History of Astrophotography Timeline

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1800- Thomas Wedgwood (1771-1805) produces "sun pictures" by placing opaque objects on leather treated with silver nitrate; resulting images deteriorated rapidly.

1816- Joseph Nicéphore Niépce (1765-1833) combines the camera obscura with photosensitive paper.

1826- Joseph Niépce produces the first permanent image (Heliograph) using a camera obscura and white bitumen (Figure 1).

1829- Niépce and Louis Daguerre (1787-1851) sign a ten year agreement to work in partnership developing their new recording medium.

1834- Henry Fox Talbot (1800-1877) creates permanent (negative) images using paper soaked in silver chloride and fixed with a salt solution. Talbot created positive images by contact printing onto another sheet of paper. Talbot's *The Pencil of Nature*, published in six installments between 1844 and 1846 was the first book to be illustrated entirely with photographs.

1837- Louis Daguerre creates images on silver-plated copper, coated with silver iodide and "developed" with warmed mercury (daguerreotype).

1839- Louis Daguerre patents the daguerreotype. The daguerreotype process is released for general use in return for annual state pensions given to Daguerre and Isidore Niépce (Louis Daguerre's son): 6000 and 4000 francs respectively.

1939- John Frederick William Herschel (1792-1871) uses for the first time the term *Photography* (meaning writing with light).

1939- First unsuccessful daguerreotype of the moon obtained by Daguerre (blurred image – long exposure).

1839- François Jean Dominique Arago (1786-1853) announces the daguerreotype process at the French Academy of Sciences (January, 7 and August, 19). Arago predicts the future use of the photographic technique in the fields of selenography, photometry and spectroscopy.

1840- John William Draper (1811-1882) obtains the first successful (correctly exposed) daguerreotype of the moon using a 13 cm reflector with a long focal length (20 min exposures).

1841- Henry Talbot patents his process under the name "calotype".

1842- Austrian astronomer G.A. Majocchi obtains the first photograph of the partial phase of a solar eclipse on a daguerreotype in 1842 (July, 8) (2 min exposure).

1844/1845- According to J.D. Arago, a large number of daguerreotypes of the sun were obtained by Armand Hippolyte Louis Fizeau (1819-1896) and Jean Bernard Léon Foucault (1818-1868) at the Paris observatory. One of these photographs, taken on April 2, 1845, still survives (Figure 2).

1849/1852- William Cranch Bond (1789-1859) and John Adams Whipple (1822-1891) obtain a series of lunar daguerreotypes with the 38 cm Harvard refractor (40 s exposures) (Figure 3).

1850- First star photograph (α Lyrae, Vega) obtained by John Adams Whipple and William Cranch Bond using the 38 cm Harvard refractor (daguerreotype, 100 s exposure).

1851- Frederick Scott Archer (1813-1857), improves photographic resolution by spreading a mixture of collodion (nitrated cotton dissolved in ether and alcohol) and chemicals on sheets of glass. Wet plate collodion photography was much cheaper than daguerreotypes; the negative/positive process permitted unlimited reproductions. The process was published but not patented.

1851- First daguerreotype of a total eclipse of the Sun obtained by M. Berkowski , recording the inner corona and several prominences (July, 28) (Figure 4). In Rome Angelo Secchi (1818-1878) records the partial phases of the eclipse (daguerreotypes) (162 mm refractor, 2.5 m focal length).

1852- First wet plate collodion images of the Moon obtained by Warren de la Rue (1815-1889) using a 33 cm reflector with 3.05 m focal length. Mount without a clock drive.

1853- J. Phillips photographs the Moon with a 159 mm refractor (3.35 m focal length) (60 s exposures).

1854- Joseph Bancroft Reade (1801-1870) uses a 60 cm reflector to photograph the sun (wet collodium). These images reveal the solar molted appearance (photosphere).

1855- Warren de la Rue publishes *A series of twelve photographs of the Moon*.

1856/1858- Lewis Morris Rutherfurd (1816-1892) photographs the Moon and the Sun using an achromatic refractor of 285 mm aperture.

1857- George Philips Bond (1825-1865) (son of W.C. Bond) photographs (wet collodion) the double star Mizar (ζ UMa) and Alcor (80 UMa) using the 38 cm Harvard refractor (Figure 5).

1857- Warren de la Rue obtains images of Jupiter and Saturn with a 33 cm reflector. The exposures (12 s for Jupiter and 60 s for Saturn) were unsuccessful (the planet images measured only 1/2 mm on the plate).

1858- Warren de la Rue tries to image comet Donati without success. M. Usherwood records the comet with a 7 s exposure.

1858- George Philips Bond shows that the magnitude of stars could be derived from astronomical photographs (stellar photometry).

1958/1859- Warren de la Rue publishes the first stereographs of the Moon (by obtaining images at different librations) (Figure 6).

1858/1872- Warren de la Rue obtains daily images of the Sun (weather permitting) using the Kew photoheliograph (Figure 7). A total of 2778 Sun photographs were obtained between 1862 and 1872.

1860- Warren de la Rue photographs (wet collodion) the total eclipse of the Sun in Spain (July, 18) with the Kew photoheliograph (60 s exposures) (Figure 7). Angelo Secchi also obtains excellent photographs of the same eclipse (Spain).

1861- Warren de la Rue mentions the possibility of conducting a photographic survey to obtain a Star Map of the whole sky (astrometry).

1861- James Clerk Maxwell (1831-1879) demonstrates a color photography system involving three black and white photographs, each taken through a red, green and blue filter.

1865- Lewis Morris Rutherfurd obtains excellent Moon images using a specially corrected (photographic) 290 mm lens (Figure 8).

1864/1865- Henry Draper (1837-1882) images the Moon using a 40 cm reflector built by himself.

1871- German astronomer Hermann Carl Vogel (1841-1907) obtains excellent photographs of the Sun using a 294 mm refractor equipped with an electrical shutter (1/5000 to 1/8000s exposures).

1871- Richard Leach Maddox (1816-1902), proposes the use of an emulsion of gelatin and silver bromide on a glass plate, the "dry plate" process.

1871- Lord (James Ludovic) Lindsay (1847–1913) photographs the total eclipse of the Sun (December, 12) at Baikul (Figure 9).

1871- Lewis Morris Rutherfurd records the solar molted appearance with some detail.

1872- Henry Draper records the spectrum of α Lyra using a 720 mm reflector.

1872- Henry Draper records for the first time a star spectrum (Vega) using a 72 cm reflector and a quartz prism.

1873- Edward Walter Maunder (1851-1928) installs at the Greenwich observatory a photoheliograph to record the Sun on a daily basis. Maunder is best remembered for his study of sunspots and the solar magnetic cycle that led to his identification of the period from 1645 to 1715 known as the *Maunder Minimum*.

1874- Pierre Jules César Janssen (1824-1907) develops the photographic revolver to record the transit of the planet Venus across the face of the sun, on 8 December 1874.

1875- Henry Draper photographs the spectra of almost all the bright stars using a 29 cm lens and a quartz prism located close to the photographic plate.

1876- William Huggins (1824-1910) uses the dry plate for the first time to record spectra. From 1876 to 1886, Huggins and Miller photograph the spectra of all the first and second magnitude stars (60 min exposures).

1876/1878- In 1876 Jules Janssen presents his first solar photographs to the French Academy of Sciences (10 to 70 cm diameter). These wet collodion images were obtained with a 150 mm refractor with exposures of 1/500 to 1/6000s. During 1877/1877 Jules Janssen obtains a high number of solar photographs showing the solar granulation (photosphere) for the first time (Figure 10).

1879- Andrew Ainslie Common (1841-1903) photographs Jupiter using his 91 cm reflector (5.30 m focal length) (1 s exposures, images 1 mm wide).

1879/1883- Henry Draper photographs the spectra of 50 stars.

1880- Henry Draper obtains the first photograph of the Orion nebula (M 42) on September, 30. Draper used a 28 cm Alvan Clark refractor supported by an equatorial mount also built by Clark (51 min exposure) (Figure 11). Draper obtains two other photographs of M 42 on 1881/1882 with longer exposure times (104 min and 137 min).

1881- First successful image of a comet (Tebbutt 1881 III) obtained by Jules Janssen on June, 30. Janssen used a dry plate and an exposure of 30 min (50 cm *f*/3 instrument) (Figure 12). The same comet was also imaged by H. Draper, A. Common and M. Huggins.

1882- David Gill (1843-1914), of Cape observatory, photographs the great comet of 1882 using a portrait lens of 63 mm aperture (*f*/4.5) (Figure 13).

1882- W. Huggins photographs of the spectrum of a nebula (M 42) for the first time (45 min exposure).

1882- Edward Charles Pickering (1846-1919) starts a program at the Harvard observatory using objective prisms. This setup enabled Pickering to obtain several spectra on a single plate.

1883- Andrew Ainslie Common photographs the Orion nebula using his 91 cm reflector on January 30. The 37 min exposure reveals stars that were not detected visually, for the first time. On February 28, Common obtains a deeper image with an exposure of 60 min (Figure 14).

1885/1886- The Henry Brothers: Paul Henry (1848-1905) and Prosper Henry (1849-1903); photograph Jupiter and Saturn using the Paris observatory 33 cm refractor (3.43 m focal length). These were the first successful planetary images (Figure 15).

1887- Amédée Mouchez (1821-1892) hosts the first meeting of the "Carte du Ciel" Project at the Paris observatory. Eighteen observatories agreed to cooperate and to adopt, as a standard design for a photographic telescope, the 33 cm refractor developed by the Henry brothers (Figure 16).

1885/1899- Isaacs Roberts (1829-1904) obtains a long series of photographs from 1885 to 1897 and publishes two volumes with these results (the first in 1893 and the second in 1899, both with the same title *Photographs of Stars, Star Clusters and Nebulae*) (Figure 17).

1887/1899- William Edward Wilson (1851-1908) records several deep-sky images at the Daramona observatory (Westmeath, Ireland). The Wilson photographs are practically unknown today (Figure 18).

1888/1890- William Henry Pickering (1858-1939) successfully photographs Mars using two refractors (38 cm and 32 cm aperture) at Pic du Midi observatory (France).

1890- Edward Singleton Holden (1846-1914) obtains high resolution images of the Moon using the 91 cm Lick refractor.

1894/1910- Moritz Loewy (1833-1907) and Pierre-Henri Puiseux (1855-1928) obtain 6000 photographs (500 nigths) of the Moon using the 60 cm Paris observatory Coudé refractor. The *Atlas Photographique de la Lune* was edited from 1896 e 1910 by the Paris observatory (Figure 19).

1899- James E. Keeler (1857-1900) starts a photographic survey of nebulae at the Lick observatory (Mount Hamilton, California). Keeler used the Common reflector (91 cm aperture) that was offered to the observatory by Edward Crossley (1841-1905). The images obtained by Keeler were the best of its kind until the end of the century (Figure 20).

1889- First of a long series of wide-field deep-sky astrophotographs obtained by Edward Emerson Barnard (1857-1923). Lick Observatory, Crocker telescope, Willard 6" lens (Figure 21).

1899- The german astronomer Julius Scheiner (1858-1913) records the spectrum of M 31 with an exposure of 7 ½ h proving that it was composed of individual stars.

1901/1902- George Willis Ritchey (1864-1945) obtains a series of excellent photographs of nebulae using the Mount Wilson 60 cm reflector (Figure 22).

1903- Jules Janssen publishes his monumental work *Atlas de photographies solaires* (Gauthiers-Villars).

1909/1911- G.W. Ritchey records several star clusters and nebulae with the 1.52 m *f*/5 Mount Wilson reflector (exposures of up to 11 h obtained during several nights). These photographs had a resolution of about 1" (Figures 23 and 24).

1911- E.E. Barnard obtains excellent images of Saturn using the 1.52 m Mount Wilson reflector (Figure 25).

1913- E.E. Barnard publishes *Photographs of the Milky Way and of Comets*. Publications of Lick Observatory, vol. 11. These images were obtained from 1892 to 1895 using the Crocker telescope (Figure 26).

1918- First photographs of nebulae obtained by F.G. Pease (1881-1938), with the Hooker 2.54 m reflector at Mount Wilson (Figure 22).

1924- Edwin Hubble (1889-1953), using the 2.54 m Hooker Telescope, was able to identify Cepheid variables in the Andromeda galaxy and estimates it's distance (800 000 light years). Hubble changed astronomers' understanding of the nature of the universe by demonstrating the existence of other galaxies besides the Milky Way.

1927- Publication of *Atlas of Selected Regions of the Milky Way*", five years after the disappearance of E.E. Barnard. Most of the plates included in the Atlas (40 out of 50) were obtained at Mount Wilson observatory with the Bruce Telescope (Figures 26, 27 and 28).

1929- Edwin Hubble, based on photographs of spectra (exposures of tenths of hours), discovers that the degree of the redshift observed in several galaxies increases in proportion to their distance to the Milky Way. This became known as Hubble's law, and would help establish that the universe is expanding.

1929/1934- French astronomer Marcel de Kerolyr photographs nebulae and galaxies using the 80 cm *f*/6 reflector of the Paris observatory astrophysics station at Haute Provence.

1936- Milton Lasell Humason (1891-1972) images galaxies at 240 000 000 light-years with the Hooker telescope.

1948- Edwin Hublle uses the 200 inch (5.08 m) Hale telescope for the first time (Figure 29).

1948/1958- The Palomar Observatory Sky Survey (POSS), was completed in 1958 (the first plates were shot in November 1948 and the last in April 1958). This survey was performed using blue-sensitive (Kodak

103a-O) and red-sensitive (Kodak 103a-E) photographic plates on the 48 inch (1.22 m) Samuel Oschin Schmidt telescope (Figure 30).

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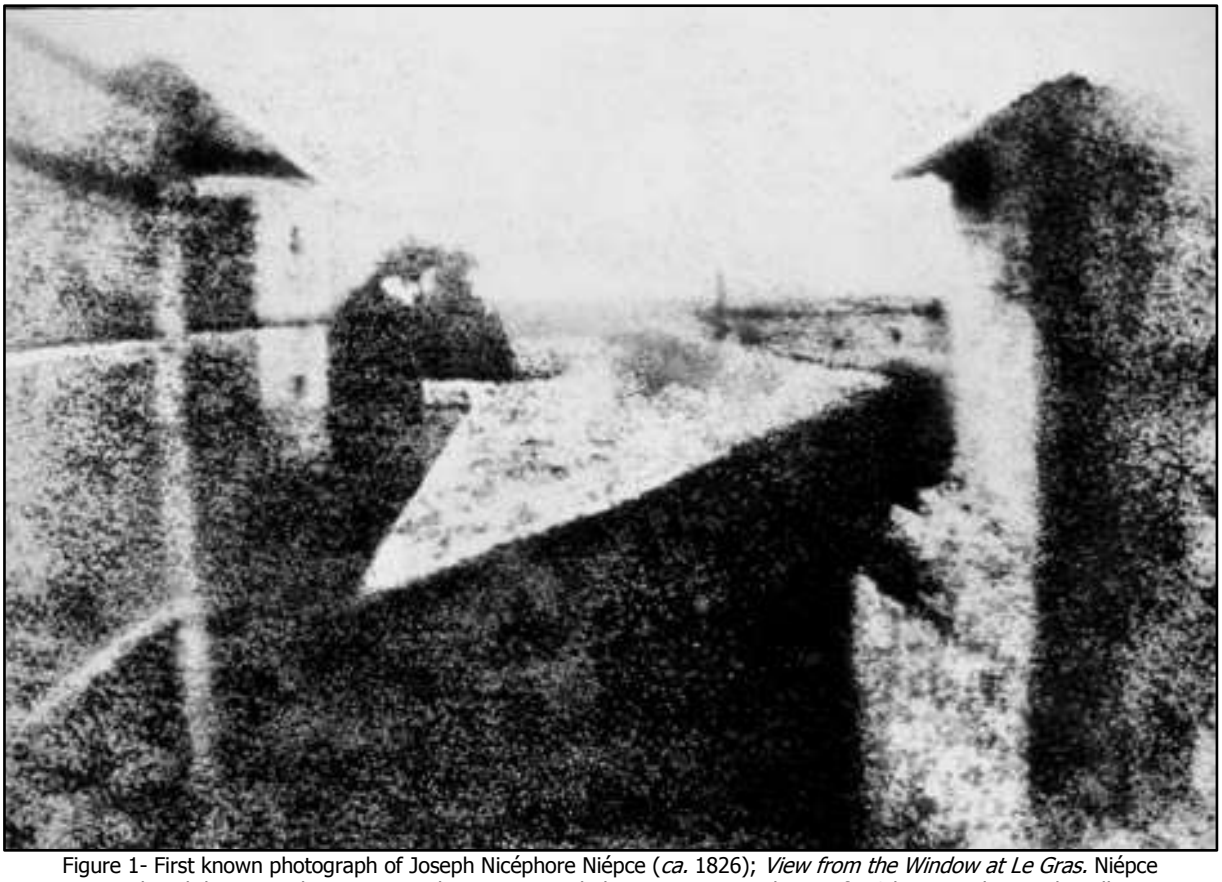

Figure 1- First known photograph of Joseph Nicéphore Niépce (*ca.* 1826); *View from the Window at Le Gras.* Niépce produced this image by exposing a bitumen-coated plate in a camera obscura for 8 hours on his windowsill.

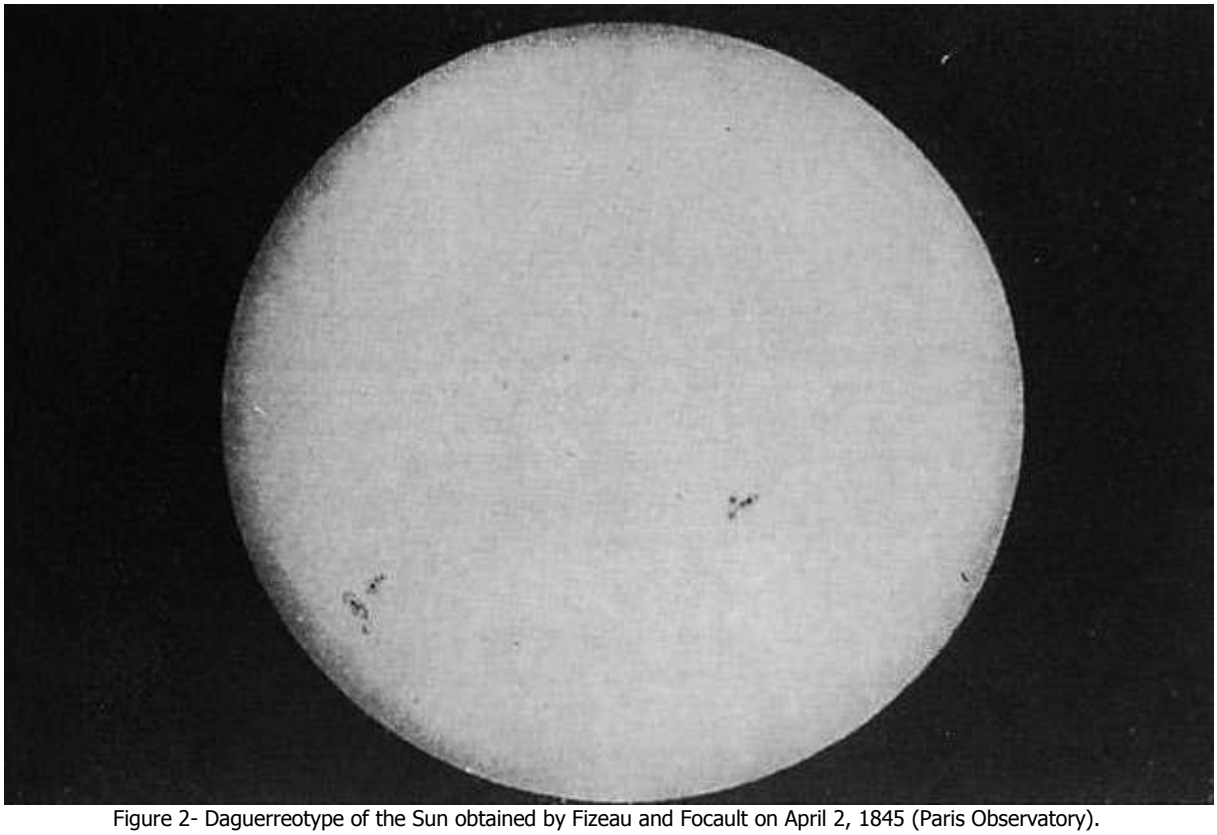

Figure 2- Daguerreotype of the Sun obtained by Fizeau and Focault on April 2, 1845 (Paris Observatory).

Figure 3- Lunar daguerreotype obtained by John Adams Whipple on February 26, 1852 (Harvard observatory).

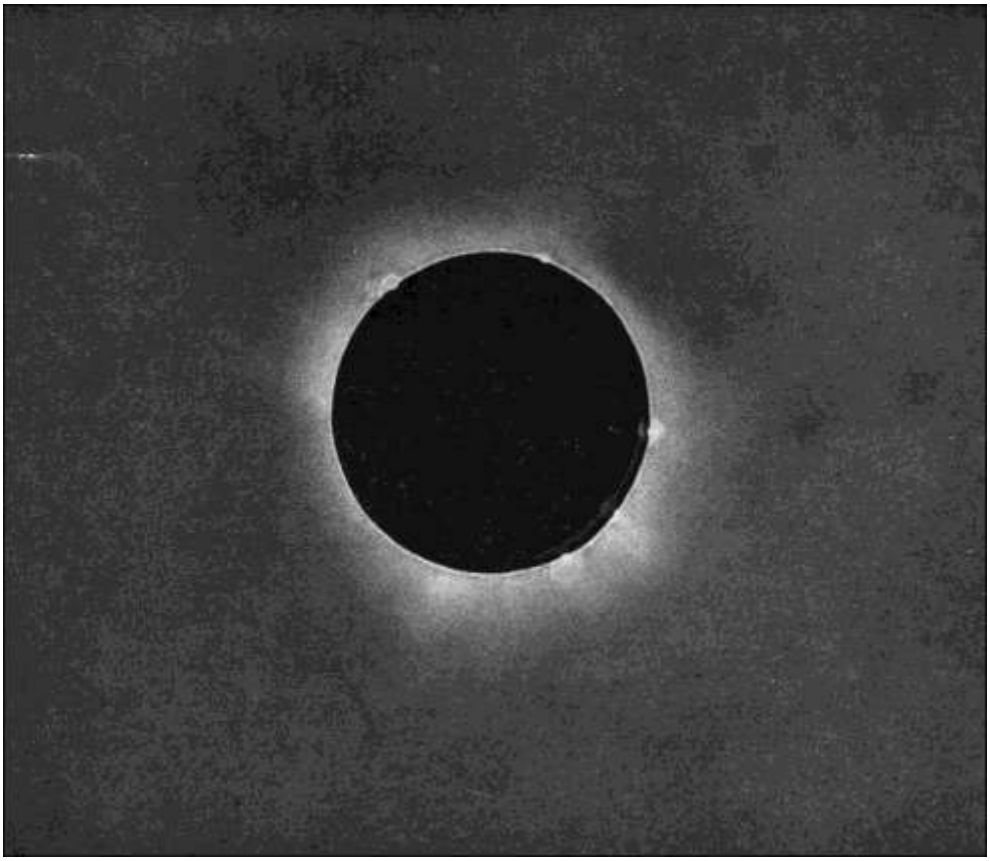

Figure 4- First daguerreotype of a total eclipse of the Sun obtained by M. Berkowski on July 28, 1851. 60 mm refractor, 79 cm focal length (24 sec exposure).

Figure 5- Wet collodion image of Alcor & Mizar obtained by in 1857 by G.P. Bond using the 38 cm Harvard refractor.

Figure 6- Two stereographs of the moon by Lewis M. Rutherfurd and Henry Draper.
Pedro Ré's private collection.

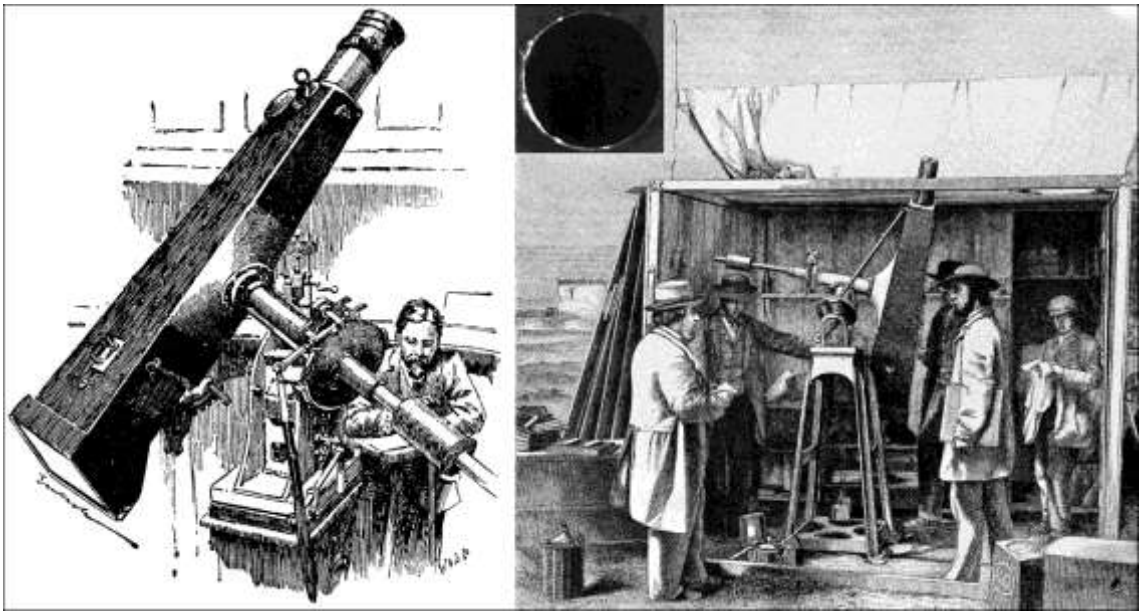
Figure 7- Kew photoheliograph (86 mm aperture, 127 mm focal length). The Kew photoheliograph was transported to Spain by Warren de la Rue for the observation of the 1860 total eclipse of the Sun.

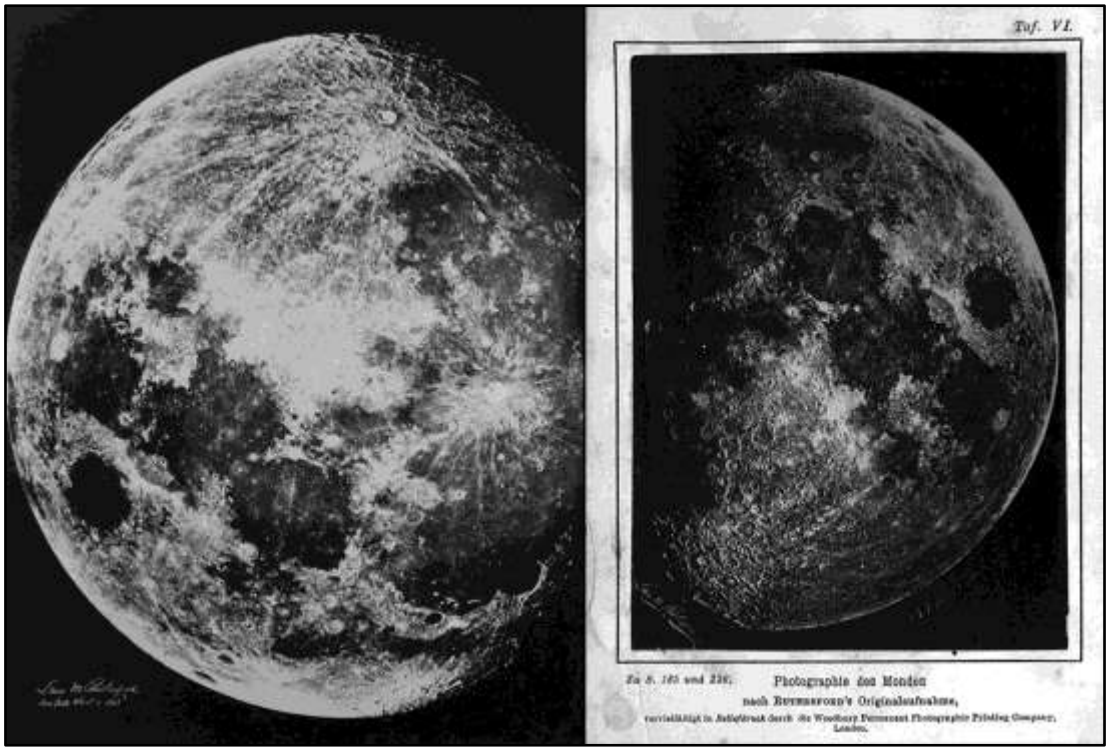

Figure 8- Wet collodion Moon images obtained by Lewis M. Rutherfurd in 1865.

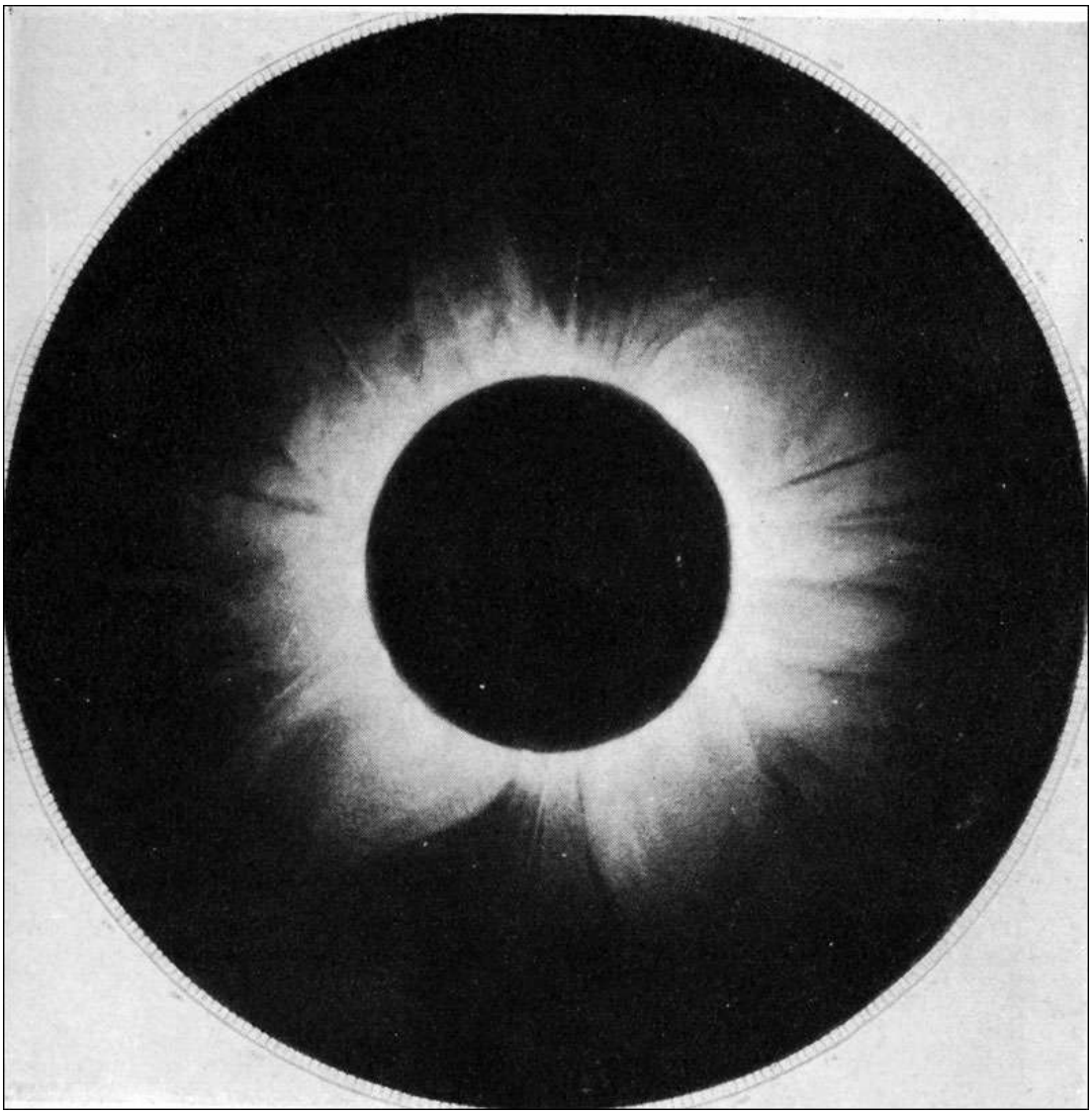
Figure 9- Wet collodion image of the December, 12, 1871 total Eclipse of the Sun obtained by Lord Lindsay at Baikul (12 cm refractor, 84 cm focal length). Image obtained during a solar maximum.

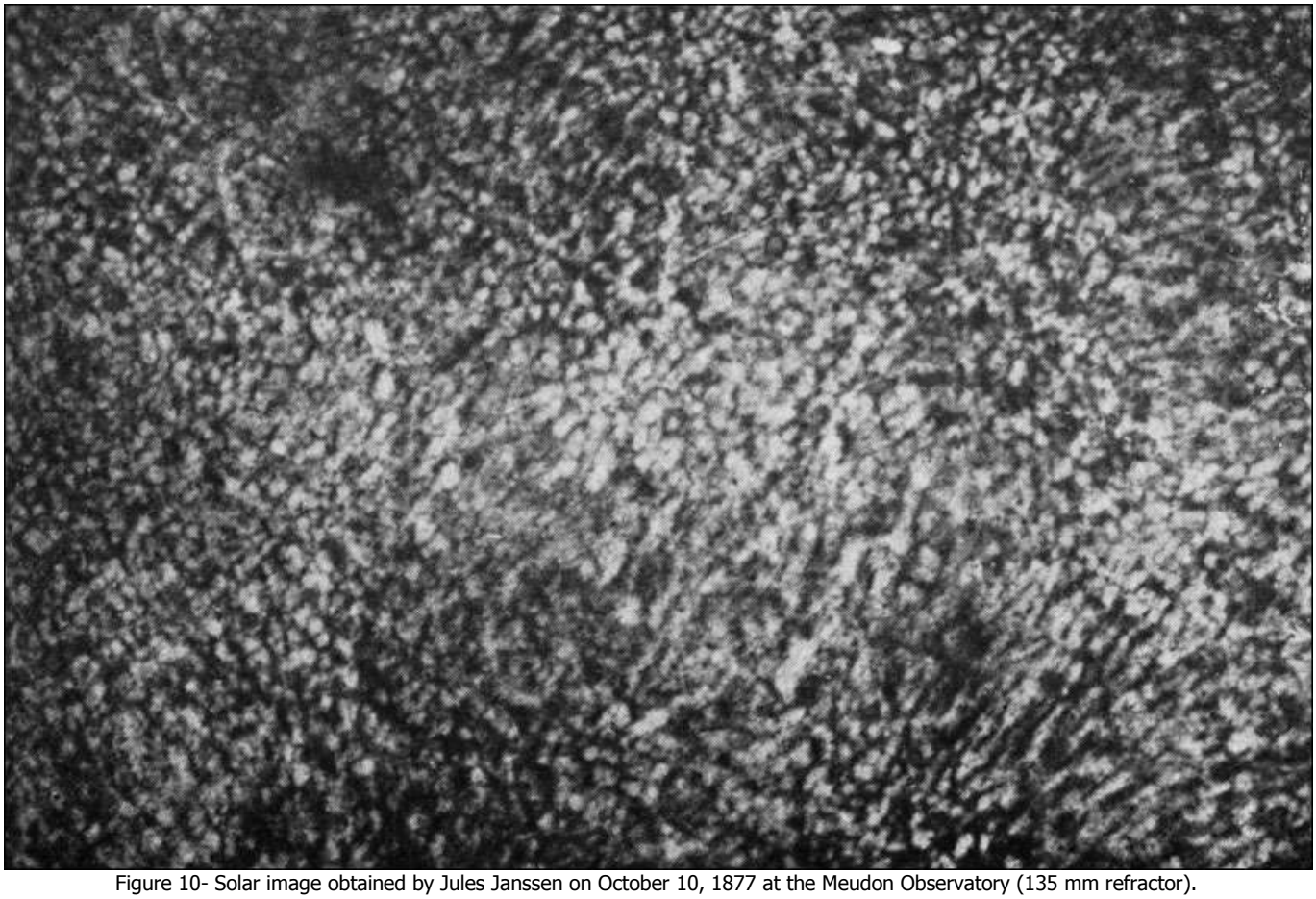

Figure 10- Solar image obtained by Jules Janssen on October 10, 1877 at the Meudon Observatory (135 mm refractor).
Solar granulation.

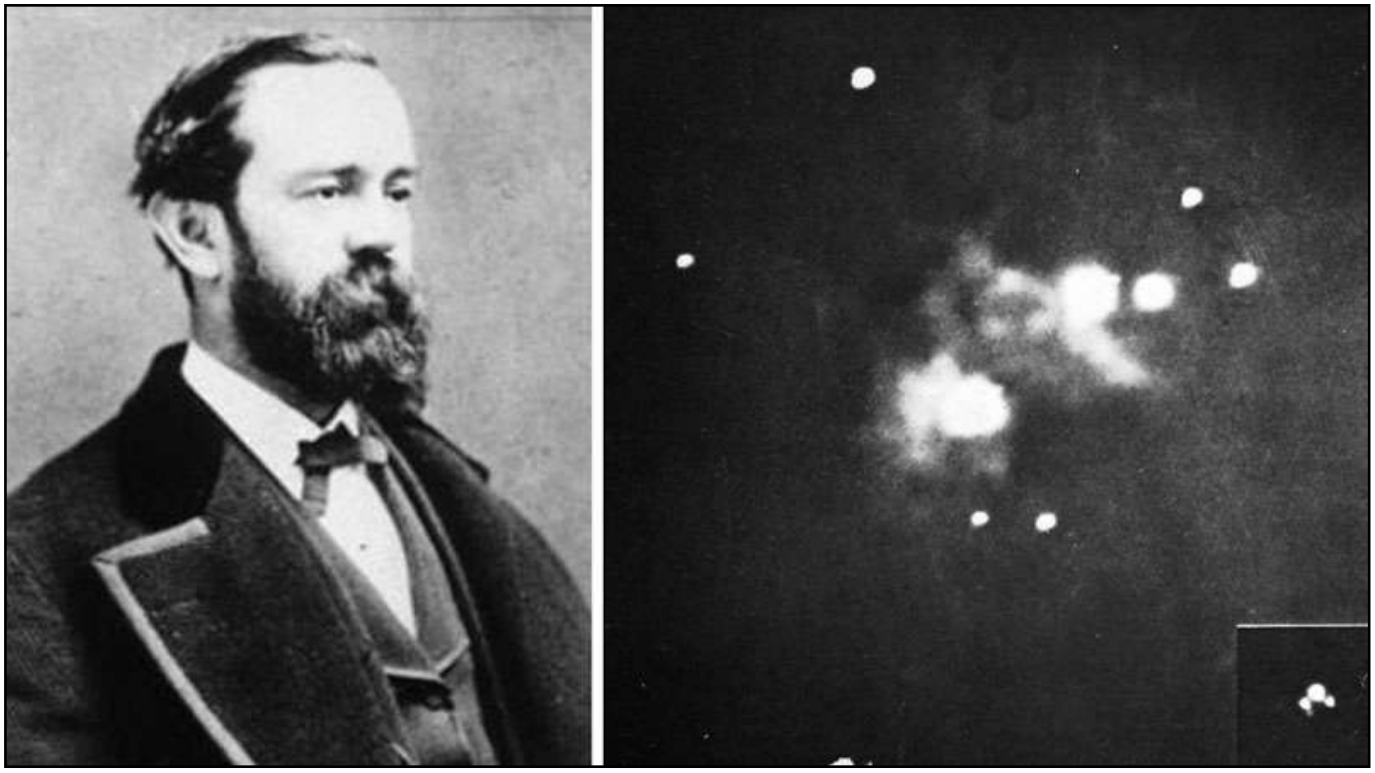

Figure 11- First image of the Orion nebula (M 42) obtained by Henry Draper on 1880.

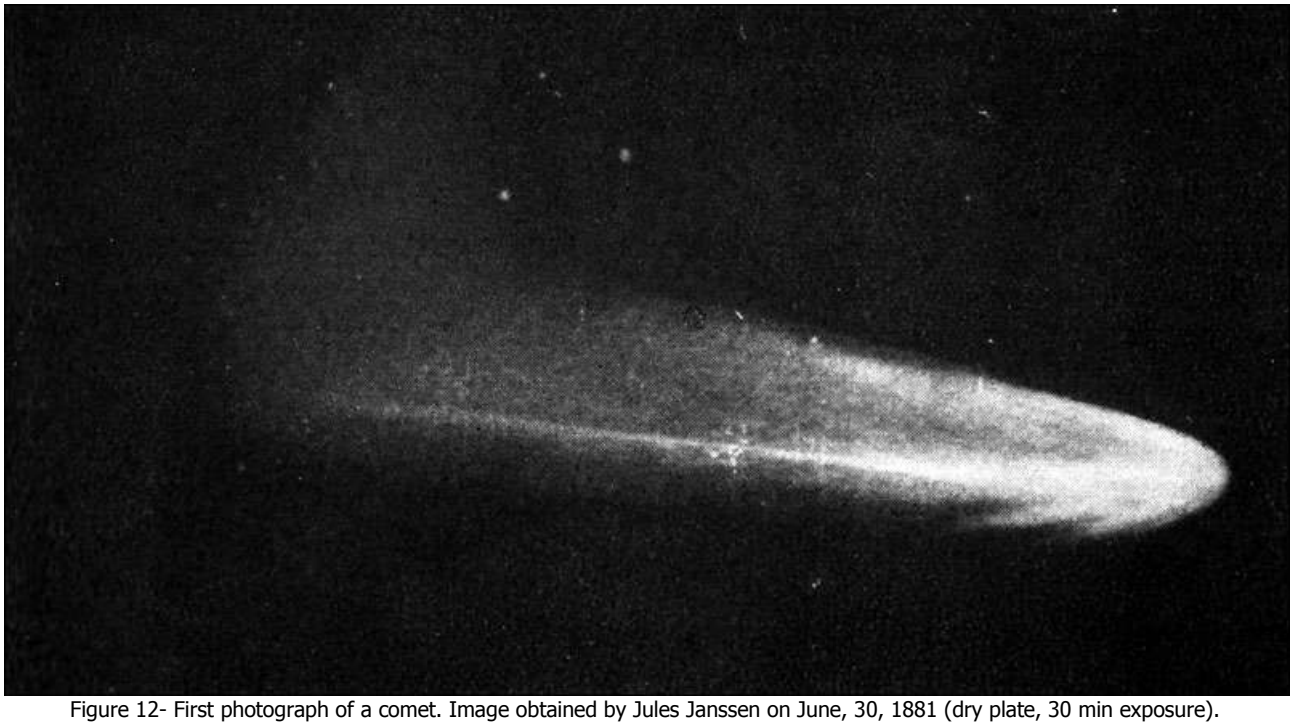

Figure 12- First photograph of a comet. Image obtained by Jules Janssen on June, 30, 1881 (dry plate, 30 min exposure).

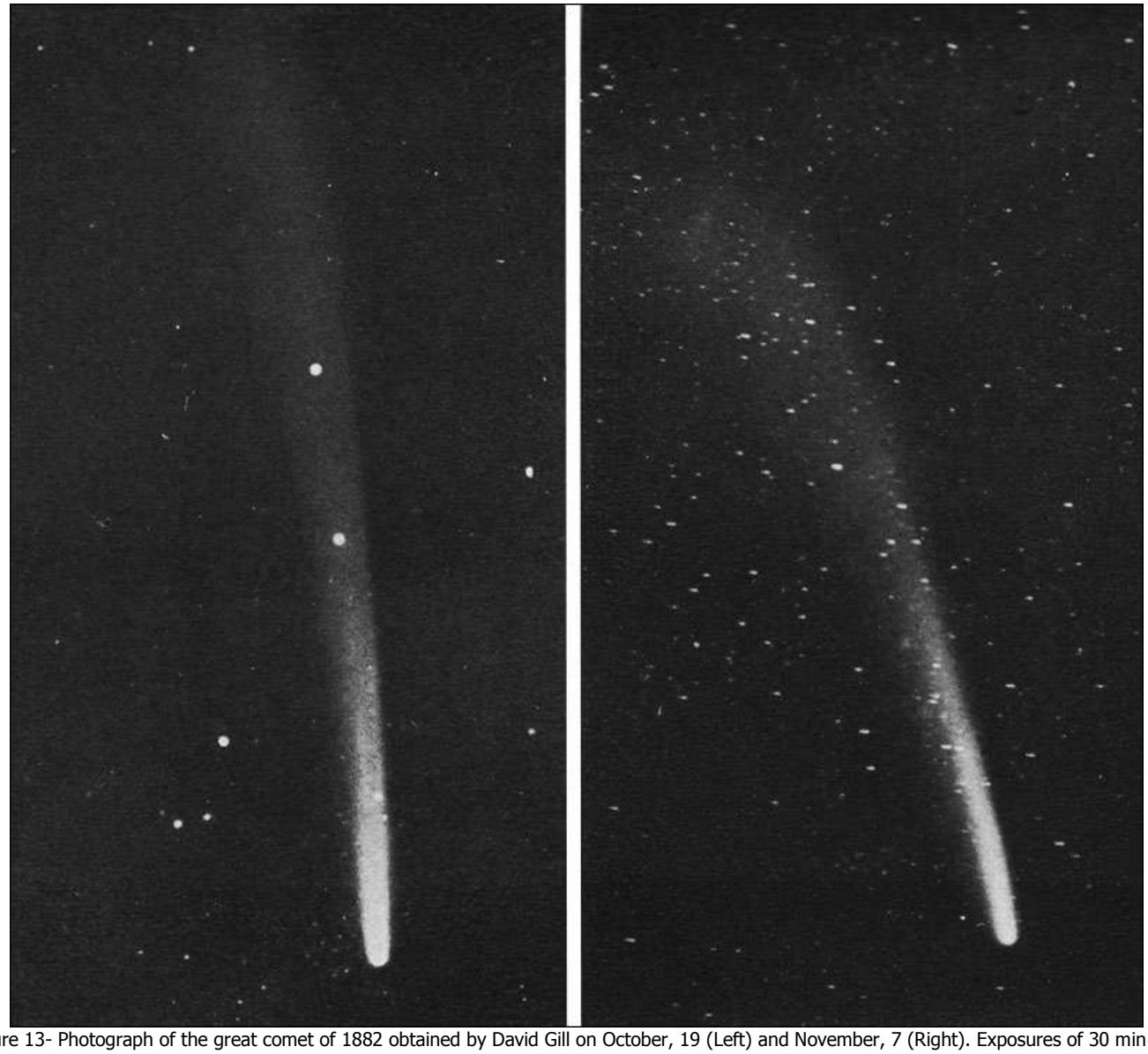

Figure 13- Photograph of the great comet of 1882 obtained by David Gill on October, 19 (Left) and November, 7 (Right). Exposures of 30 min and 110 min respectively.

Figure 14- Photograph of M 42 obtained by Andrew A. Common on February 28, 1883, 91 cm reflector, 60 min exposure.

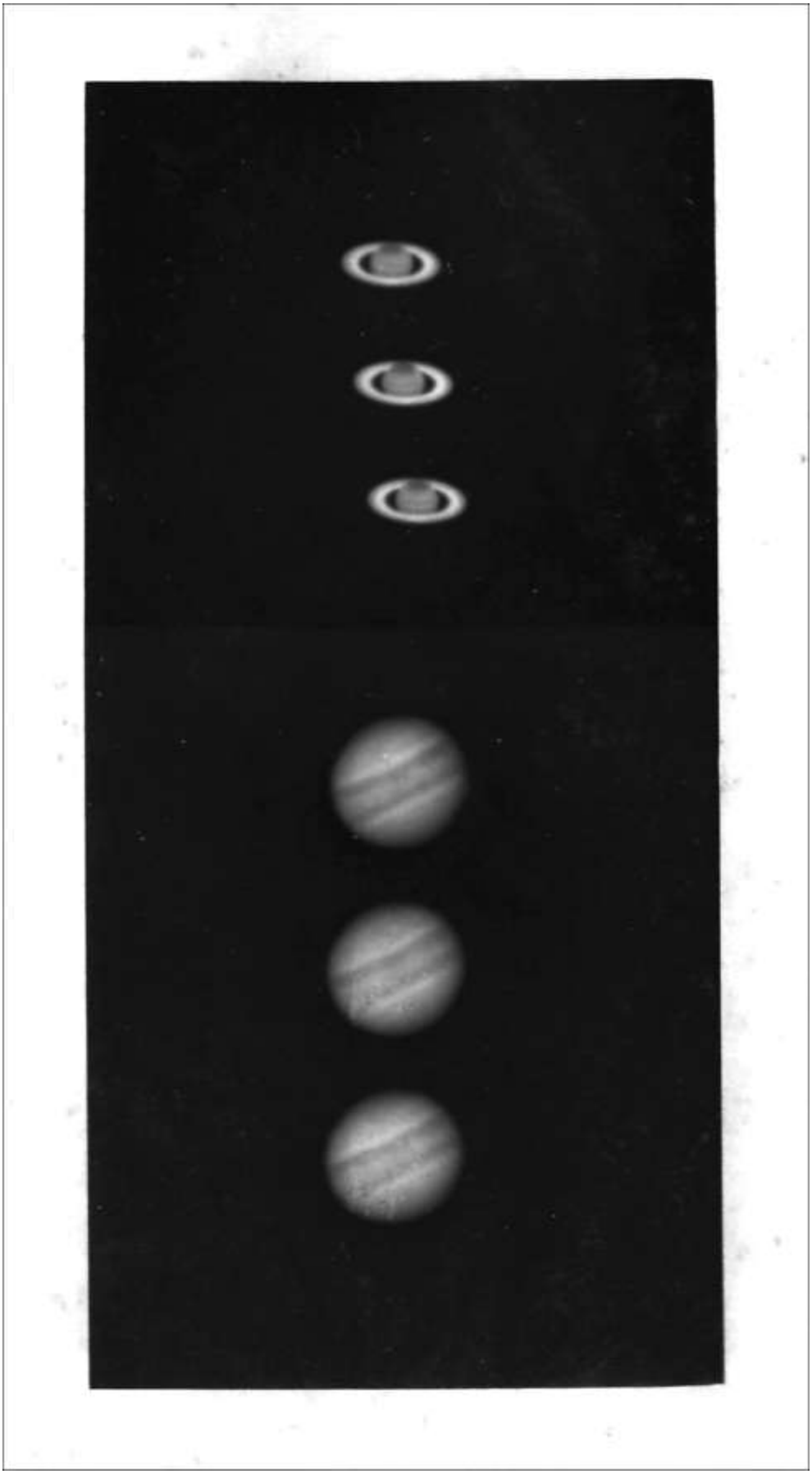

Figure 15- Saturn and Jupiter. Images obtained by the Henry brothers (Paris Observatory) (1886).

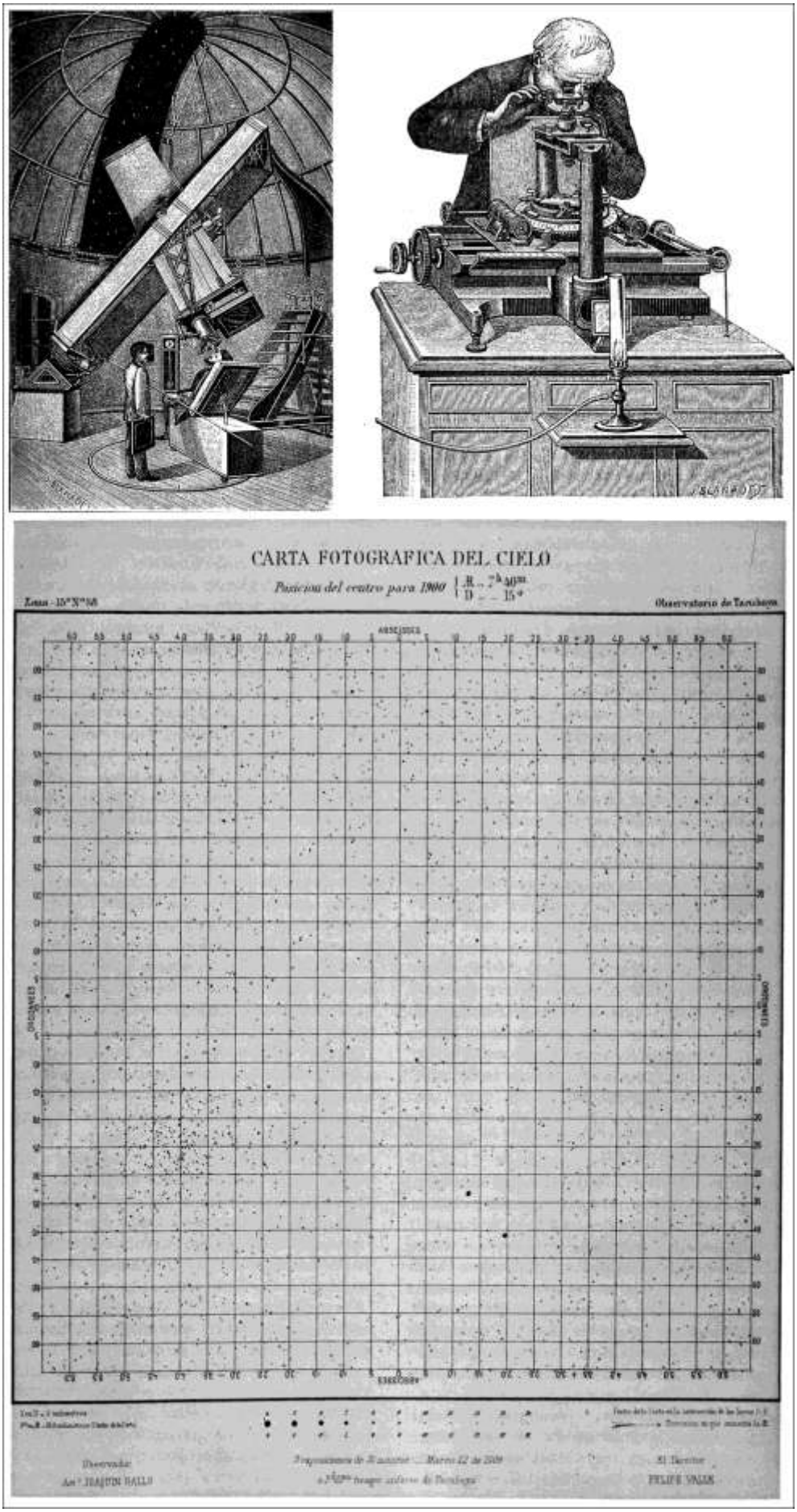

Figure 16- Photographic refractor (Left) and measuring machine (Right) used in the "Carte du Ciel" Project. Image obtained at the Tacubaya observatory (Mexico) in 1909 (Below).

Figure 17- Photograph of M 42 obtained by Isaacs Roberts on January 15, 1896, 50 cm reflector *f*/5, 90 min exposure.

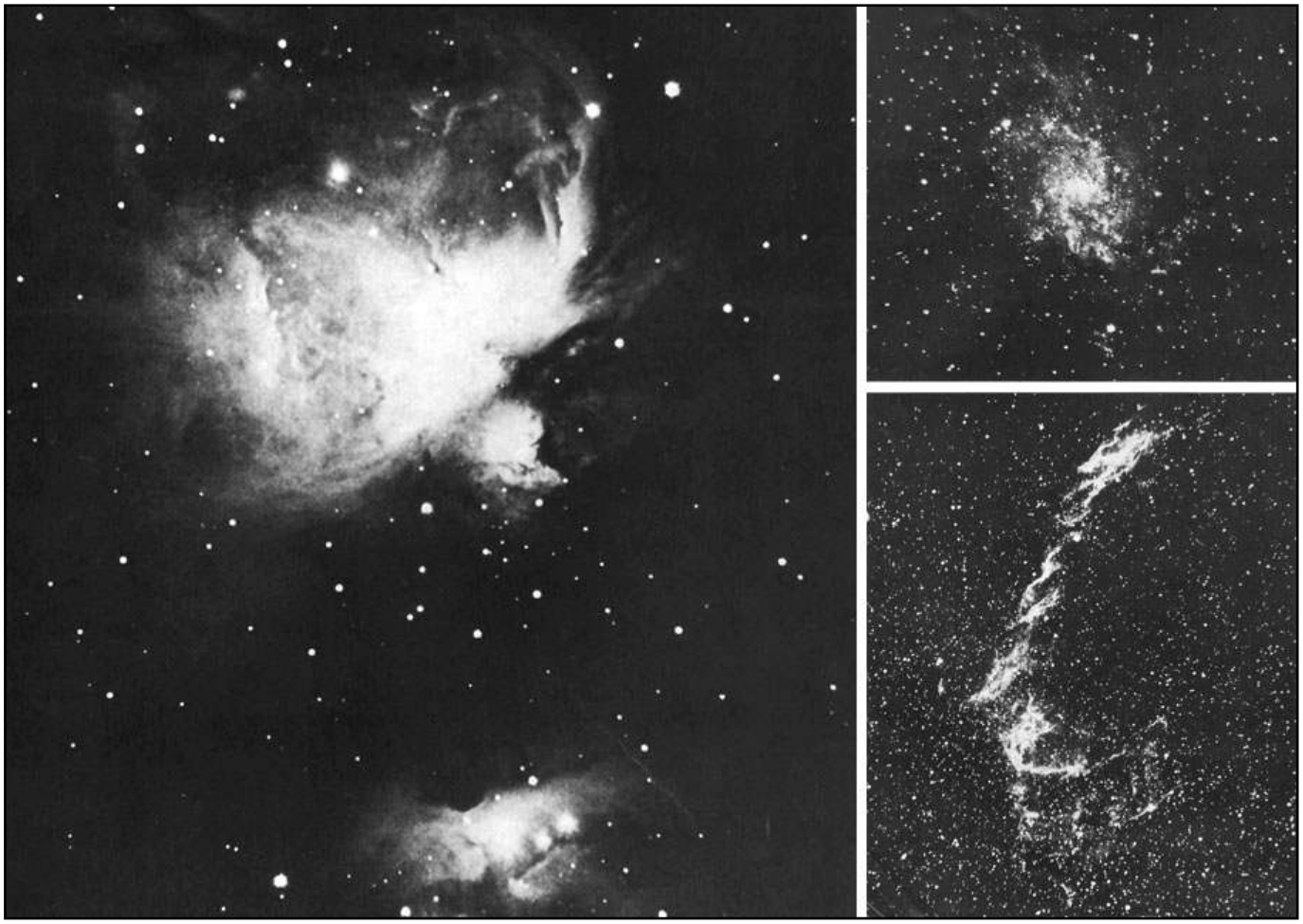

Figure 18- Photographs obtained by William Wilson at the Daramona observatory, 60 cm aperture Grubb reflector, M 42 (1897), M 33 (1899) and NGC 6992 (1899), 90 min exposures.

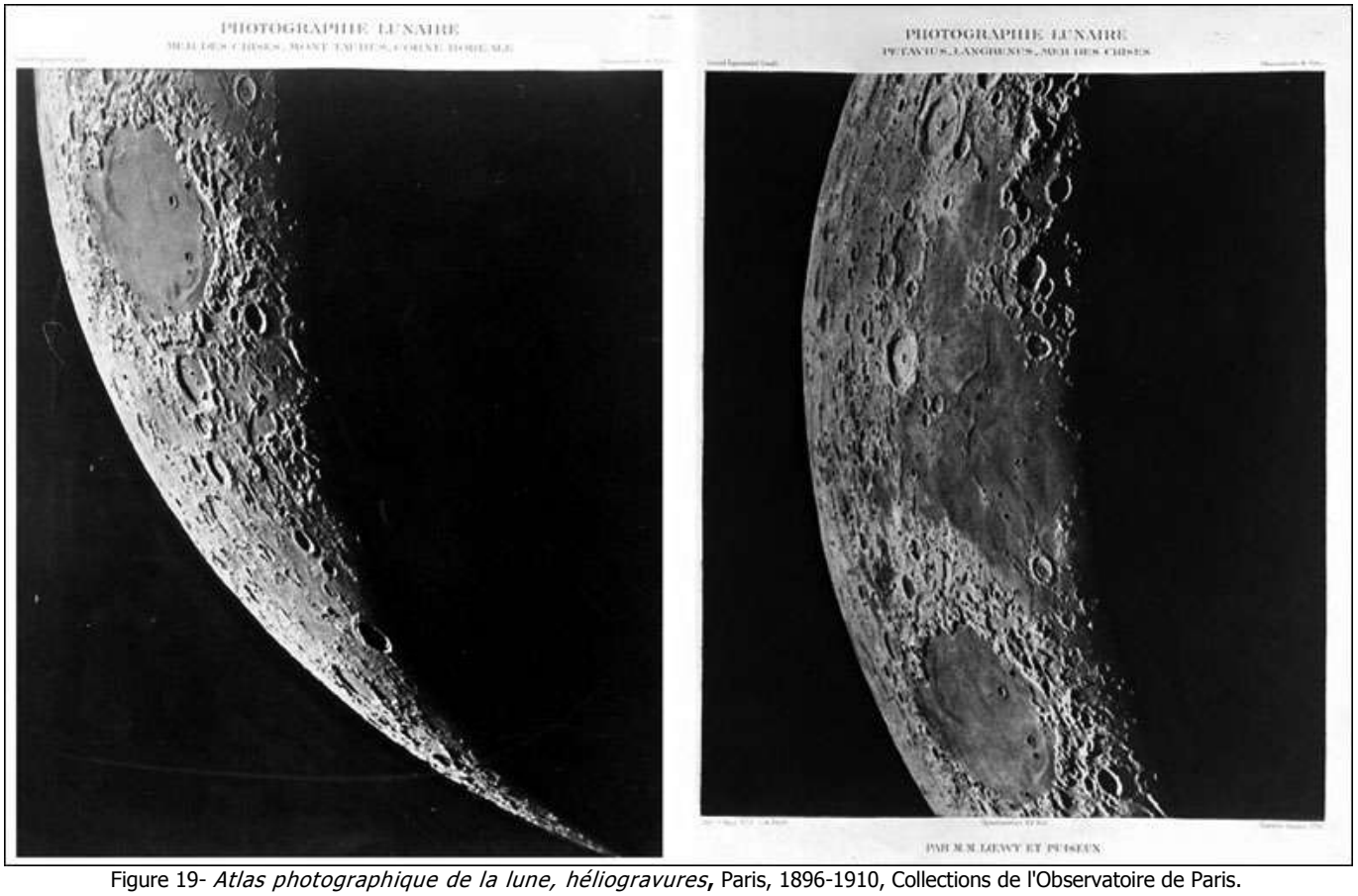

Figure 19- *Atlas photographique de la lune, héliogravures***,** Paris, 1896-1910, Collections de l'Observatoire de Paris. Images obtained on March 7, 1897.

Figure 20- The great nebula in Orion (M 42). Photograph obtained by James E. Keeler with the Crossley reflector (91 cm *f*/5.7, 40 min exposure, November 16, 1898).

Figure 21- One of the first wide-field images obtained by Edward E. Barnard.
Lick observatory, Croker telescope, 6" Willard lens (August 1, 1889, 3h 7m exposure).

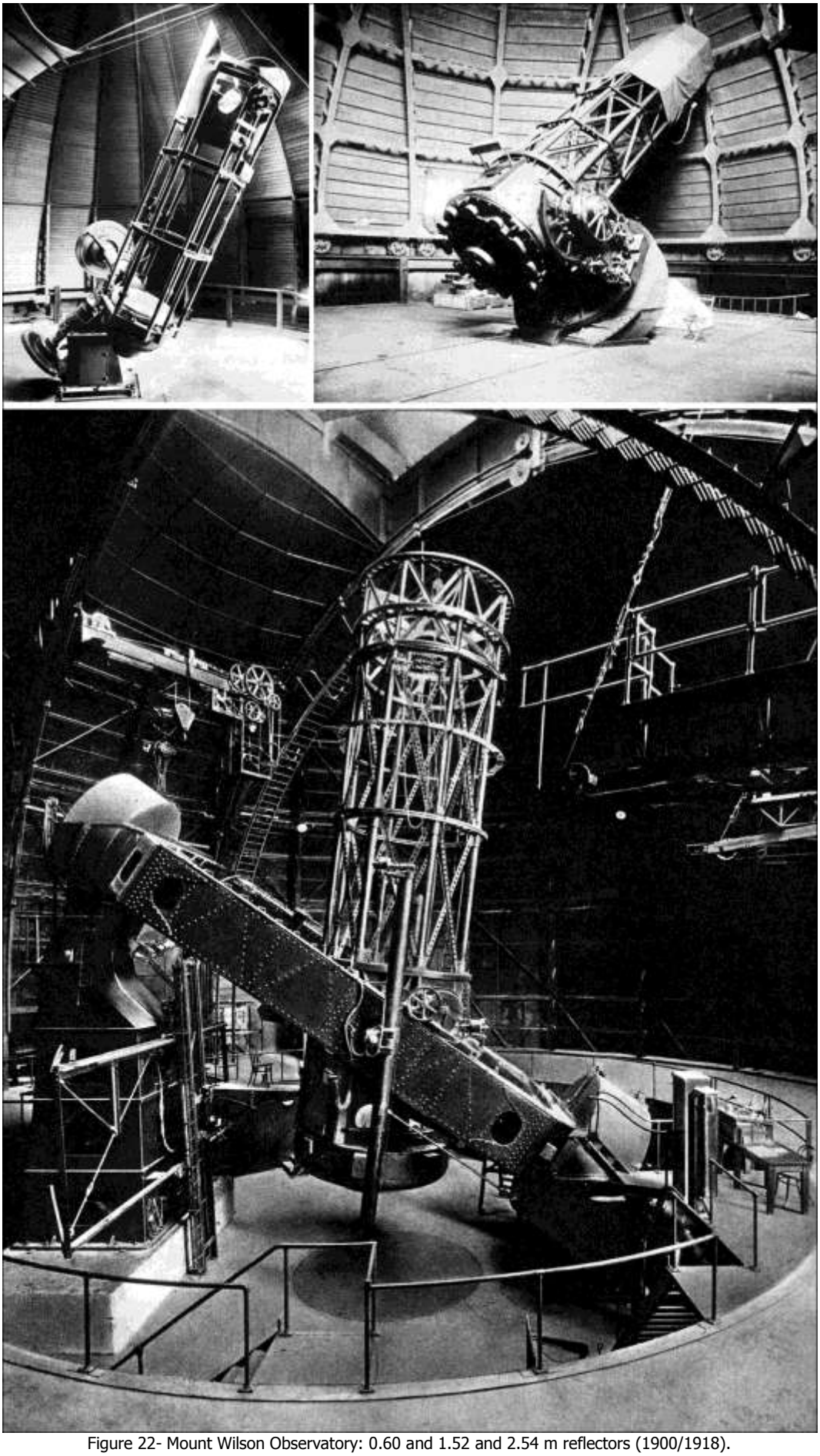

Figure 22- Mount Wilson Observatory: 0.60 and 1.52 and 2.54 m reflectors (1900/1918).

Figure 23- M 3. Image obtained by G. W. Ritchey on April 9, 1910, 1.52 m Mount Wilson reflector, 3 ½ h exposure.

Figure 24- M81. Image obtained by G. W. Ritchey on 1917, 1.52 m Mount Wilson reflector, 3 h exposure.

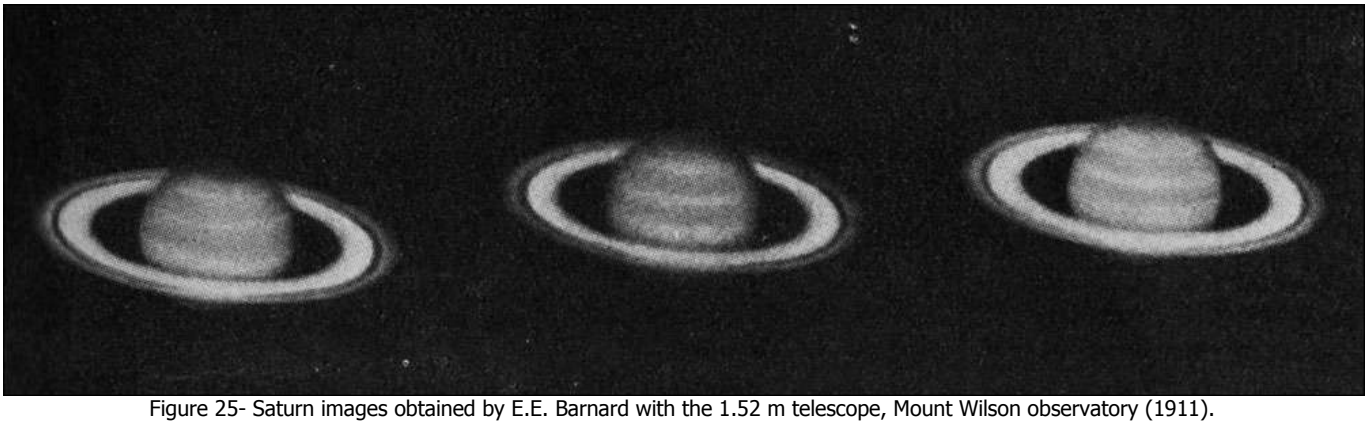

Figure 25- Saturn images obtained by E.E. Barnard with the 1.52 m telescope, Mount Wilson observatory (1911).

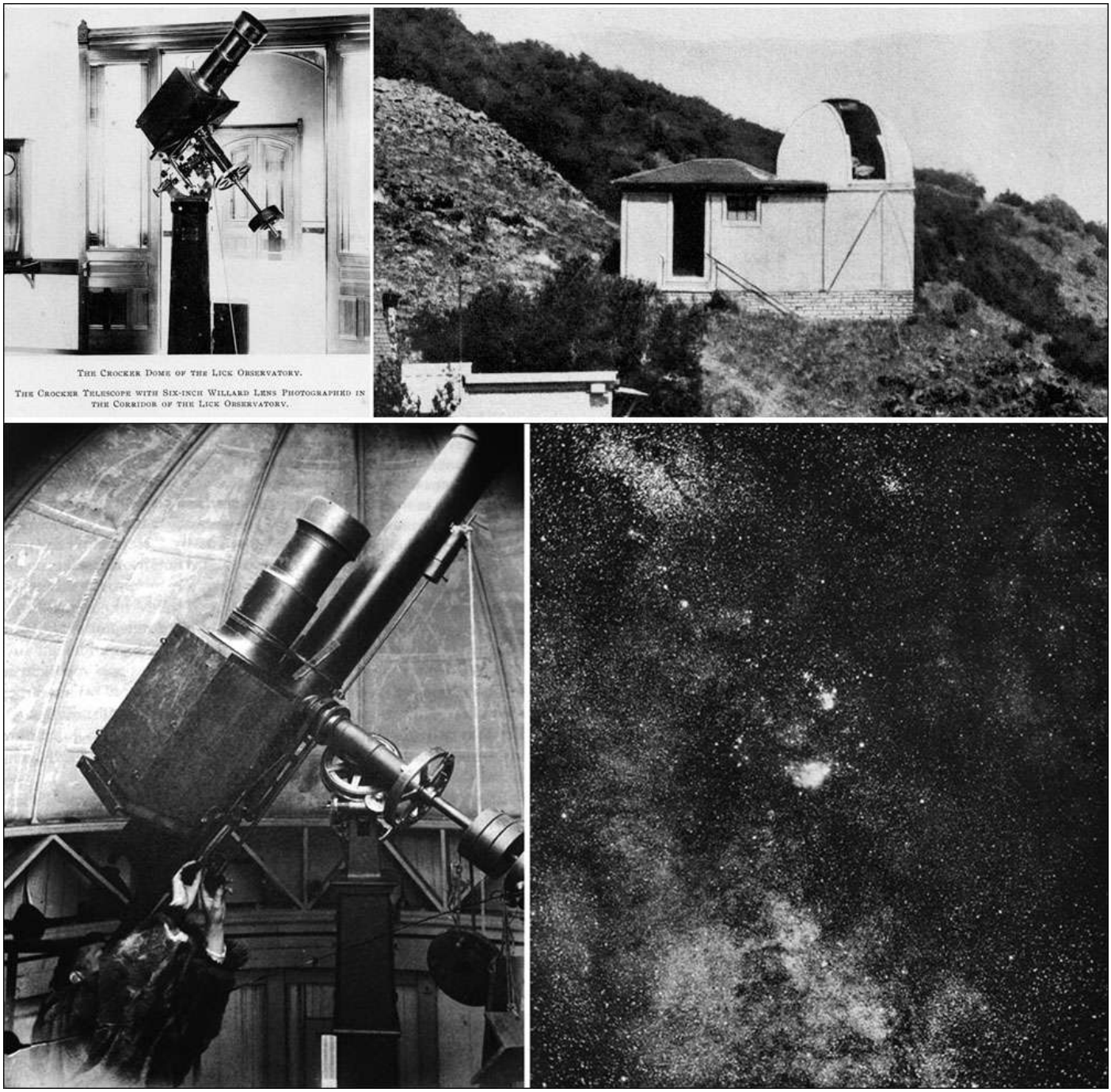

Figure 26- Crocker telescope and dome (Lick observatory). Plate 51 - Barnard, E.E. (1913). *Photographs of the Milky Way and of Comets*. Publications of Lick Observatory, vol. 11 (Below right).

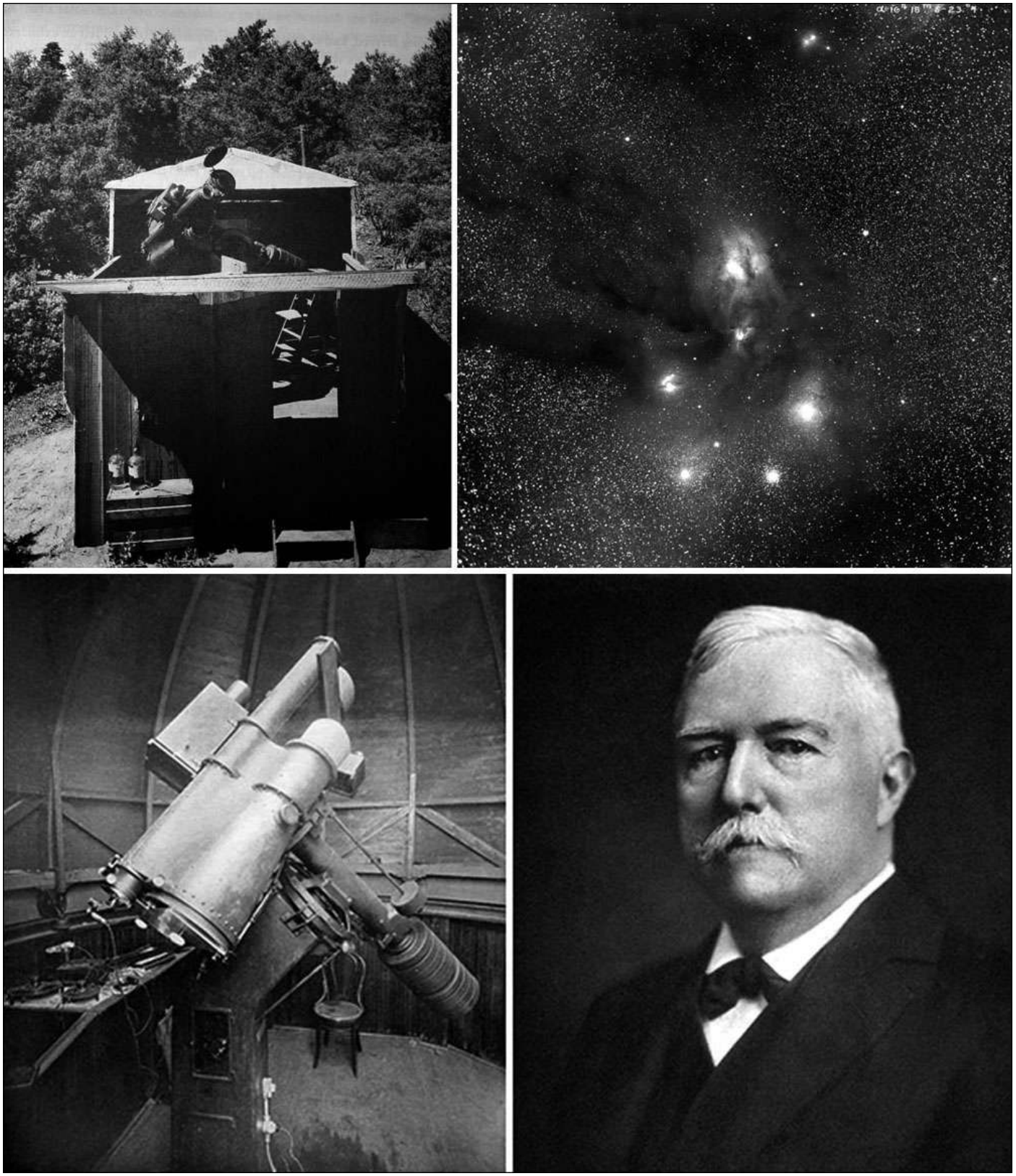

Figure 27- Bruce astrograph (Mount Wilson observatory) and Rho Ophiuchi region (4h30m exposure) (Top).
Bruce astrograph (Lick Observatory) and E.E. Barnard (1917) (Below).

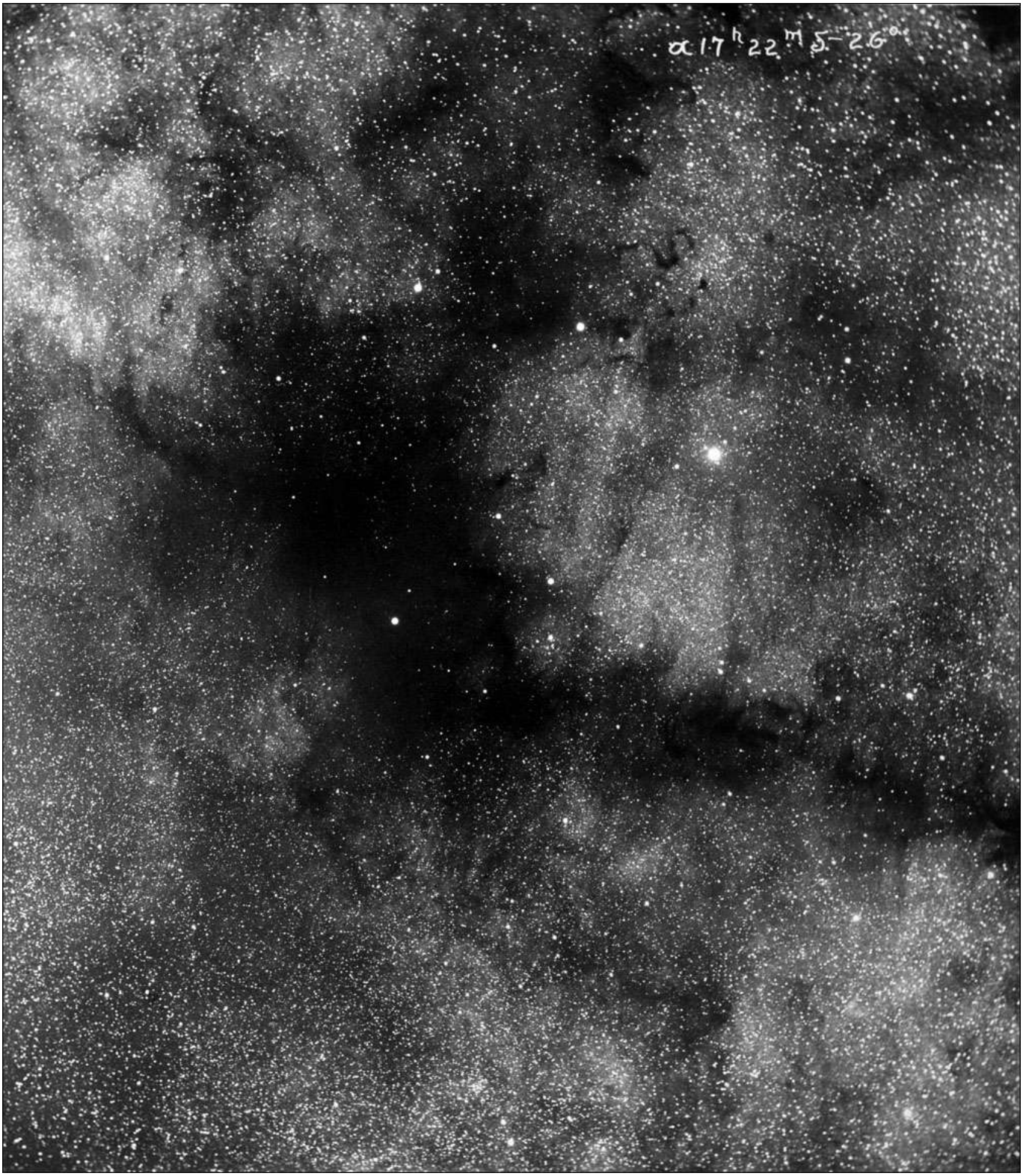

Figure 28- Milky way at Ophiucus. Image obtained by E.E. Barnard with the Bruce astrograph, 4h45min exposure, July 30, 1905 (Mount Wilson observatory).

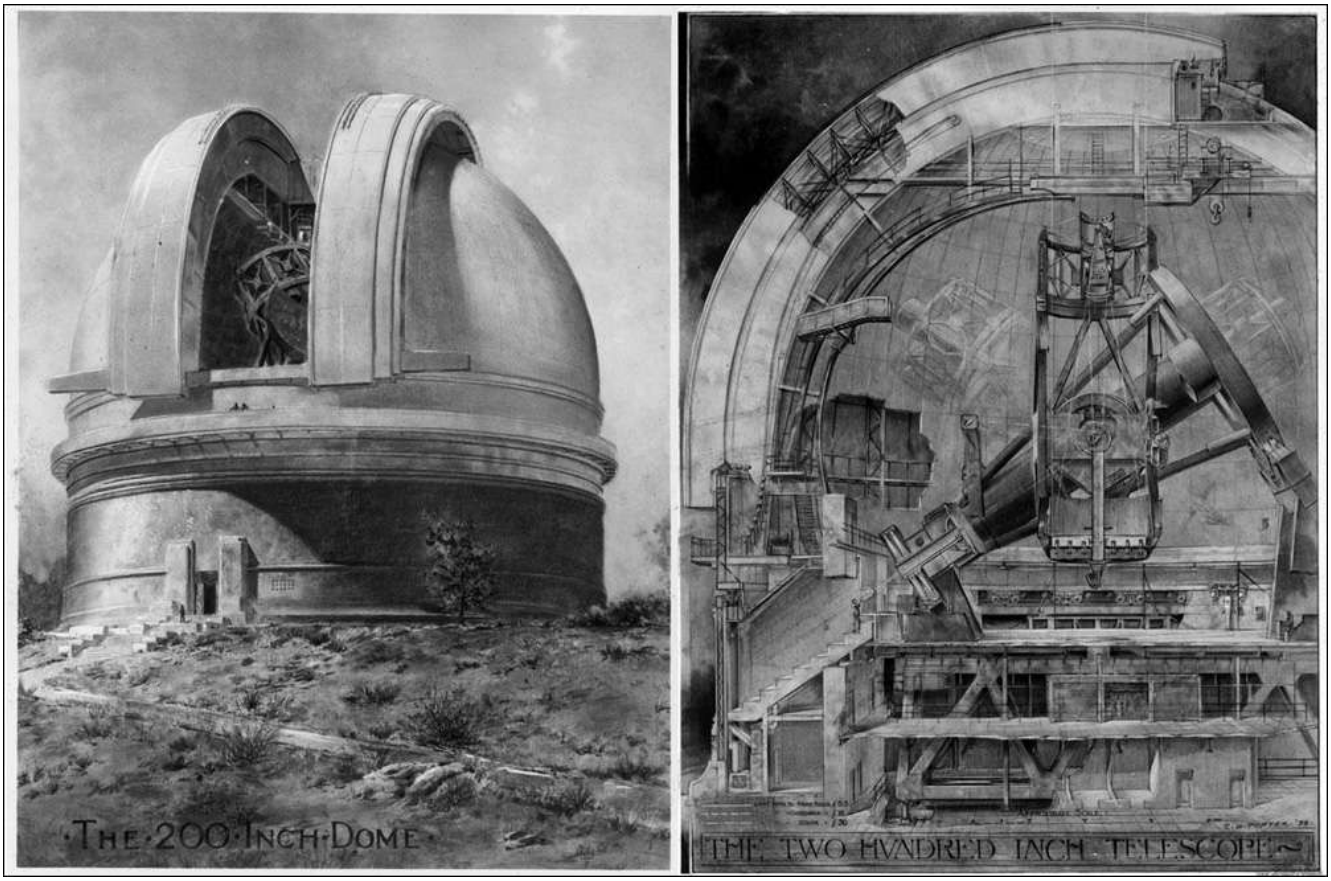

Figure 29- 200 inch (5.08 m) Hale telescope. Drawings by Russell W. Porter (1871-1949).

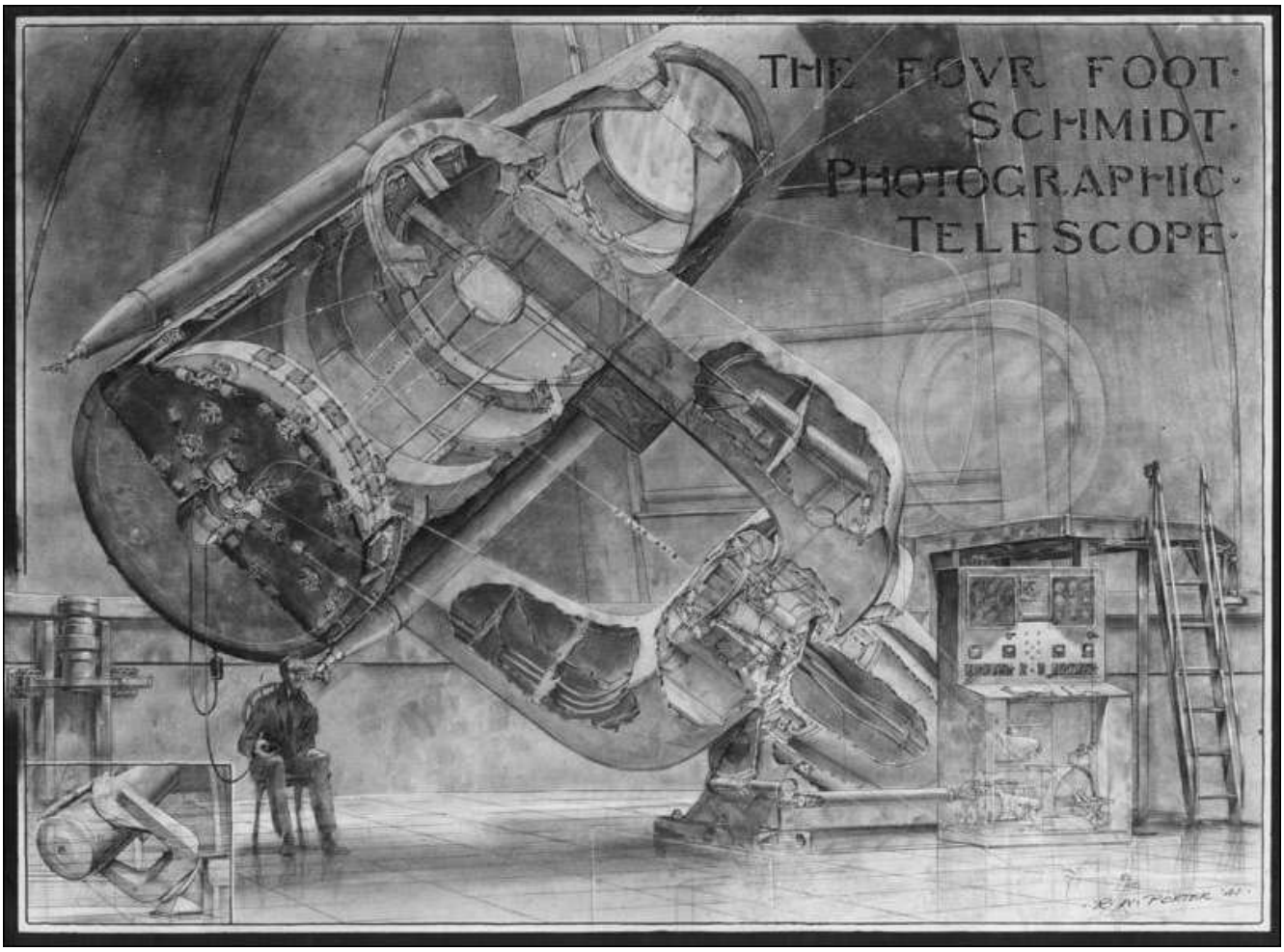

Figure 30- 48 inch (1.22 m) Samuel Oschin Schmidt telescope. Drawing by R. W. Porter.