WILLIAM LASSELL'S (1799-1880) TELESCOPES AND THE DISCOVERY OF TRITON

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William Lassell (1799-1880) (Figure 1) was born in Bolton in 1799. His family business was associated with clock and watch making. Lassell became an amateur astronomer and a telescope maker at an early age. With only 21 years he built two reflecting telescopes of 7-inch aperture, a Newtonian and a Gregorian. Soon after, a private observatory was built, housing a 9-inch Newtonian equatorial mounted telescope.

Lassell married a widow of a wealthy Liverpool brewer gaining at the same time financial independence. He founded his own brewery in 1825 and from it secured the fortune that permitted him to devote his entire time to building and using large telescopes of his own making. Lassell was well known for his exceptional mechanical skills. His mountings and speculum-mirrors were among the best during the early nineteen century. Lassell is also considered by some authors as the creator of the first modern big reflecting telescopes.

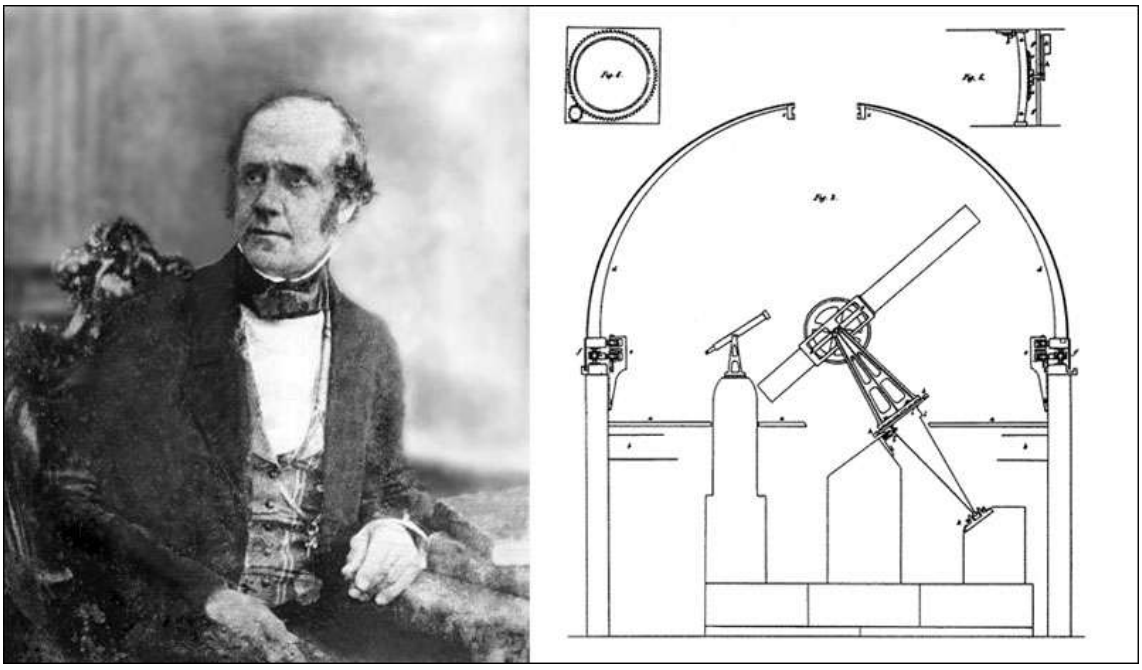

Figure 1- William Lassell and the 9-inch reflector.

His first mirrors were cast around 1820. In 1839 he described his 9-inch equatorial reflector to the Royal Astronomical Society. It was considered at the time as a big step forward. The tube and mount were built in cast iron. The speculum mirror had a focal length of 112 inches. The telescope was mounted in an iron box that was bolted upon an iron cone (Figure 1). Ball-bearings were used in all the moving parts of the mount. Lassell claimed that the motions were perfect and that the whole telescope could be easily moved with the pressure of a finger. Lassell used this telescope mainly for the observation of the planets.

In 1843 he decided to build a 24-inch reflector. This instrument was an enlarged version of the 9-inch (Lassell never published a detailed drawing if this instrument). A steam-driven machine

was built for grinding and polishing the 24-inch speculum mirror. The instrument was completed in 1845 (Figure 2). The original speculum mirror weighting 168 kg was made of a special alloy of copper and tin (with small quantities of arsenic). The *f*/10 mirror was installed in a 6 m long tube made of thick sheet iron. The tube was riveted internally and could be rotated for the comfort of the observer (Newtonian focus). When the tube was on the vertical position the height of the whole instrument was close to 9 m. The secondary mirror was also made of speculum. Lassell sometimes used a prism instead of the secondary mirror that was heated (to prevent due) by placing a hot iron cube wrapped in felt in a special holder close to it.

The overall weight of the telescope was over 2 tons. The equatorial mount rested in two stone piers that weighted 6 tons. This innovative telescope was the first big reflector mounted on an equatorial mount. There was no clock-drive, the telescope was driven by means of a winch handle operated by an assistant. This telescope was completely restored in 1996. The Lassell telescope project started in 1995 and the fully restored telescope was presented to the public by the Liverpool Museum, on October 10, 1996.

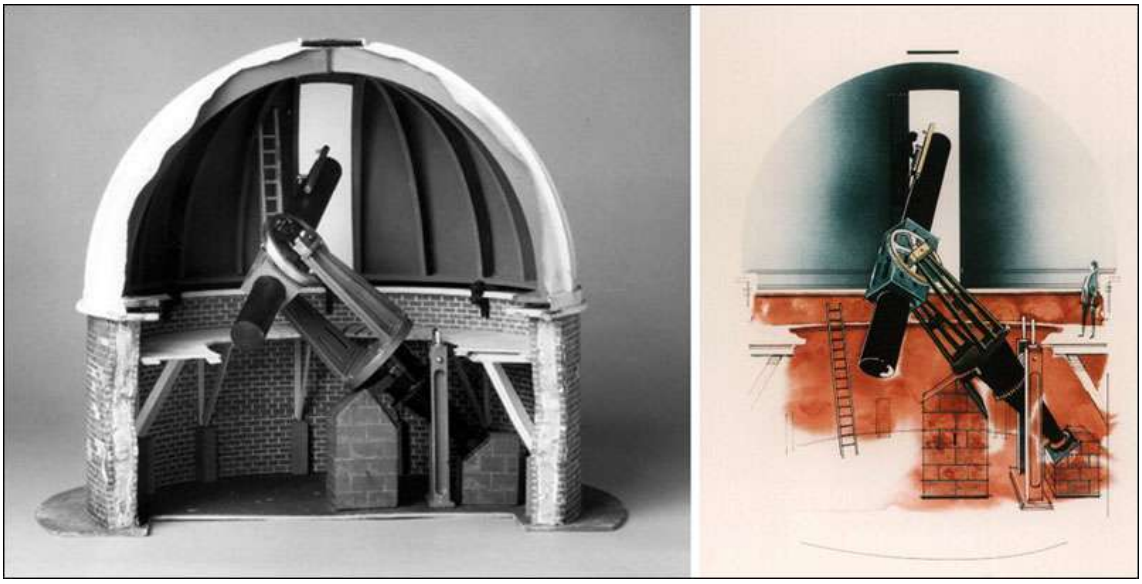

Figure 2- Model and artist's impression of the 24-inch Lassell reflector telescope.

Before building the 24-inch, Lassell visited Parsonstown were he inspected the erection of the Leviathan and Lord Rosse's workshops and instruments. Lassell invented a curved-stroke machine to grind and polish his speculum mirrors. This machine was different from the straight-stroke machines devised by Lord Rosse. He also cooperated with James Nasmyth (1808-1890) who was a gifted mechanical engineer and amateur astronomer. Nasmyth extensive foundry experience was invaluable to Lassell and his telescope making projects.

Lassel discovered Triton, the brightest satellite of Neptune, with the 24-inch reflector. The Planet Neptune itself was founded on September 23, 1846. The Triton discovery was made soon after, on October 10, 1846. The first observations made by Lassell on October 2 and 3, enabled him to see a clear disk. He was also convinced that the planet had a ring similar to what can be observed in Saturn. Two years later he discovered Hyperion, the eight satellite of Saturn.

In 1852, the 24-inch was moved to the isle of Malta in the Mediterranean. There, during the winter season, and under clear skies, Lassell was able to observe clearly four satellites of Uranus.

At this point, Lassell undertook the building of a 48-inch reflector. The telescope was first erected in Liverpool on the grounds of his villa. The 48-inch *f*/9.4 speculum mirror had a 11.1 m open tube made of flat iron bars. It was mounted as a Newtonian. The author described this instrument in considerable detail (Memoirs of the *Royal Astronomical Society*, 36, 1867):

There is no roof or covering over the telescope, but the observers are protected by being placed in one or other of the storeys of a tower, which affords a means of getting conveniently at the eyepiece, which, when the telescope points to the zenith, is about 39 feet from the ground. A staircase within the tower leads to the different storeys, which are about 4 feet and 6 inches square, and afford abundant room for papers, micrometers, eyepieces, lamps, and other small apparatus required; beside furnishing to the observer a most grateful shelter from the dew, and occasionally from the inclement wind. During observation, however the size of the storey in use becomes practically much larger, by the opening of the folding doors and letting down the platform, as shown in the engraving (Figure 3); the available space being then about 6 feet 9 by 4 feet and 6 inches. The tower is carried round on a circular railway, and has besides, a revolution on its axis, and a radial motion to and from the telescope: so that at most altitudes and hour-angles the eyepiece is easily accessible. It has been usual, however, for the most obvious reasons, to observe within three hours of the meridian, east or west.

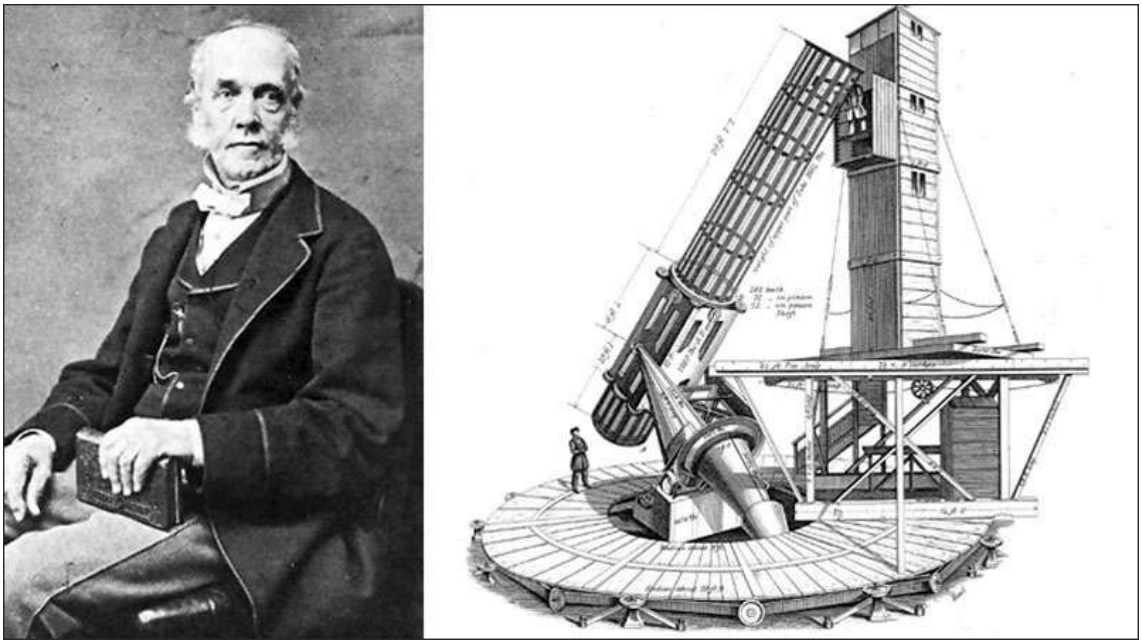

Figure 3- William Lassel and the 48-inch reflector (Memoirs of the *Royal Astronomical Society*, 36, 1867).

The 48-inch mount had no driving clock. It was moved through a gear train with the help of an assistant, that turned the crank once each second in synchronism with a clock. A star or planet could, with this primitive arrangement, be kept within the field of view for several hours (the moving parts of the whole telescope weighted more than eight tons).

With this telescope, Lassell observed mainly nebulae. At the time, it was the largest telescope in England. Several drawings were published: Dumbell nebula in Vulpecula (M27); Ring nebula

in Lyra (M57); Crab nebula in Taurus (M1) and M88 in Coma Berenices (Memoirs of the *Royal Astronomical Society*, 36, 1867). Lassell regarded these drawings as accurate representations of these objects. In the case of M27 Lassell mentioned that the nebula could not be resolved into stars and that the stars in the field were not connected to the nebula "*the sky around is quite as full of stars as the space occupied by the nebula*" (Figure 4).

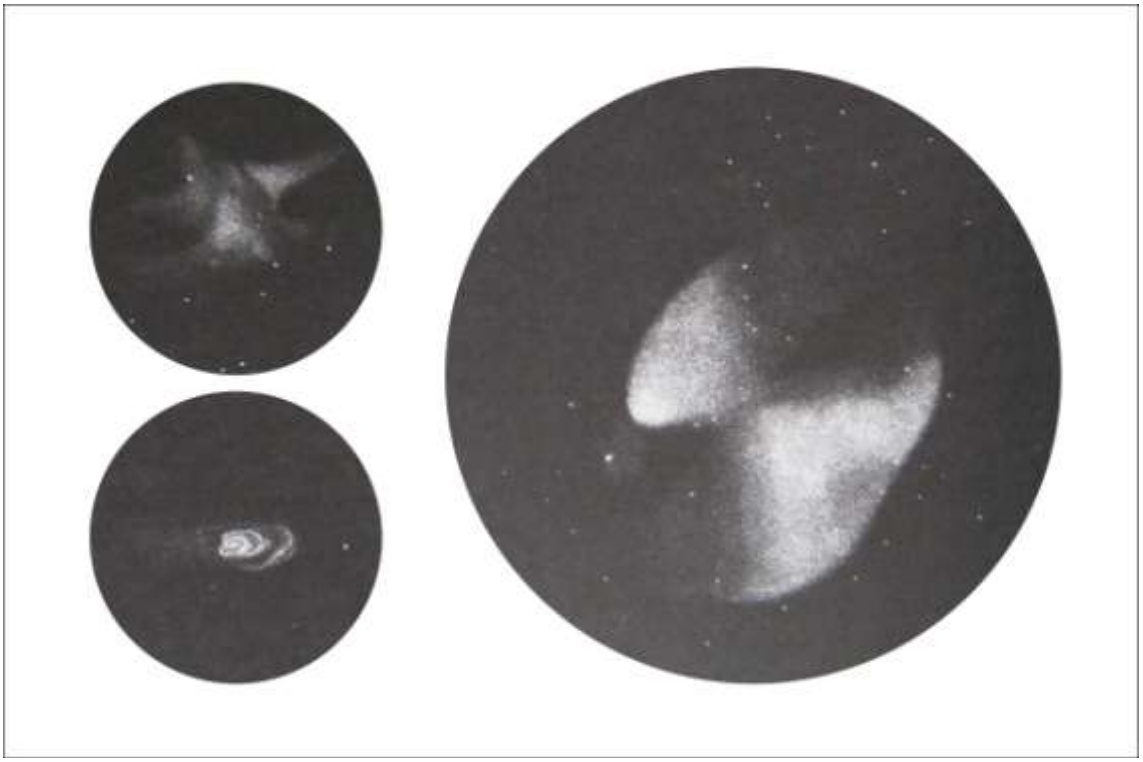

Figure 4- Drawings of several nebulae made by William Lassell with the 48-inch telescope in Malta: upper left M1; below M88; right M27 (Memoirs of the *Royal Astronomical Society*, 36, 1867).

In 1861 the 48-inch was moved to Malta. During a period of four years a huge number of observations were performed: measurements of faint planet satellites; bright nebula; planetary surfaces (…)

A number of nebulae were recognized as spirals with the 48-inch. A catalogue of previously unknown nebulae was complied under the clear skies of Malta. Most of these observations were done by Lassell's assistant Albert Marth (1828-1897). Marth was a hardworking German astronomer that never received adequate recognition for his important contributions to astronomy.

Lassell returned to England in 1865 but 48-inch was never re-erected. It was sold as scrap metal shortly before his death in 1880. He wrote "(…) *when witnessing the breaking up of the speculum I was not without a pang or two on hearing the heavy blows of sledge-hammers necessary to overcome the firmness of the alloy*".

Sources:

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- Glass, I.S. (1997). *Victorian Telescope Makers: The Lives & Letters of Thomas & Howard Grubb*. Institute of Physics Publishing, London
- King, H.C. (1955). *The History of the Telescope*. Dover Publications, Inc. New York.