The Hamburg Observatory

Justification of outstanding universal value

Hamburg
Freie und Hansestadt
Hamburg
Kulturbehörde

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NAME OF PROPERTY: Hamburger Sternwarte
State, Province or Region: Hamburg/Germany
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DESCRIPTION:

The Hamburg Observatory in Bergedorf was built between 1906 and 1912. It replaced the old observatory located at Millerntor on the western part of the ramparts around the core of Hamburg City. At the time, the new facility in Hamburg-Bergedorf was considered to be among the most modern and largest of Europe. About 20 kilometers away from the city centre, it was placed on a hill and extended over an area of some seven hectares that resembled a park. The facility consists of the main building, three residential buildings, several domes, the solar building and sheds for the various telescopes. There were several ancillary buildings, too.

The design of the facility can be termed modern in that it was placed on a hill and far away from the city. Also, the fact that the instruments were housed in several buildings spread over the entire grounds was a new feature. The Hamburg Observatory is one of the first where the principle of setting up the instruments in a large ensemble of buildings was consistently put into practice. Also, the Hamburg Observatory's equipment with instruments demonstrated its modern character and showed the desire to adapt to the change that was occurring in astronomy towards the end of the 19th century. This was a move away from classical astronomy which had exclusively focused on the measuring of positions and, instead, a trend towards modern astrophysics, which aimed to unveil the nature of the celestial bodies with physical methods This change was accompanied by the development of astronomical instruments, particularly telescopes, which had to comply with new requirements (light-gathering power, free of chromatic aberration). In this context the transition from refractors (lens telescopes) which dominated observations throughout the 19th century to large reflector (mirror) telescopes was very important. The latter were more suited to spectroscopy. In parallel, traditional astrometrical instruments such as meridian circles, transit instruments and refractors (which had been turned into more advanced astrographs) were still required for the production of stellar catalogues. This was because observatories continued to be responsible for the time service and were needed to support navigation until after WW II which is why observatories had to have at their disposal a wide range of instruments to perform their various functions and could not permit themselves to be too highly specialised. The Hamburg Observatory bears witness to this transition process through its equipment of large refractor and reflector telescopes which have been preserved to this day.

The original telescopes were: The Equatorial, the Large Meridian Circle, the Large Refractor, the reflector telescope and the Lippert-Astrograph. Over time more instruments were added, the following of which are particularly important: The first Schmidt-reflector world-wide, the double reflector, the AG-Astrograph and the large Hamburg Schmidt-Reflector (which was later replaced by the Oskar-Lühning-Telescope), the Salvador-Reflector, the Zonenastrograph and the Hamburg Robotic Telescope (HRT).

With respect to the instruments two then well-known companies were commissioned: the Hamburg-based company of Adolf Repsold & Söhne (Large Refractor and Meridian Circle) and Carl Zeiss in Jena (1m Reflector Telescope, Lippert Astrograph, the rising floor for the Large Refractor and also the domes).

The external design chosen for the administrative building and the domes was a combination of representative neo-baroque elements which to this day are a clear expression of the high priority given to this facility by the city of Hamburg. The domes were engineering works built in such a way that they exactly fitted the dimensions of the telescopes. The residential buildings, by contrast, were designed as "simple" plastered houses which were supposed to "match the rural surroundings".

The Main Administrative Building and the Residential Buildings

The main administrative building has two storeys and with its lesene-structured, plastered walls, its mansard roof and the middle pavilion is reminiscent of a chateau. It contains the administrative offices, the director's room, a large well-insulated chamber that protected the main clocks of the observatory from changes in temperature and rooms for the clocks that were used for the time service. It its centre the building houses a spacious library of two-storey baroque design with a gallery that runs around the entire room.

Residential buildings are the director's house, the smaller caretaker house and the twin-building for civil servants.

The Large Refractor

The dome building of the Large Refractor is the most sophisticated and expensive of the dome buildings and consists of a circular building with a lesene-structured, plastered-wall façade topped by a spherical dome with a diameter of 13 m and an oblong annex. The dome can be rotated and opened by means of a sliding shutter. The entrance is accentuated by a portico with pillars and balusters.

The telescope rests on a massive separate foundation which has no contact with the rest of the building. In order for the observer to be able to follow the telescope at any position while comfortably being within reach of the eyepiece, the floor of the observation room is moveable. It has a hole in the centre for the pillar that supports the telescope and is suspended from three iron columns that are separately founded. This means that the position of the user is continuously adjustable over a range of 4.50 metres of height according to the movements of the instrument.

The Meridian Circle

The building for the Hamburg Meridian Circle is situated on the highest elevation of the observatory grounds. It is strictly west-east orientated and consists of the oblong observation room with a portico annex and a cylindrical roof. It is cut through in the middle along a north-south axis. With the help of two sliding shutters the roof can be opened to a width of 3 metres. 110 m north of the Meridian Circle building an associated Miren cottage is preserved.

The Large Hamburg Meridian Circle was manufactured by the company of Adolf Repsold & Söhne. It was equipped with a 19 cm lens and had a focal length of 2.30 m. This instrument marks the end of one hundred years of evolution in meridian circles. Such instruments allow the exact observation of star transits through the meridian (the south-zenith-north line). By means of such observations it is possible on one hand to determine the time, on the other hand to measure precise star positions.In 1967 the Meridian Circle was transferred to Perth/Australia in order to survey the southern hemisphere from there. Currently it is preserved at the *Deutsches Museum* in Munich.However, if certain conditions granting preservation are fulfilled, the instrument could again be set up in Hamburg.

The Equatorial

To the northeast of the meridian building is a small dome that houses the Equatorial, the oldest remaining telescope in Bergedorf that is still in operation. It is a refractor with a 26 cm aperture and a focal length of 3 m which was manufactured in 1867 by A. & G. Repsold. The two-lens object glass was manufactured by the Munich-based company of G. & S. Merz. Recent analyses have shown that the Merz-objective of the Hamburg Equatorial is exceptionally free from chromatic aberration if one considers its time of manufacture. Given the special type of glass used, it may actually be regarded as the first semi-apochromatic objective in the world.
For easier use of the instrument, Adolf Repsold had developed a wooden seat in 1867 which allowed the observer to move around the telescope as well as up and down with the help of pulleys without having to get up from his seat. This rarity, too, has been preserved in a functional state in the Equatorial building of the Hamburg Observatory.

The Reflector Telescope and the Lippert Astrograph

The two domes for the reflector telescope and the Lippert Astrograph on the northeastern part of the grounds outwardly resemble the building for the Large Refractor. However, their dimensions are smaller and their design more modest: They were originally equipped with only a square portico entrance that was crowned with balusters. In 1925, oblong plastered-wall extensions were added to both buildings that matched the original buildings in design. They are situated to the north of the respective entrance porticos.

The Reflector Telescope

The 1 m Reflector Telescope was built in 1911. It was an extremely fast system with a diameter of 1 m and 3 m focal length. Because of its special weight-stress compensated multi-counterpoised mounting it belongs among the most unusual telescope constructions. The telescope was supplied by Zeiss and is the first large reflector telescope from this manufacturer. In 1947, the 1 m telescope was transformed to a Nasmyth system instead of a Newton telescope in order to perform high-resolution spectroscopy. This increased the focal length from 3 to 15 m.

The Lippert Astrograph

This instrument was named after its donor, Eduard Lippert (1844 -1925). Originally, it consisted of a combination of three astrographs on a joint mounting. It was supplied entirely by Zeiss. Over the decades, this instrument has undergone several modifications. Largely speaking, only the Zeiss mounting is still in its original position and, of the original optical equipment, only the 20 cm guiding refractor and a 10 cm finder are still in use. The astrographs were replaced in 1957 and 1974 respectively by a 60 cm reflector telescope, initially a Newton system taken from the double reflector built by Bernhard Schmidt, and later (1974) replaced by Cassegrain optics.

The Hamburg Schmidt Reflector and the Oskar Lühning Telescope

Between 1951 and 1955 another building was added to the Observatory, namely the one that was to house the Large Schmidt Reflector. As early as 1930, the optical scientist Bernhard Schmidt (1879-1935) had developed a reflector that was later named after him. The *Schmidt Spiegel* is a very fast wide-angle camera. It was the first reflector telescope that could image large areas of the sky of several degrees diameter, which were absolutely sharp even far from the plate centre. The Schmidt principle was later adopted also for other optical purposes (e.g. photographic and TV cameras). However, the Hamburg Observatory is not only the birthplace of the Schmidt reflector; in the Schmidt museum on its grounds it still displays the first instrument of this kind worldwide. This first Schmidt reflector has an aperture of 36 cm, the mirror measures 44 cm in diameter and it has a focal ratio of f/1,75 which was unprecedented at the time.

It took 25 years until the Hamburg Observatory was equipped with a large Schmidt Telescope which had an aperture of 80 cm, a mirror diameter of 1.20 m and a focal length of 2.40 m. For several years it remained the world's second largest Schmidt telescope. In 1976, the instrument was transferred from Hamburg to the German-Spanish Astronomical Center at Calar Alto in southern Spain. Because of the more favourable climatic conditions there, the Schmidt Reflector was able to perform valuable observations, among others the Hamburger Quasar Survey (HQS)

In 1975, the Oskar Lühning Telescope was inserted into the fork mounting of the Large Schmidt Reflector. It is a Ritchey Chrétien system manufactured by Grubb-Parsons in Newcastle upon Tyne. It has an aperture of 1.20 m and a Cassegrain focal length of 15.60 m. It is the largest of all the telescopes at the Hamburg Observatory and Germany's second biggest. This telescope has been upgraded in recent years. It now features remote control via the Internet and a CCD-camera.

Other Instruments

In addition to the buildings that accommodate the large telescopes, there are several sheds for smaller instruments and the unadorned small solar building which was built in 1942.

Justification of „Outstanding Universal Value": Criteria met:

***(ii)* (exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design)**

For the late 19th and early 20th centuries, the Hamburg Observatory constitutes an important landmark for the transition from classical astronomy to astrophysics. It reflects the fundamental changes in observation technology that occurred in the course of this development because right from the start the observatory was equipped with large state of the art refractor and reflector telescopes as well as astrographs.

Also, the Hamburg Observatory was the place from where the Schmidt reflector started to revolutionize observational astronomy. The development and realisation of a coma-free reflector system was a ground-breaking invention. It was named after its inventor, Bernhard Schmidt. Numerous original instruments and exhibits from Schmidt's estate have survived at the Hamburg Observatory, e.g. the world's first Schmidt telescope.

***(iv) (*be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history);**

For the period of time around the turn of the century, the Hamburg Observatory constitutes a site of cultural, scientific and architectural heritage as well as an astronomical location of outstanding universal value because it combines various levels of significance such as a modern facility design, representative architecture, universal instrumental equipment, great importance for science and research and a good state of preservation. This is evidenced by a number of facts: The facility was built as a large ensemble of buildings in a park environment where each instrument is housed in a different building. It was erected on a hill at some distance from the city centre. The representative buildings with their neo-baroque elements formed an ensemble which has been preserved to this day with hardly any modifications. The Hamburg Observatory is one of the few observatories that was equipped with large instruments for both research disciplines right from the start. Therefore, it illustrates the transition in astronomical research around the turn of the century. At the same time, through the wide range of instruments preserved on its site, the Hamburg Observatory documents in a unique way the development of telescope technology that went hand in hand with advances in the astronomical sciences between 1850 and now. The Equatorial and the Large Meridian Circle represent the astronomical science of the 19th century when the focus was on determining stellar positions and visual observation dominated astronomy. The astrographs, the 1 m Reflector Telescope and the Large Refractor mark the transition to photographic observation technologies. The Large Refractor and the 1 m Reflector Telescope symbolise the competition between these two types of telescope design at the beginning of the 20th century and mark the beginning of astrophysical research. An example of up-to-date telescope technology is the Oskar-Lühning-Teleskop with its modern improvements including modern computer and CCD-technology. The Hamburg Observatory illustrates several different types of reflector telescope design. Additionally,, it is not only the birthplace of the Schmidt reflector, but, in the Schmidt Museum on its grounds, it still displays the world's first instrument of this kind. Finally, the observatory encompasses a collection of several smaller telescopes and scientific instruments, some of them being historically important, a large photographic plate archive which is currently being digitized and made available on the net, as well as a large library.

(vi) (*be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance*).

Inventions and research activities of extraordinary universal significance are connected with the Hamburg Observatory: For example, during the 20th century the Hamburg Observatory participated in several large international collaborations to produce stellar catalogues which still form the basis of today's satellite navigation. Then there was the ground-breaking work by Walter Baade, one of the most important astronomers of the 20th century. During the 1920's he investigated the structure of the Galaxy with the 1 m Reflector, pointing towards modern astrophysics. Finally, the work carried out by the optical scientist Bernhard Schmidt was of exceptional importance for the development of astronomical instruments. Schmidt invented the so-called Schmidt Reflector at the Hamburg Observatory in 1930, revolutionizing astrophotography because it had an exceptionally wide field of view and produced distortion-free images.

Statements of authenticity and/or integrity

The Hamburg Observatory, built between 1906 and 1912, has been preserved almost in its entirety with only minor modifications. This is not only true for the ensemble as a whole with its historical buildings and furnishings, but also for the optical instruments and technical details. The large telescopes of the Hamburg Observatory particularly represent a cross section of telescope technology in the 19th and 20th centuries. They have been preserved close to their original state and they are in service to this day. In 1996, the ensemble of the Hamburg Observatory including its historical buildings, its furnishings and its optical instruments as well as the other technical details was put under protection by inscribing it in the monuments list of the City of Hamburg on account of its significance for the city as well as on cultural, historical and scientific grounds. In 2008, the Hamburg Observatory was recognized as a monument of national importance for the Federal Republic of Germany.

To this day, research activities at the Hamburg Observatory are ongoing. The observatory was incorporated into the University of Hamburg in 1968, but it also offers astronomical classes and lectures to school students in the framework of the "*Astronomie-Werkstatt"* project organised by the Hamburg Department for Education. A visitors' centre and *the* "*Förderverein Hamburger Sternwarte"* (Friends of the Hamburg Observatory) offer lectures on astronomical subjects and guided tours to the observatory for the public. The Schmidt Museum houses numerous exhibits such as the world's first Schmidt reflector.

Comparison with other similar properties:
Looking at the Hamburg Observatory within the context of all modern day observatories, it is evident that the Hamburg Observatory combines a series of features which served as a benchmark for the future development of observatories at the threshold between classical astronomy and astrophysics and for modern observatories themselves:

Location outside the City Centre
As a result of the industrial revolution, conditions for astronomical observation from the city centres rapidly deteriorated. The manufacturing industry and new means of transportation caused air pollution and vibrations while street lights produced scattered light that made observations of faint objects impossible. Since 1850, therefore, observatories were moved to the outskirts of cities.

Observatory Design as an Ensemble of Buildings
Until the end of the 19th century most observatories were constructed as single main buildings which housed offices, a library, workshops and residential quarters and on whose roof one or several domes were distributed. For purposes of observation it is much preferable to have each instrument in a separate building with no heated rooms below because that would lead to air turbulence and unsharp images.

Wide Range of Modern Instruments
Around 1900 a fundamental change occurred in astronomy, particularly in observation techniques which led to a simultaneous change in scientific objectives. The astronomical science changed from classical astronomy to modern astrophysics.This transition was accompanied by the development of astronomical instruments, particularly telescopes, which had to comply with new requirements (great lens speed, no chromatic aberrations).

The Hamburg Observatory combines all of the criteria mentioned above for a modern observatory: It is situated outside the city at an elevation of 40 m – the surroundings did not allow for higher locations. It is one of the earliest observatories in the world with a consistent ensemble design. The Hamburg Observatory is one of the rare examples of an observatory that was equipped with top quality instruments for classical as well as modern research right from the start. Also, the Hamburg Observatory documents in a unique manner the development of telescope technology that accompanied advances in astronomical science from 1850 to the present. The Observatory itself has also been preserved nearly in its original state. It exhibits a representative architecture and can justly claim to have had an important influence on many areas of scientific research. The Hamburg Observatory is still an active astronomical research institute.

There are few observatories in the world which can be compared to Hamburg Observatory in this respect. Among the European observatories are essentially the observatory facilities on Mont Gros near Nice (1879-86), the state observatory in Heidelberg-Königstuhl (1896-1900) and the Observatoire Royal de Belgique in Uccle (Brussels), built between 1883 and 1891. In relation to size and diversity of research and instrumental equipment, however, in all these cases, there are significant differences to the Hamburg Observatory.

The observatory that shows the highest degree of similarity with the Hamburg Observatory is the La Plata Observatory, Argentina, built between 1883 and 1894. It is characterised by a representative architecture and was one of the first in the world that was designed as an ensemble of buildings. In the port city of Buenos Aires, too, it was the requirement of time service and support of navigation that determined both the equipment with instruments and the scientific work at the observatory that is situated to the south of the city. But like in Hamburg, in addition to the traditional instruments used for classical astronomy – two meridian circles (of which one was manufactured by Repsold), a transit instrument, a zenith telescope and a 43 cm refractor – a large reflector telescope (80 cm) and a 33 cm astrograph were set up there so that astrophysical investigations could be performed as well. Similarly and like the Hamburg Observatory, the observatory in Buenos Aires continues to be an active university research institute. It is in a remarkably good state of preservation. Because of these similarities, it is suggested to prepare a serial transnational nomination for both observatories. The Argentinian government has declared its willingness to file a joint submission together with Hamburg.

Site plan

Main Building and Library

Residential-Buildings

Outbuildings

Large-Refractor-Building

Large-Refractor

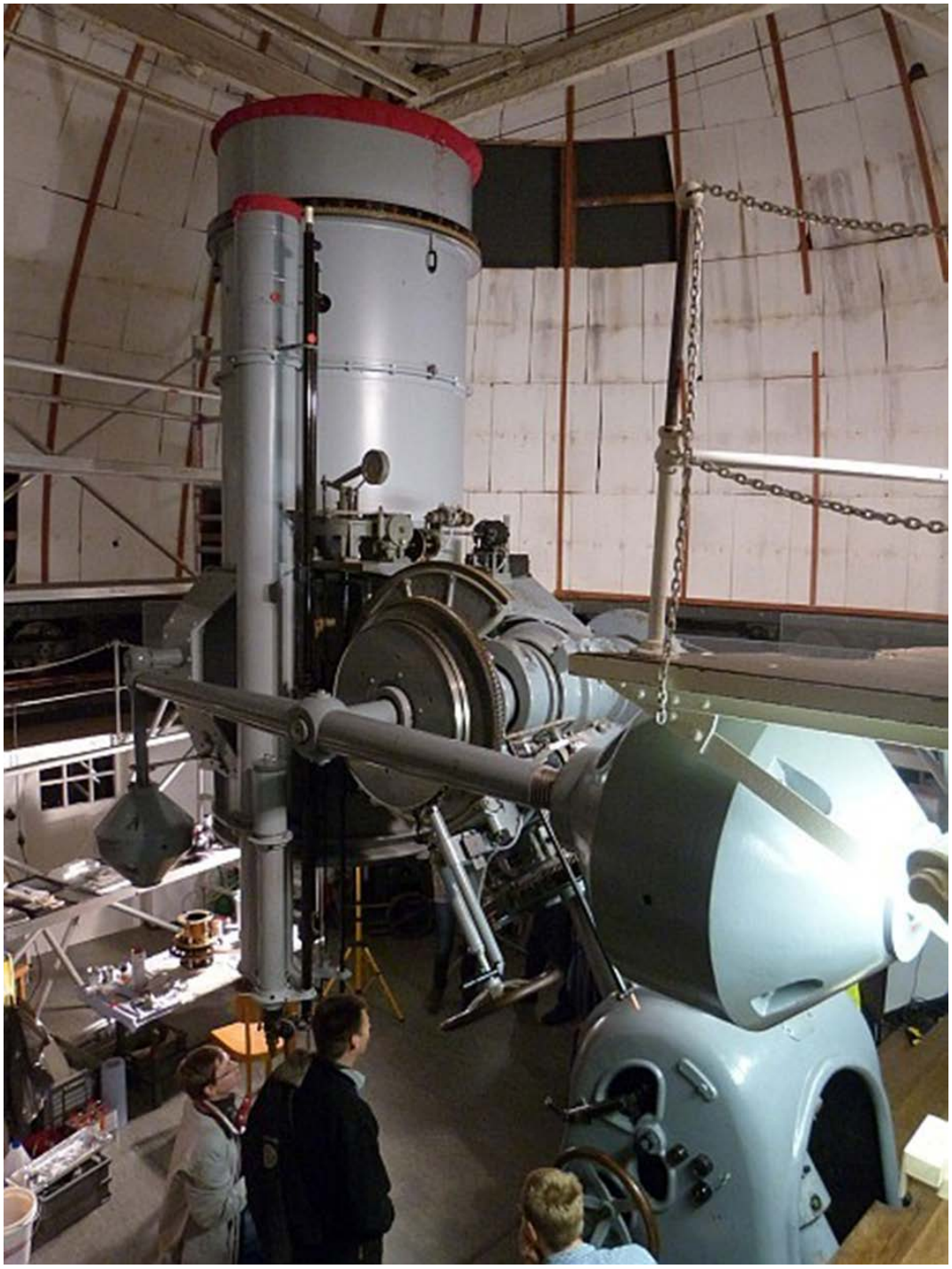
Meridian-Circle-Building

Meridian-Circle
currently at the “Deutsches Museum”

Mire

1-Meter-Reflector-Building

1-Meter-Reflector

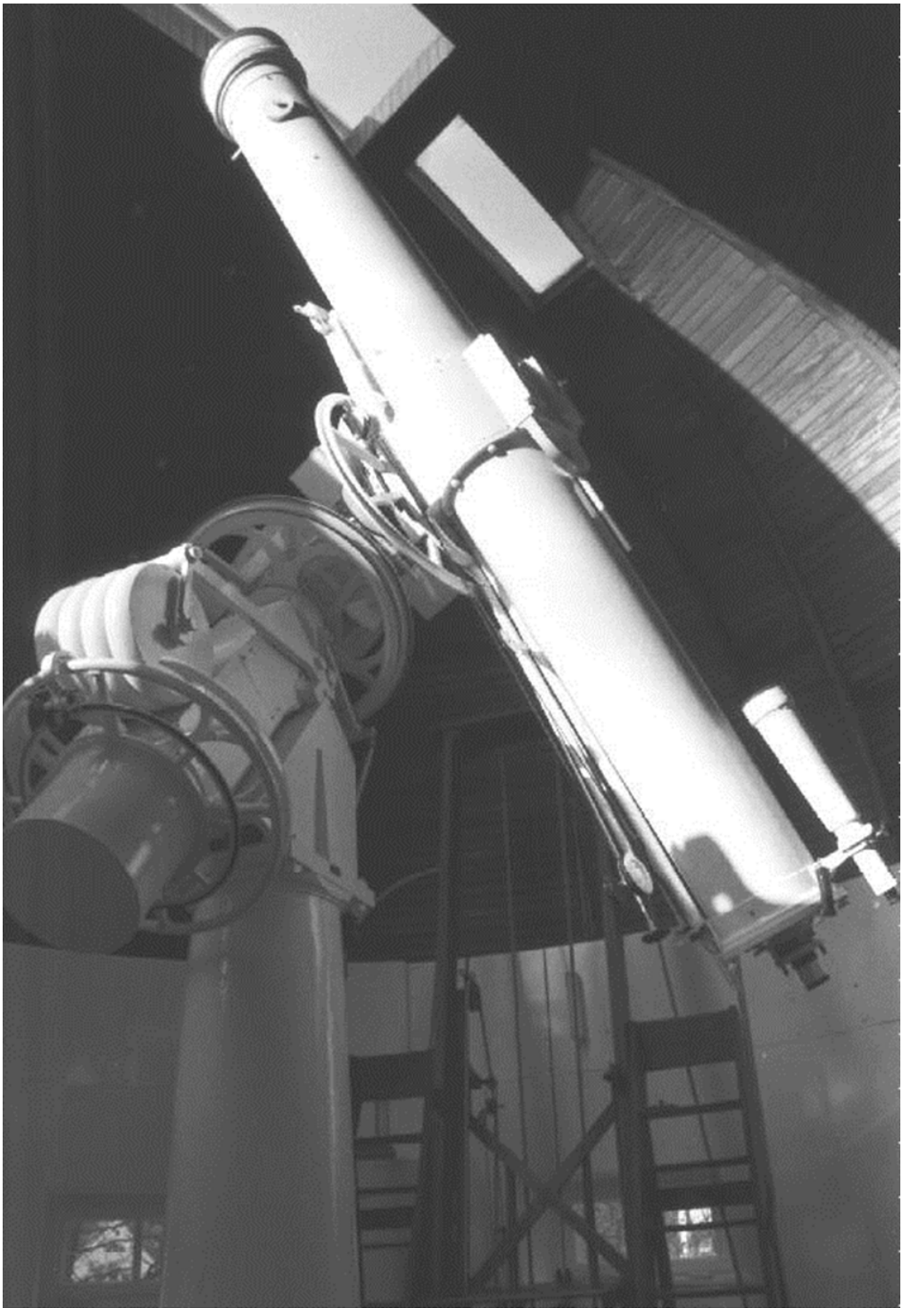


Lippert-Astrograph-Building

Lippert-Astrograph

Equatorial-Telescope-Building

Equatorial-Telescope



Observing chair of the Equatorial Telescope

Oskar-Lühning-Telescope-Building

Oskar-Lühning-Telescope

The First Schmidt-Telescope