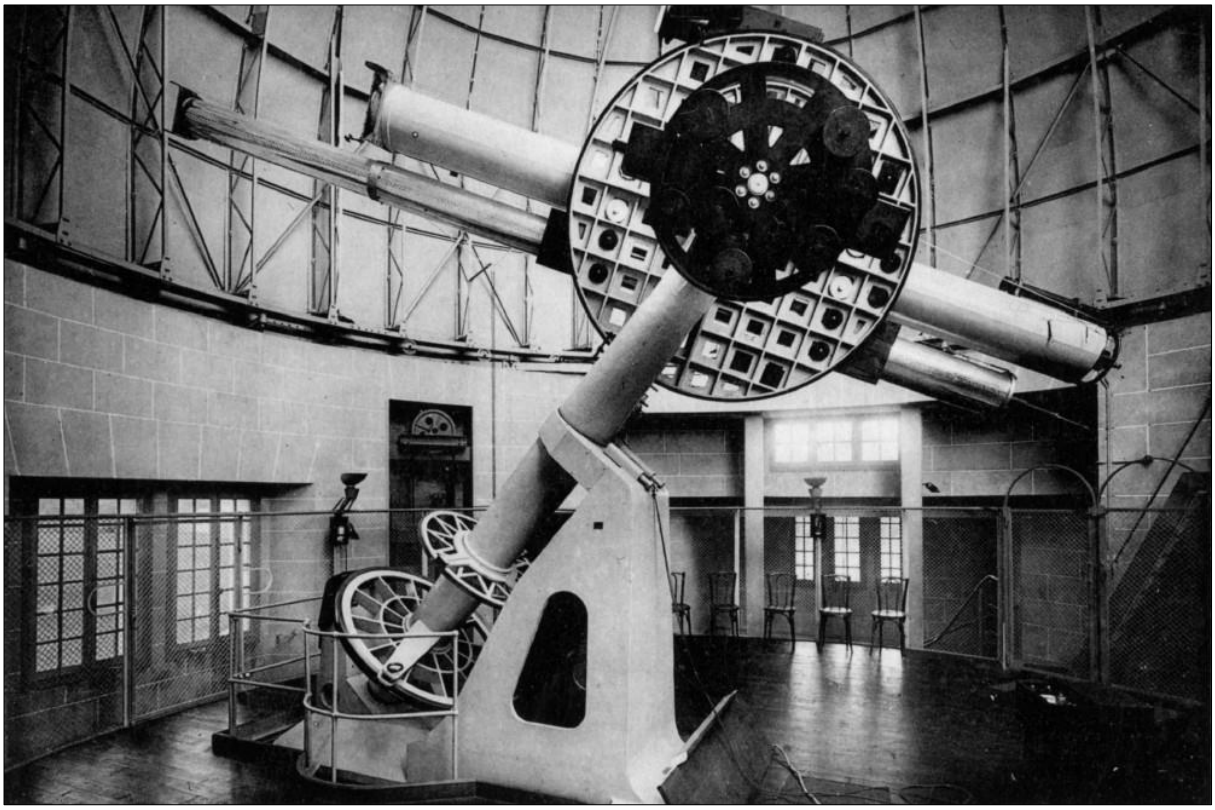

Figure 6: The so-called 'equatorial table'. This comprised an equatorial mounting to which various instruments could be attached. In this photograph, which dates to about 1935, there is a 5-m long guiding refractor (courtesy: Paris Observatory Library).

ascent), then in August 1890 to Vallot's Observatory and the summit. As he could not walk easily, he was carried by guides on a specially made combination of ladder and chair during the first ascent (see Figure 7), and pulled on a sled during the second one. Encouraged by these ascents, he had an observatory constructed at the summit in 1893, requiring 15 tons of material and equipment carried on the backs of men as 800 loads. Janssen was present at the dedication. He ascended the mountain for the last time in 1895, where he could use the 33-cm refractor. The following year this telescope was transformed into a polar siderostat with a 60-cm flat mirror made by the Henry brothers. However, the observatory slowly collapsed in the snow and had to be demolished in 1909. For further details see Malherbe (2022).

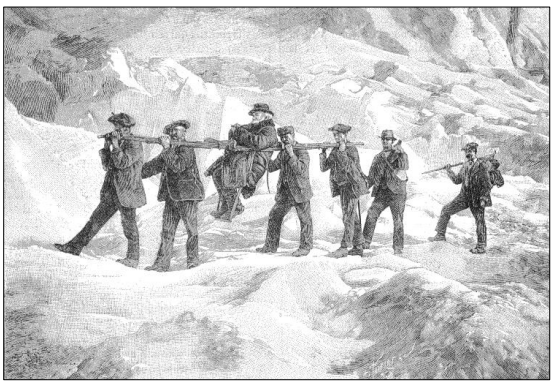

Figure 7: Janssen being carried on his ladder-chair up Mont Blanc in 1888 (from a photograph by E. Whymper, *La Nature*, 2^{e} semestre 1895, 328; CNUM/CNAM).

A large number of astronomers and physicists observed at Mont Blanc Observatory: I count about 16, as well as several biologists. The sixteen included three people from Meudon Observatory: Alexis Hansky (1870–1908), Gaston Millochau (1866–1922) and Gabriel Tikhov (1875–1960). Meudon astronomers and technicians had to accompany Janssen in his other scientific travels: the photographer Louis Pasteur (1850–1925, see later for his name) for the 1882 transit of Venus in Algeria, Pasteur again, Léopold Trouvelot (1827–1895) and another person for the 1883 total solar eclipse in the Caroline island in the Pacific Ocean, Millochau in 1904 for a trip to the Mount Vesuvius volcano in Italy, etc. Henri Deslandres (1853–1948), who had joined the Observatory in 1898, directed an eclipse expedition that year in Japan, in 1900 at Argamasilla (Spain), and still another one in 1905 at Burgos (Spain) while Janssen went to another place in Spain named Alcosebre. Almost all the minor scientific personnel of the Observatory took part in these

expeditions: see Deslandres (1901) and Launay (2008) for details. Each time, the scientists were away from the Observatory for several months, so that the time left for observing in Meudon was limited.

What happened in Meudon during Janssen's reign? The permanent personnel, who were limited to three in 1877 (Janssen, a photographer and a guard), grew progressively to a dozen in 1882. They were accommodated in the château where the Great Refractor was installed, and in the outbuildings. Janssen also purchased or rented an apartment in Paris in 1886, as he attended innumerable meetings in the city. On the scientific side, he developed photographic techniques and took astronomical photographs himself, in particular of a comet in 1881. Beautiful photographs of the Sun showing the granulation have been presented by him, but most and perhaps all of them were actually obtained by photographers: first Pierre-Marie Arents (1842–1916), hired in 1876 and replaced in 1880 by Louis Pasteur, himself helped from 1897 to 1925 at least by Florimond Coroyer (1864–1930). Louis Pasteur is the name of the famous biologist; the photographer, of Swiss origin and who had a rather complicated life before entering the Observatory, had taken this name as a pseudonym (d'Azambuja, 1980). His real name was Avise Deléchaux. The photographs were made with the wet collodion process, and the plates had to be prepared on the spot in obscurity. In 1896–1897, Janssen and Albert Nodon (1862–1934), the first Physicien de l'Observatoire (Physicist of the Observatory), made some experiments in the spectroscopy laboratory installed in the outbuildings.

The first astronomer at Meudon Observatory aside from Janssen was Léopold Trouvelot (Figure 8). Trouvelot (see Véron, n.d.) was an engraver by profession, and had to go into exile in the USA in 1855 for political reasons. He earned his living as an artist and went on to raise silk worms in 1860. For this, he imported from Europe a new species of *bombyx* that infested the whole of Massachusetts. After this disaster, he wisely turned to astronomy, and was hired in 1872 by the Harvard College Observatory. There, he produced many drawings and pastels of celestial objects, very beautiful but not always accurate. Fifteen of these pastels were published as chromolithographs in a portfolio with a manual, which enjoyed great success (Trouvelot, 1882). Recommended by the celebrated Camille Flammarion (1842–1925), he joined Meudon Observatory in 1882, where he stayed until his death in 1895 due to an unusual minor illness contracted during the observation of a lunar eclipse. During his later years, Trouvelot was in conflict with Janssen who reproached him for his bad character and his inaction, both apparently due to his poor health (Véron, n.d.). The internal conflict became a public one when the anti-Semitic newspaper *La Libre Parole* defended Trouvelot against Janssen. It is true that, in general, Janssen acted as a dictator: in his office there was only one chair on which he would sit, while visitors had to stay standing (d'Azambuja, 1980).

After Trouvelot's death in 1895, several astronomers joined the Observatory: Henri Perrotin (1845–1904) in 1896, Henri Deslandres and his collaborator Gaston Millochau in 1898, as well as Alexis Hansky, Gabriel Tikhov and Louis Rabourdin (1858–1936) the same year. We can also cite Georg Stanolevitch (1858–1921), Milan Stefanik (1880–1919) and Aymar de La Baume Pluvinel (1860–1938). Only Deslandres and Millochau were paid by the Observatory, the others were volunteer collaborators. In 1899, Deslandres hired a young helper, Lucien d'Azambuja (1884–1970), aged 15, who he paid from his own pocket. Perrotin stayed only a few months before returning to Nice where he was directing the observatory, but the other astronomers remained for a long time. Perrotin, Deslandres and Millochau made various observations with the Great Equatorial.

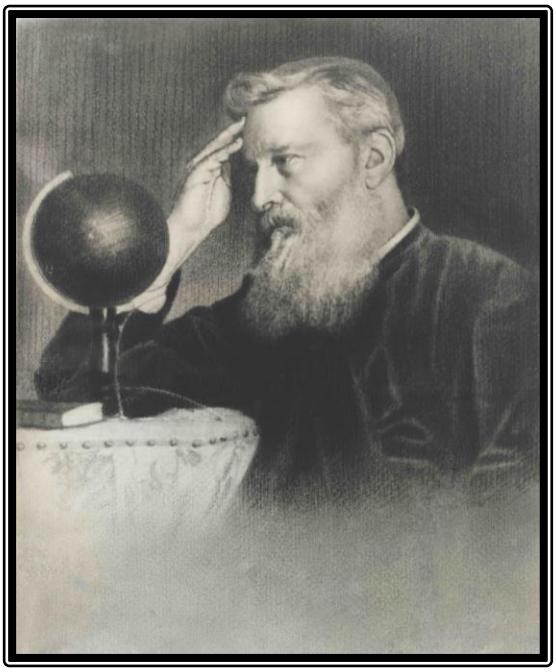

Figure 8: Photograph of a portrait of Léopold Trouvelot, held at the town hall of Guyencourt, which was his birthplace (courtesy: Paris Observatory).

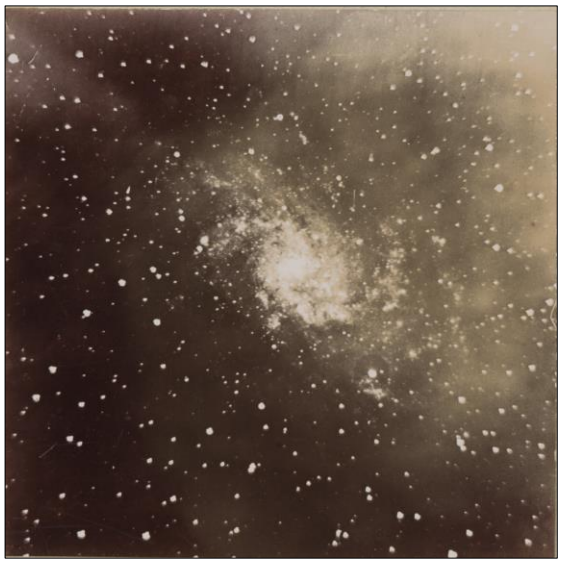

Figure 9: The galaxy M 33, photographed by Rabourdin at the 1-m telescope on 29 October 1897, exposure 2 hours; field 70′ × 70′ (courtesy: Paris Observatory).

Rabourdin, who earned his livelihood as a pawnshop employee but had been previously employed as a calculator by the Bureau des Longitudes and had stayed for four years at the Algiers Observatory, was apparently the first to use the 1-m reflecting telescope regularly, from 1897 to 1899. With this instrument, he obtained many photographs of celestial objects, such as shown in Figure 9, which illustrates the large field of the telescope. Unfortunately, these photographs were never used scientifically. For some reason, in 1899 Rabourdin was forbidden by Janssen from using this instrument, but he came regularly to the Observatory until 1912 when he was again allowed to use the reflector after Janssen was replaced by Deslandres. Tikhov also observed with this telescope from time to time.

Figure 10: Henri Deslandres in 1910 (courtesy: Paris Observatory).

Deslandres was certainly the most active of the Meudon astronomers at the beginning of the twentieth century. With Millochau and d'Azambuja, he installed several generations of spectroheliographs and initiated the continuous monitoring of solar activity, which goes on to this day in Meudon. Deslandres hoped to succeed Janssen as the Director of the Observatory, but the latter remained in this role until his death in 1908. As Deslandres had relations in the political world, he succeeded in being promoted in July 1906 to the role of "… deputy director in charge of administrative problems", a function created for him. His installation on 28 July was the occasion of a clash between him and Janssen, both strong personalities, in front of the personnel (Launay, 2008: 254). War was declared and continued after the death of Janssen between Deslandres and Mrs Janssen and her daughter. While they were taking away instruments belonging to Janssen, Deslandres blocked their cars, claiming that the instruments were the Observatory's property, and a court decision was needed to allow the removal of the equipment to proceed.

3 THE REIGN OF DESLANDRES (1908–1927)

After the death of Janssen, Deslandres (Figure 10) became officially the Director of the Observatory. As we have seen, he was a strong character, very devoted to his work and also extremely absent-minded. D'Azambuja (1980) tells us (my English translation):

> Deslandres was engaged to the daughter of a well-known physicist, Alfred Cornu. An engagement lunch had been prepared as usual, but Deslandres, who was preparing his doctorate, went that morning to the laboratory to check some results. He was so absorbed that he stayed there all day without eating, forgetting the lunch. The next morning, he found Cornu in the laboratory who asked him: "Where were you yesterday?" "But I was here, I worked all day." "We have been waiting for you, sir!" Needless to say, the engagement was broken off.

But it might have been what psychologists call a 'missed opportunity'. In any case, many years would pass before Deslandres married.

Despite his severe appearance, Deslandres was not lacking in humanity. He covered from his own pocket the studies of d'Azam-

buja and always paid great attention to the salaries and promotions of his collaborators.

Before joining the Meudon staff, Deslandres already had a bright career: he was first to disentangle the band spectrum of molecules. He was hired in 1889 by Admiral Ernest Mouchez (1821–1892), then Director of Paris Observatory, to introduce some astrophysics in this venerable institution. Working with the 1.2-m diameter reflecting telescope that was so bad that it could only be used as a light collector for spectroscopy, Deslandres and Millochau were first to verify, using the rotation of Jupiter, the still controversial Doppler–Fizeau effect on light reflected by a moving object. Deslandres was also interested in the Sun and this led to the construction of spectroheliographs and other related equipment when he came to Meudon, and to an extensive study of the Sun's chromosphere (see Deslandres, 1906; 1910).

This was not the only activity of Deslandres in Meudon. For example, he discovered in 1902 by spectroscopy the retrograde rotation of Uranus, using the Great Refractor. He took benefit of the physics laboratory installed by Janssen and continuously upgraded, to continue his work on the band spectrum of molecules, until his retirement in 1928.

We will now go through the evolution of the Observatory during the directorship of Deslandres, based principally on the annual reports (Deslandres, 1913 to 1926). In 1913, there were only five astronomers in Meudon (Deslandres, 1914): himself, d'Azambuja, Vital Burson (1881–1932), Jean Bosler (1878–1973) and Alfred Perot (1863–1925). In 1908, Perot had replaced Nodon, who had left for Bordeaux in 1905, as Physicien de l'Observatoire. Tikhov had left Meudon in 1902 for Moscow then Pulkovo, Hansky in 1905, also for Pulkovo and Millochau in 1907 for Paris Observatory. It is likely that the atmosphere at Meudon Observatory had somewhat degraded and was the reason for these departures.

The other personnel consisted of the photographer Pasteur, the laboratory helper Coroyer, a secretary-accountant, Lamiable, a security guard of the park, Dalzon, a concierge, Charpentier, and a gardener with two helpers paid by the hour. They were housed in what remained of the château or in the outbuildings.

From 1909, an amateur, Eugène Antoniadi (1870–1944), who belonged to a rich family of Greek ship-owners, observed planets

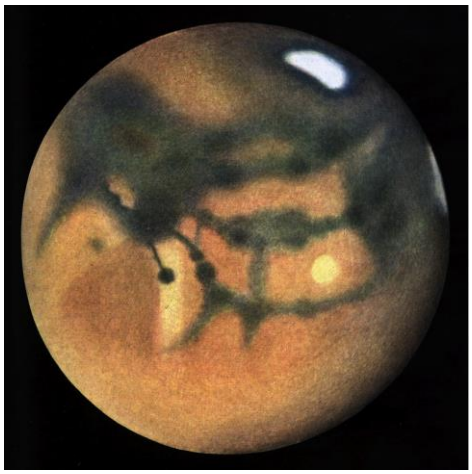

Figure 11: Drawing of Mars by Antoniadi. As in most such drawings, the contrasts and the colors are somewhat exaggerated (courtesy: Paris Observatory).

regularly with the Great Equatorial, Mars in particular, producing beautiful drawings (Figure 11). He is known as one of the astronomers who killed definitively the famous canals of Mars. A Swedish astronomer, Henrik Block (1882–1928), spent several months in Meudon in 1913 and 1914 and used the 1-m reflecting telescope for visual photometry of stars.

At the same time, there were about 16 permanent astronomers at Paris Observatory, so Deslandres complained that physical astronomy (today we would say astrophysics) was neglected in favor of classical astronomy. But, in any case, WW1 was to change the situation completely.

Deslandres, d'Azambuja, Burson, Lamiable, Dalzon and Charpentier were mobilized in 1914, and Bosler in 1915. Perot remained in Meudon, where he acted as an interim Director and worked with Colonel (later General) Gustave Ferrié (1868–1932) on transmission by radio and listening to enemy communications (Figure 12). This was a success;

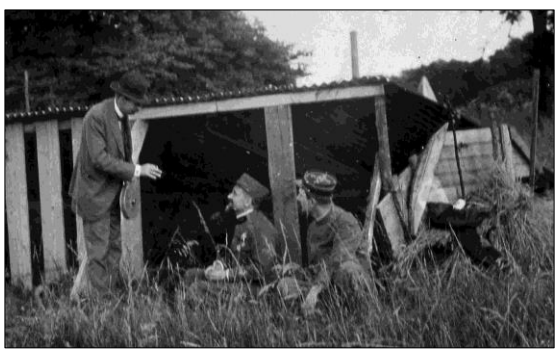

Figure 12: Perot (left), Colonel Ferrié (middle) and Captain Jouaust discussing radio transmissions at Meudon (photograph by Jacques Perot, kindly communicated by Yvon Georgelin).

Perot and Ferrié became friends and together investigated transmission of radio waves in Meudon well after the war. Pasteur and Coroyer also stayed at the Observatory. Coroyer ensured the solar patrol with the spectroheliographs throughout WW1.

The park of the Observatory was used as a livestock yard, with fences around the instruments from which the most delicate parts were removed. In 1917, the park became a testing ground for Renault tanks, so that it was completely devastated by the end of the war in 1918.

Deslandres and Dalzon were injured, the latter severely. Deslandres, Bosler, d'Azambuja and Burson were only demobilized at the beginning of 1919, and resumed their Observatory activities on 1 May of that year, as well as Dalzon who was judged "… still able to be useful." Charpentier had died from illness in 1917 and was replaced by Ancelin, who had to leave at the end of 1920, also due to illness. Thus, the situation with the personnel was about the same as in 1913.

Figure 13: Lucien and Marguerite d'Azambuja in 1950 (courtesy: Paris Observatory).

In the Annual Report, 1920 was qualified as the "… first really normal year." Bosler left for Paris Observatory and was replaced by Bernard Lyot (1897–1952). The instruments were again fully operational, in particular the solar ones, the 1-m telescope and the Great Equatorial. A Foucault-type siderostat was added, with a provisional 40-cm flat mirror. But, for lack of personnel, the 1-m telescope was little used. The Great Equatorial had been originally conceived with a single tube, but built with a twin tube without reinforcing the mount. It was difficult to use, and "… required young and vigorous astronomers …" according to the Annual Report. These problems were recurrent and were not resolved until the 1964 renovation. The photographic part was judged useless and the 62-cm objective was removed. It was only put back in 1964.

The experiments on radio transmission initiated during the war by Ferrié and Perot continued at Meudon for many years with the help of personnel from military telegraphy, even after the death of Perot in 1925.

The situation in Meudon did not change much during the following years. The mechanic, Dubourg, died in 1921 and was replaced by Martin. One notes the arrival in July 1922 of an astronomer from Algiers Observatory, Fernand Baldet (1885–1964), then in 1924 of another one, Henri Grenat (1900–1968), and in 1925 of Henri Mineur (1899–1954) and of Miss Stefania Mărăcineanu (1882–1944). The latter had obtained a PhD in 1924 under the direction of Marie Curie, and thought that solar radiation could influence the value of the disintegration constant of polonium. She worked on this topic in Meudon until 1928, without result of course, and then left for Bucarest where she became an Assistant at the Faculty of Sciences. Pasteur died in 1925.

In 1923, Perot had brought to the Observatory a young female Assistant, Miss Marguerite Roumens (1898–1985), who was paid by an external body, the École des Hautes Études (School for Advanced Studies). After Perot's death, she worked with Deslandres and d'Azambuja, and ended up marrying d'Azambuja in 1935 (Figure 13).

The solar work was of high quality under Deslandres and d'Azambuja, and without real competition since Hale, who had invented the spectroheliograph independently of Deslandres, had completely abandoned solar research while the Mount Wilson astronomers focused on galactic and extragalactic work. The Foucault siderostat was mainly used to observe the spectral lines of different types of stars, with the purpose of detecting their chromospheres. Baldet observed the spectra of comets and novae.

The most interesting observations were undoubtedly those of Perot and Lyot. Perot used the Perot–Fabry interferometer to detect the gravitational redshift of solar lines. With the Great Equatorial and other instruments like the 1-m reflector, Lyot (Figure 14) made remarkable observations of the polarization of light from the Moon and planets.

Bernard Lyot was universally appreciated for his human and scientific qualities (d'Azambuja, 1980; Dollfus, 2009). He was charming and shy in spite of his celebrity. After WW2 he would come to the Observatory on a *vélo-solex* (the famous French bicycle whose motor directly drove the tyre of the front wheel), or on his old Citroën B12 car when bringing his

pair of poodles. His absent-mindedness was proverbial, and when he borrowed something you cared about, you had better try to get it back before he went to observe elsewhere (Olivieri, 1993).

Henri Grenat, whom I knew personally, was a particular character (d'Azambuja, 1980; Olivieri, 1993). A former student of the École Polytechnique, he was very cultivated and a good mathematician, but completely devoid of ambition. He was helpful to others, but also terribly critical, especially towards VIPs like the Directors of the Observatory. He was supposed to have demonstrated that the temperature of the solar corona was 2 million degrees, which would have been a very important result, but it has not been possible to check this. He published only a few papers; no one can understand the last one (Grenat, 1940), which was probably intended for a PhD thesis, and about which the editors wrote (my English translation):

> We have reservations about certain original conclusions of the author which are in opposition to generally admitted classical theories.

Is it any wonder that Grenat was often viewed with suspicion?

In the Annual Report for 1921, we find a long discussion about a possible reorganization of French observatories. Deslandres noted that amongst the 11 public observatories in France, only Meudon was fully devoted to astrophysics,[4] while most large observatories elsewhere in the world specialized in that area of astronomy, with numerous personnel, and large instruments that often were located at good mountain sites. Paris Observatory, which contained one third of all French astronomers, had the worst location of all French observatories. Deslandres noted that the Minister, conscious of the situation, had ordered an inspection of French observatories before deciding what to do.

Deslandres was put in charge of this review in 1922. He summarized his conclusions in the report for 1923:

- Removal of several redundant instruments for astrometry;
- Closure of several poorly located observatories;
- Distribution of half the personnel of Paris Observatory to other French observatories;
- Reinforcement of astrophysics, and
- Creation of mountain observatories similar to the best foreign ones.

Not surprisingly, nothing came out of these wise recommendations, and the main result was the merging of Paris and Meudon Observatories, an idea that had already been in the air for several years.

3 PARIS–MEUDON OBSERVATORY (1927–1945)

The merging of the two observatories, decided by decree of 5 October 1926, was official on 1 January 1927. The first result was the suppression of four positions at Meudon: the Director, the Secretary and two Astronomers! Fortunately, the Secretary, Amiable, was soon re-installed as it proved impossible to run everything from Paris. Deslandres became the Director of the merged institutions, but only for two years: he retired on 1 November 1929 and was replaced by Ernest Esclangon (1876–1954), who was previously Director of Strasbourg Observatory.

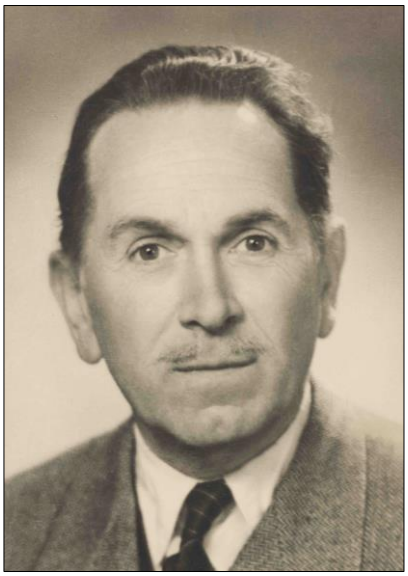

Figure 14: Bernard Lyot, date unknown (courtesy: Paris Observatory).

In 1927, Louis Dunoyer de Segonzac (1880–1963) replaced Perot as Physicien de l'Observatoire. He was an already well-known physicist who had obtained his PhD under Paul Langevin, and was Professor at the École Supérieure d'Optique from 1920 to 1939. He settled in Meudon where he worked with success on thermoelectric detectors and photoelectric cells. He also was first to aluminize mirrors by cathodic projection, the technique universally used nowadays. In parallel he was a significant political activist on the extreme right, but apparently this did not have much consequence on the life of the Observatory.

The *Annual Report* of the joint observatories for 1927 (Deslandres, 1928: 8) contains considerations on the sites of the two

Observatories and concludes that the site of Meudon is considerably more suitable for astronomy than Paris. Thus (my English translation),

> It is necessary to transfer to Meudon, little by little, progressively, the principal instruments of Paris, and also their observers, by sparing as much as possible the acquired situations; it is necessary at the same time to direct the young astronomers towards the physical branch.

This was again wishful thinking. No money was available for a transfer, and the priority was to restore the remains of the château and the outbuildings: they were very dilapidated, which posed serious problems for their use as housings. However the construction of a meridian room to house the Paris instruments started in 1928 and continued in 1929, but finally stopped through lack of money.

Figure 15: Dauvillier's 'Blue-eyed Negress', ca. 1935 (courtesy: Université fédérale Toulouse Midi-Pyrénées).

The *Annual Report* for 1929 (see Esclangon, 1929 to 1940) mentions a project to refurbish the 1.2-m Paris telescope, while the better 1-m Meudon one was neglected and in poor condition. Indeed, Couder repolished the 1.2-m mirror, but with the idea of transferring the whole telescope to Haute-Provence, a dream of Esclangon that never came to pass. In the meantime, an 80-cm reflecting telescope built by Prin, with optics by Couder, was installed at Forcalquier in Alpes de Haute-Provence (*Annual Report* for 1930). In Meudon, only the solar instruments, the small equatorials and the Great Refractor were used, the last-mentioned only from time to time because of frequent breakdowns.

In 1931, the Equatorial Table (Figure 5), was installed in a new building after many years of waiting, due to the overload of the constructor, Prin. This was a modern instrument, which became operational in 1932. That year, the Secretary-Librarian, Lamiable, was transferred to Paris and not replaced, and Miss Roumens took charge of the library in Meudon.

Nothing very remarkable happened in Meudon before WW2, with the exception of spectroscopic observations of novae and comets by Baldet and of Lyot's observations of the polarization of light from several planets and from the solar corona (see Lequeux and Georgelin, 2022). There was some independence with respect to Paris, and d'Azambuja in practice acted as a Director. The buildings were in poor condition, but money was lacking for repairs.

In 1935, Alexandre Dauvillier (1892–1976) installed a laboratory for cosmic rays in a tower, 7 meters high and 4 m in diameter, a kind of water tank with the laboratory at its center (Figure 15); water was supposed to protect the equipment from parasitic radiations. It was painted black and had blue portholes on the top, so that it was nicknamed 'The Blue-eyed Negress' (Olivieri, 1993: 6). It was devastated by the war in 1940, but reconstructed later and worked until 1954. A variation in the intensity of cosmic radiation with the solar activity cycle was observed, but was wrongly attributed to cosmic rays of solar origin (while it actually was due to the modulation of galactic cosmic rays). Dauvillier had come with a mechanic named Brebion, who later officially joined the Observatory where he was to play a major role.

The 1-m telescope was used by Albert Arnulf (1898–1984) for observations of occultations, and the Great Equatorial for spectroscopy of novae when available, which was not very often. They were few changes in the personnel. A new astronomer, Charles Bertaud (1904–1982), came as volunteer collaborator in 1931 and obtained a permanent position in 1939.

Then WW2 came. The instruments were disassembled and safeguarded; the equatorial table alone was reassembled in 1940 and could be used from time to time. The precious collection of solar photographs was cleaned and transported from the spectroheliograph building to the cellars of the outbuild-

ings on a carriage driven by the Observatory horse, named Cocotte (Servajean, 1978). The personnel was dispersed, many moved to Bordeaux, and the only continuous activity was solar monitoring, insured by two newcomers, Joseph Leclerc (1900–1979) and Roger Servajean (1913–1986), and by Mrs d'Azambuja, then also by Mr d'Azambuja once he was demobilized.

5 THE REIGN OF DANJON (1945–1963)

After the retirement of Esclangon at the end of WW2, in 1945, André Danjon (1890–1967, Figure 16) became Director of the Paris–Meudon Observatory. This was the beginning of a new era, on which I have extracted most of the information from the vivid account of Olivieri (1993) and some personal reminiscences, as there were no Annual Reports during this period.

Danjon had joined Strasbourg Observatory in 1919 and became Director there in 1930. He was soon appointed Professor at the University, and became Dean of the Faculty of Sciences in 1935. In 1939, the fear of German aggression forced the relocation of the entire University to Clermont-Ferrand. Acting as the University Rector, Danjon opposed the military use of the campus. He was arrested and jailed in late November 1943. Many of the professors and students arrested in this sweep were sent to Auschwitz, though Danjon and other docents (including my father-in-law Jean-Daniel Benoit) escaped that fate. Released the following January, Danjon did not recover his position until November 1944, when the University returned to Strasbourg freed from occupation.

Danjon was a strong and impressive personality, with a severe aspect due in particular to his single eye (he lost the right one during WW1). He was an old-style Director: when you were given an appointment with him, you had to wait in the antechamber until a green light allowed you to enter his office, where he was sitting like a king in Arago's old armchair. But he was very open-minded, and this was really needed when, on his arrival in Paris, he was faced with the urgent need to restore not only the Paris–Meudon Observatory, but the whole of French astronomy, which like many other sciences had been deeply affected by two successive wars, and also by inertia. He sat in all committees of importance and presided over the National Council that decided the careers of astronomers. He even added to the Directorship of the Paris–Meudon Observatory that of the Institut d'Astrophysique in Paris after the death of its Director, Henri Mineur, in 1954. All this came to an end when he suffered from a severe stroke in 1963.

We should not be surprised that the arrival of Danjon caused some turmoil in the sleepy Meudon Observatory. After WW2, there were only about a dozen people there, distributed into four groups (Dollfus, 2009; Olivieri, 1993):

- The Service du spectrohéliographe et du spectrohélioscope, with Lucien and Marguerite d'Azambuja and three technicians: Leclerc, Servajean and a newcomer, Gualtiero Olivieri (1928–2021), the one who wrote the interesting reminiscences I am often referring to. They were joined later by Mrs Marie-Josèphe Martres (1926–2017);

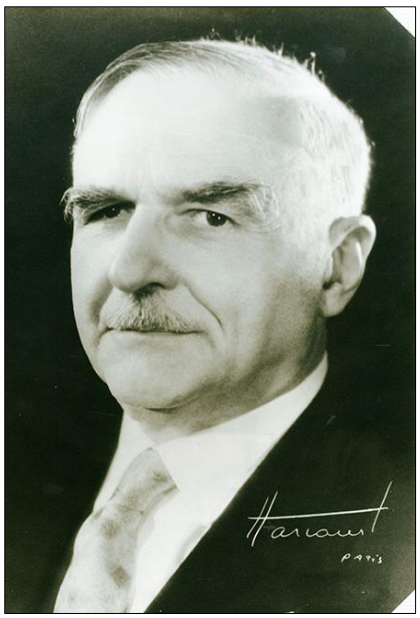

Figure 16: André Danjon, ca. 1960 (courtesy: Paris Observatory).

- The Service de la table équatoriale et de la grande lunette, comprising Baldet, Bertaud, Grenat, and in 1947 a technician, Miss Giselle de Obaldia (1915–1996);
- The 'Service' of Lyot, with a technician, Oberlin, and in 1946 a new young researcher, Audouin Dollfus (1924–2010); after the death of Lyot in 1952, it was directed by Dollfus under the name of the Laboratoire de Physique Solaire et Planétaire, with five or six members; and
- The Physics Group; the Physicien de l'Observatoire, Dunoyer de Segonzac, had been suspended in 1944 due to his sympathy for collaboration with the Germans. He was replaced in 1945 by Bertaud who was not a physicist, probably in order to preserve the position.

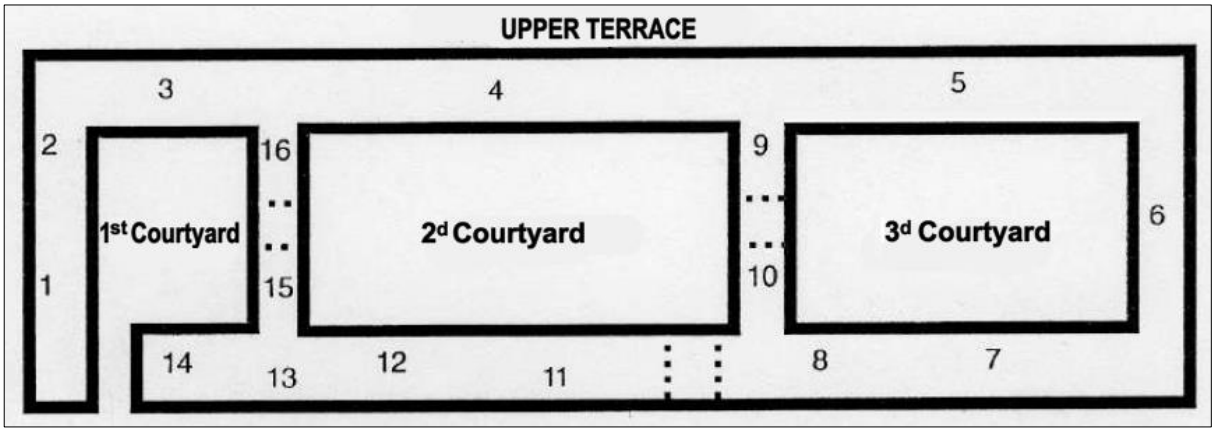

Figure 17: Plan of the outbuildings of Meudon Observatory in 1946. Ground floor: 1-2: cellar, reserve of library; 3: junk; 4: physics laboratory; 5: gardeners, horse stable; 6: unoccupied; 7: carpentry, material depot; 8: cellar; 9: electric batteries; 10: workshop; 11: East laboratory, Lyot's laboratory, photo laboratory, clocks; 12: mechanical workshop; 13: mirror silvering; 14: garage; 15: toilets; 16: reserve of library. First floor: 1-2: lodgings; 3-4-5: dilapidated rooms; 6-7-8: lodgings; 9-10: solar service; 11-12: d'Azambuja's office; 13-14: Director's office; 15-16: library, secretariat (after Olivieri,1993: 5).

There was also a Secretary-Accountant, Daudard, rather inefficient so that the Paris Secretary, Édouard Marandon (1897–1961), took over his duties alongside that of the Paris branch. The personnel included also two mechanics, Marcel Brebion and Marius Devove who had replaced Martin and had a weakness for the wine bottle, two laboratory boys/cleaners, Monfort and Frappat, two concierges-guards, Lempérière and Leroy, a gardener, Havard, with three helpers: Gaucher, Georget (also horse groom and coachman) and Villeneuve.

At the beginning, Danjon let Lyot run the Observatory but he showed his authority after Lyot's death in 1952. At this date the solar service had six members, that of Baldet four and that of Dollfus increased to six people. There was a revival of physics: a Service de spectroscopie was created in 1956 and entrusted to Mrs Renée Hermann (1908–1992), who had come in 1947 to work with Baldet and Bertaud.

All these people formed a kind of family (Dollfus, 2009), and this was clearly still the case when I met them for the first time in the late 1950s.

Figure 17 is a plan of the outbuildings in 1946. The East laboratory, reserved in principle to the solar staff and equipped with a majestic stove, was the center of the scientific life and of the gossips. Baldet and Bertaud had their laboratory on the other side of the courtyard, and d'Azambuja had his own office above the East laboratory, from which he could be called from the laboratory by a special bell. This laboratory also had the only telephone connected to the outside world; as the equipment was of poor quality one had to shout, so that everyone could hear the conversations. The telephone line went through a manual switchboard located in the guardhouse, which caused long delays and frequent confusion.

With the exception of the principal astronomers (D'Azambuja, Lyot and Baldet), all the personnel were housed at the Observatory, either in the outbuildings or in the remains of the château, on each side of the Great Equatorial. The personnel had their own vegetable garden in the park, and were heated with wood cut in its forested part of the park: three cubic meters per lodging every year. The heating of the offices and laboratories was (poorly) ensured in the same way.

The Observatory survived through a great economy of scale. For example, all the wood for carpentry was recovered from crates left by the Germans, and the paper for the reproduction of the images of the Sun from left-over paper rolls, on which sheets with the relevant size were cut by hand. All the drawings and letters had to be drawn and written with the same low-cost violet ink used in schools. Purchasing any equipment, no matter how necessary, was an endless struggle, and even if Danjon had promised the money, it rarely materialized due to the inertia of the system. For example, the Observatory did not manage to acquire a refrigerator to preserve photographic plates, which therefore had to be purchased in small quantities. A fridge was finally purchased by Jean-Claude Pecker (1923–2020) from his own money. The observers were freezing in the various buildings due to insufficient heating. And while the Equatorial Table was operational, observing with the Great Equatorial continued to be a nightmare and the 1-m telescope was practically abandoned.

Figure 18: The 7.5-m diameter Würzburg antenna in Meudon, installed in 1947. It was moved in 1962 to the Bordeaux Observatory, but the concrete basement is still visible (courtesy: Paris Observatory).

There was only one car for the whole Paris–Meudon Observatory, with a chauffeur named Aimé Couder (no relation to the astronomer André Couder). It mainly served the Director. As a consequence, there was still a horse in Meudon, even several at times. The Observatory's accountant had recurrent difficulties in convincing the Ministry that the Observatory had to purchase a large amount of straw for these animals. The last horse, named Bijou, was still there in 1955. When something had to be brought to Paris or vice-versa, it was with this horse drawing a *tapissière* (a chariot with benches) driven by Georget. Usually, the horse was let free in the Observatory park. This created various problems: its dark mass frightened the observers going to the telescopes by night; in the day time, the horse sometimes liked to admire itself in the cœlostat mirror, with the result that observations of the Sun were lost!

A recurrent problem was the cooperation with journalists. Their papers often distorted the information, or even were cut arbitrarily to fit into the journal page. As a consequence, the astronomers tended to systematically ignore their requests. Danjon decided that things had to change. In his 1945 introductory discourse, he exposed his plans for the development of the Observatory, which required of course more money, hence more notoriety and consequently more articles in the newspapers. The astronomers had to be more cooperative with the journalists. Then a number of journalists visited the Observatory and had discussions with the astronomers. A misunderstanding in a report created a diplomatic incident between France and the United Kingdom, and violent anger from Danjon, who specified henceforth that no interview should be granted anymore without his permission. As expected, the following days were filled with telephone calls from journalists eager for sensationalism. In retaliation, all of them were referred to Danjon by Mrs d'Azambuja. That was the end of the episode.

The instruments in use in Meudon were essentially the equatorial table, the spectroheliographs and Lyot's filter. In 1947, Marius Laffineur (1904–1989) from the Institut d'Astrophysique installed a radio telescope (Orchiston et al., 2007), a German Riese Würzburg radar antenna (Figure 18). He was helped by soldiers specialized in radio, who were accommodated during this installation in a room close to d'Azambuja's quarters. One of them was often visited by women with a lot of make-up, who sometimes were noticed when they left stealthily in the morning. One morning, the soldier and one of these women were met by Mrs d'Azambuja, and the embarrassed man said "Hmm … I present you my mother!" (Olivieri, 1993: 13).

In 1956, Paul Muller (1910–2000) arrived from Strasbourg Observatory. Like Danjon, he was familiar with the 49-cm Merz-Repsold equatorial at this observatory and with other great equatorials. Both were well aware of the deficiencies of the Meudon one, which had stayed unused since the last Antoniadi observations in 1937. Both the telescope and especially its dome were in poor

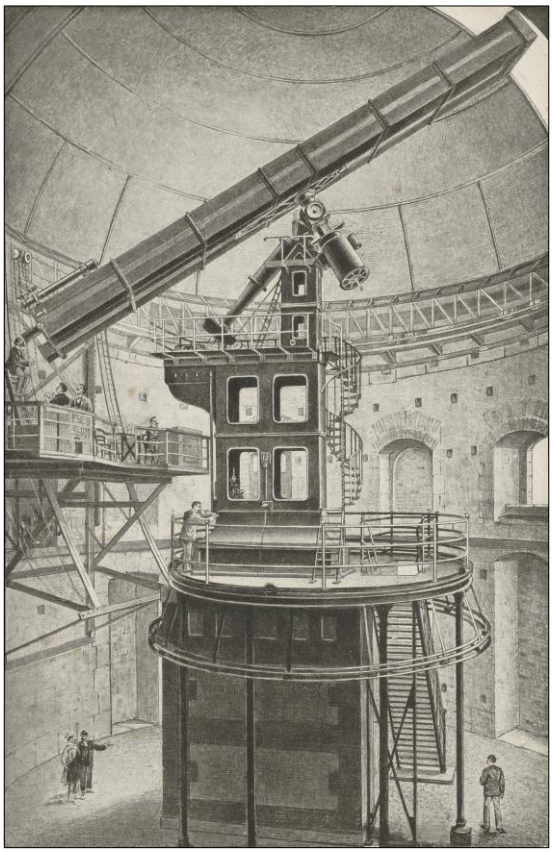

Figure 19: The Meudon Great Equatorial before the 1964 restoration. The observers were located on a rising platform attached to the rotating dome (courtesy: Paris Observatory).

condition. A major deficiency was the way the observers were placed: on a heavy platform suspended from the edge of the dome, with difficult access and the risk of being stuck (Figure 19). Muller (1964; 400) writes (my English translation):

> It is disappointing to read that Janssen had personally visited the largest existing domes (Lick's dates from 1878, Yerkes' from 1887) before deciding on his project. I know, having used it for four months, the magnificent installation at Lick which functions practically unchanged since its construction; why didn't it inspire him more in Meudon!

Danjon managed to obtain funding for the restoration, which was conducted by Muller (1964) and completed in 1964. The dome now had a rising floor, and there was even an elevator in the building (Figure 20). The equatorial was then used regularly by Muller and collaborators, essentially for observing double visual stars. As for the old 1-m reflecting telescope, this was idle until a modification in 1968 and finally its replacement in 1971 by a modern Cassegrain one.

In 1956, the arrival of the radio astronomers from the École Normale Supérieure, following an agreement between this School and Danjon, created a large disturbance. According to Dollfus (2009), this arrival had not been properly prepared by Danjon; but I suspect that this opinion rather reflects the difficulty of the staff in place to adapt to the unavoidable changes in their quiet way of life, and to coexist with these strange people, the 'Normaliens', who were not even considered to be true astronomers. Indeed, they were not observing in Meudon, but in the newly created Nançay radio astronomy field station, 190 km to the south of Paris (see Orchiston et al., 2007; 2009). The symbiosis between the two groups was to take many years to become effective.

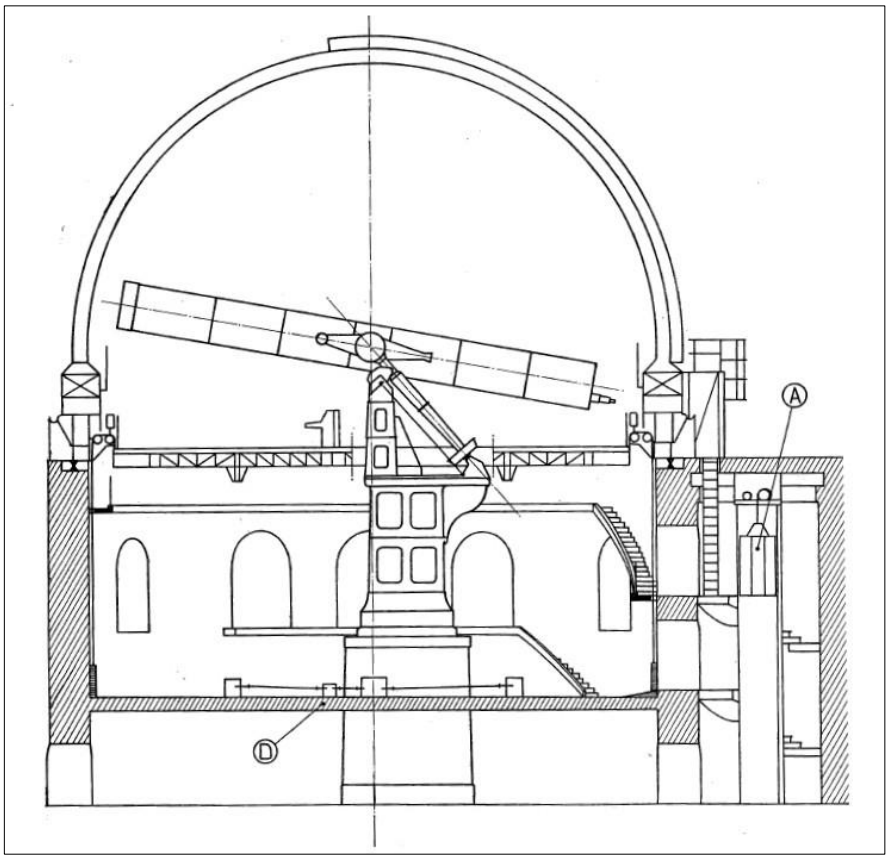

Figure 20: The restored dome of the Meudon Great Equatorial. A is an elevator, D a new concrete floor. Note the rising floor with its counterweights (after Muller, 1964: 402).

Moreover, some rearrangement of the outbuildings was needed and a part of the personnel had to move. Several of the ground-floor rooms were divided into two superposed floors, with the result that those who were accommodated in the upper floor (like myself when I came to Meudon in 1959) had the natural light coming only from the upper part of the high unmodified windows, which did not even reach the level of their tables, so that electric light was needed all day long.

The first computer, an IBM 650, was installed in 1960 by a radio astronomer, Jacques Arsac (1929–2014) in an unoccupied part of the outbuildings (#6 in Figure 17). Many looked with suspicion at this facility (it is true that its failures were frequent), so that the computer was for some time used essentially by astronomers from Paris who were working on stellar atmospheres and interiors, and by Arsac and myself for Fourier transform calculations relative to my interferometer observations.

More and more people joined the Observatory in the 1960s, which were incredibly favorable years for the development of research in France. When Danjon was replaced in 1963 by a radio astronomer, Jean-François Denisse (1915–2014), this was the end of the supposed privileges of the old-style astronomers, and also of their quiet way of life: Meudon Observatory had entered the modern era, and things would never be the same again.

6 NOTES

1. A first sixteenth century château (*Château vieux*) accidentally burnt down in 1795, was demolished in 1806; another one (*Château neuf*) was built in 1705 by the son of Louis XIV.
2. Initially, Janssen wanted to know if the Sun produced lines of oxygen aside the telluric ones, and wanted to go to high elevations to decrease the latter. He concluded from his Mont Blanc observations that they were entirely due to the terrestrial atmosphere but was careful enough not to claim that the Sun does not contain oxygen, at least in the same form as in the Earth atmosphere. He was satisfied with his result, because he thought that if there were both oxygen and hydrogen in the solar atmosphere, they would combine as water vapor during the cooling of the Sun, would absorb its calorific radiation and reduce its emission, making it even fainter (Janssen, 1890: 444; this paper contains a vivid description of the ascent)! Various astronomical observations were performed in the Vallot and Mont Blanc observatories, but, apart from that on oxygen lines, none of them produced really important results.
3. These were pioneering images of C/1881 K1 (Tebbutt), the Great Comet of 1881 (see Orchiston, 2017: 269–272).
4. Note that what Deslandres considered as *Astronomie physique* (we would now say: astrophysics) was limited to the Solar System and stars: studies of our Galaxy and other galaxies were completely neglected until the 1930s. Henri Mineur and Jean Dufay (1896–1967) were the first French astronomers to publish papers on these topics, in 1932–1933 (Brémond, 2011). In practice, galactic and extragalactic astronomy had still to wait for a few years after WW2 to develop in France.

7 ACKNOWLEDGEMENTS

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Dr James Lequeux, born in 1934, started a second career in the history of science when he retired in 1999. Before that, he was an astronomer at Paris Observatory, specializing in interstellar matter and the evolution of galaxies. He has been Director of the Nançay Radio-astronomy Station and of Marseilles Observatory. He has visited Meudon Observatory since 1954, and had the chance to encounter several of the people cited in this paper.

For 15 years James was one of the two Editors-in-Chief of the European journal *Astronomy & Astrophysics*. Currently, he is an Associate Editor of the *Journal of Astronomical History and Heritage (JAHH)*. He has published several textbooks and many books on the history of physics and astronomy, and has written ten papers for the *JAHH*.