

The Sunset Gazette

Serving the Tri-Cities since 1975

Volume 10, Issue 3

November, 2012



Meeting information

Meetings are generally in the theater in the Delta College Planetarium in Bay City. The meetings will usually be on the 2nd Friday of each month at 7:00 PM. Watch the newsletter for changes in dates and times. Membership is not required to participate in meetings and activities. See last Page for this month's meeting site.

Membership Information

Our club has switched to e-mailing our newsletters. For those wishing to receive a hard copy mailed an additional dues of \$10.00 per year is required.

New Membership Rates:

5\$ per Year

Treasurer's address for renewals and subscriptions:

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Astronomy at Birr Castle

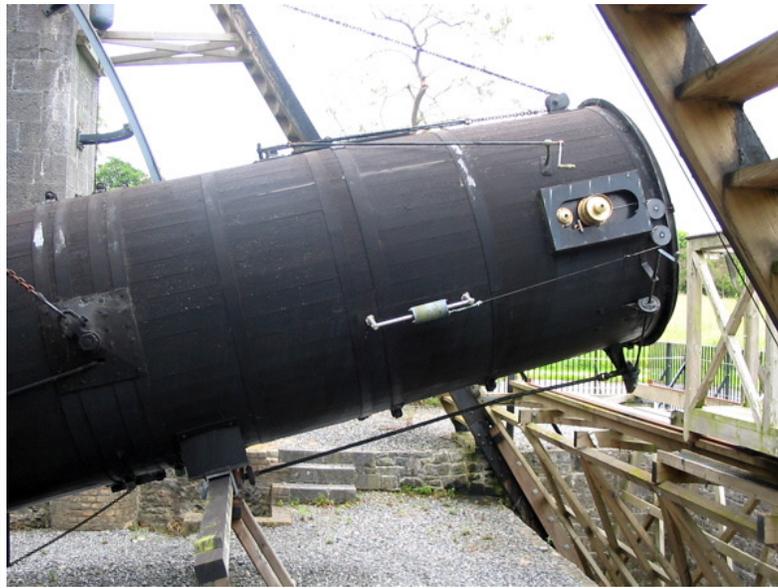
This new series tells the story about the astronomy undertaken at Birr castle in Ireland which started in 1827 and led to the construction of the largest telescope of its time, the great 72" Birr reflector who for more than 70 years was unsurpassed in its size (the 100 inches (2.5 m) Hooker telescope on Mount Wilson was going into operation in 1917). Unlike modern state of the art telescopes which involve many hundred people to make the great Birr reflector really was the brain child of one man: the third Earl of Rosse who solely imitative and money led to the construction of the most powerful telescope the world had known and who used it to make astronomical discoveries of fundamental importance. But it did not stop there: after his death, his son the fourth Earl of Rosse continued the work so that Birr became a major scientific center and only in the early 20th century the story came to an end and the telescope was dismantled.



Birr castle (Irish: *Caisleán Bhiorra*) is a large castle in the town of Birr in County Offaly, Ireland (see picture above).

Today the restored telescope can be visited by the public and the photos give a good impression about its size and how it was operated. (see picture on the right and the next page).





The story of the development of the great Birr reflector cannot be complete without one other name: Sir William Herschel, probably the greatest visual observer of all time. He died in 1822 so his career did not overlap with that of the third Earl of Rosse who started his first experiments in telescope making as early as 1827. Apart from being a superior observer spending all clear nights behind the eyepiece of his telescopes, Herschel was also a magnificent instrument maker. Born in Hannover William Herschel came to England as a young man to work as a musician. In the 1770s he became interested in astronomy and started to make telescope mirrors. It took nearly 200 attempts to cast and polish a mirror which was good

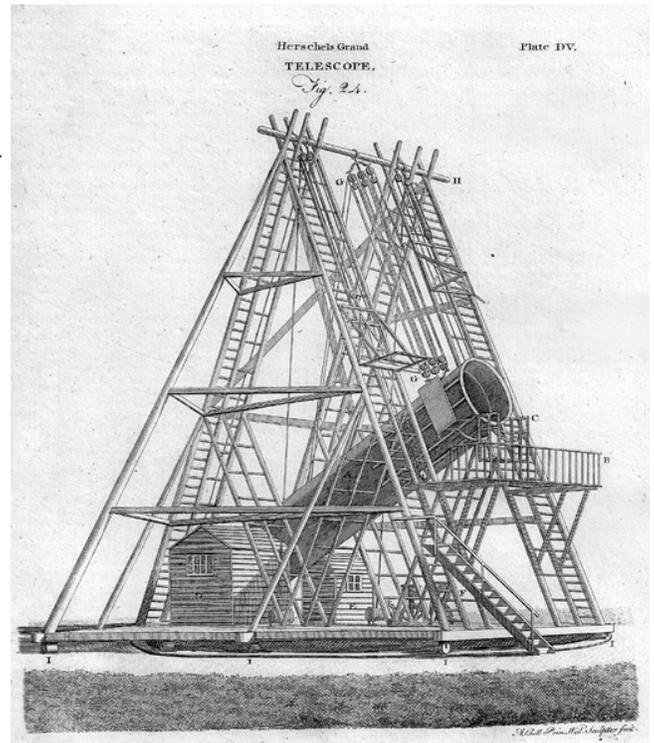
enough but he finally succeeded. In 1781 he became famous for discovering a new planet, now called Uranus. He was using a modest telescope of his own construction and had been carrying out a systematic review of the heavens, when in the constellation of Gemini he discovered an object which was not a star but showed a perceptible disk. Herschel first thought he discovered a comet but when he studied his movements it soon proved to be a planet further away from the Sun than Saturn. In one moment the size of the solar system with its original 5 planets (Mercury, Venus, Mars, Jupiter, and Saturn) known from ancient times had suddenly doubled! Given his systematic search it would do Herschel injustice to call it a sheer chance discovery because as Herschel himself wrote, if he had not found it that night 'he must have found it the next'. It was a life changing discovery because a generous yearly grant from George III, King of England, enabled him to give up his career as musician and solely devote himself to astronomy and to building ever larger telescopes. Naturally this would be a reflecting telescope rather than a refractor because at that time the manufacturing of optical grade glass was still in its infancy. The achromatic refracting lens was invented in 1733 by Chester Moore Hall but was also independently invented and patented by John Dollond around 1758. Till then very long focal lengths in refracting telescopes were needed to overcome and limit the effects of chromatic and spherical aberration. The achromatic lens improved on these designs by using an objective made of two pieces of glass with different dispersion, "crown" and "flint glass". Later Joseph Fraunhofer would revolutionize the way optical grade glass was made and polished. Still refractors were difficult to build, small in size (4—5 " would be regarded as large to very large) and forbiddingly expensive. Much easier to build and scale up in size was the reflecting telescope. Isaac Newton designed the first one about 1669. The advantages were clear: mirrors reflect all colors equally and can be supported on the back unlike a lens, which has to be supported round its edge and will distort under its own weight when it becomes too large and heavy. Also the light does not have to pass through the mirror so its optical quality regarding bubbles and other artifacts are not as tight as for a refractor lens. Modern mirrors are made of glass or glass ceramic with a thin layer of aluminum or silver but in Herschel's time and up to the second half of the 19th century a material named speculum metal was used instead. In 1783 Herschel finished a 20 foot reflector (20 feet focal length) and immediately thought of building a larger telescope (yes, aperture fever was born around that time!). The next telescope had to have a focal length of 40 feet and a diameter of 49" ($f = 9.8$) and a royal grant of £4000 was given for the purpose. The construction of the instrument did not go smoothly: the mounting was heavy and cumbersome and the first mirror (1787) proved to be optical faulty.

The second mirror cracked during cooling and had to be recast—finally with success. First light was on 28 August 1789 when Herschel looked at Saturn. In the same year he discovered the Saturn moons Mimas and Enceladus.

The 49" reflector was a major scientific and technological undertaking given that over 40 workmen had been employed on it and it took years to build, always under the supervision of William Herschel. The telescope was not Herschel's primary observing instrument because it proved to be quite cumbersome to use. The observer had to be raised to the top of the tube in order to reach the eyepiece via a system of ladders up to the main gallery (see picture to the left, source Wikipedia). The big 49" was last time used several years before the death of William Herschel in 1822 and in 1838 Sir John Herschel, his son, decided that the mounting had become unsafe and the telescope was taken down the following year.

When the third Earl of Rosse started to build his first large reflector its mounting design very much resembled that of the large 49" reflector. Also like Herschel, Lord Rosse shared the same interest in nebula — in connection with which Lord Rosse would make his greatest discoveries. When Lord Rosse planned

his first telescope around 1828 refractors were actually quite fashionable, mainly because of the superb object glass made by Joseph Fraunhofer, but English glass making was still in a backward state. Also he disagreed with those who declared the refractor was now the superior design and had superseded the reflector. In his opinion there were greater possibilities in the reflecting type and decided to try his hand at mirror making. As mentioned back then mirrors were not made of glass because casting a really large glass disk of the required quality was completely out of question in the 1820s. The only alternative were mirrors made out of metal. The material was called speculum metal and consisted of an alloy of copper and tin. Like today the difficulties increased with size: Casting was a major problem and so was the grinding of the curve to the correct optical shape. In addition optical workers tended to keep their secrets of casting, grinding and polishing to themselves—very unlike to Lord Rosse's own attitude who had the opinion that all scientific progress had to be published and shared with everyone. So with the help of a carpenter, a blacksmith and some farm workers he enlisted from the Birr estate he began experiments on casting mirrors. This included building a forge and testing a variety of different alloys and finally settled on mixture of copper and tin mixed in proportion of 4 to 1. The next problem was the grinding of the mirror: the basic principle is to rub two discs together and with regular strokes on disc will become concave (the mirror) while the other (the tool) will become convex. This can be quite laborious especially on really large mirrors, so Lord Rosse developed a steam driven apparatus in which 'the speculum was made to revolve very slowly, while the polishing tool was drawn backwards and forwards by one eccentric or crank, and from one side to another'. Despite many failures, delays and disappointments Lord Rosse finally felt ready to begin work upon a really large telescope with 36" in diameter, the largest since the now dismantled 49" reflector and the predecessor of the giant 72" Birr reflector.



Next time in the SAS newsletter: The giant 72" Birr reflector

SUNSET ASTRONOMICAL SOCIETY
THE SUNSET GAZETTE
SERVING THE TRI- CITIES SINCE 1975



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This issue can be accessed in color on the website of the SAS!!!

<http://www.sunsetastronomicalsociety.com>

SAS Meeting

Start: 7:00 PM

Friday, Nov 9th, 2012

Delta Planetarium

Welcome members and guests

New and old business

Club Business

Treasure report

Refreshments Break

Presentation:

TBD

**If clear we will observe on
the observation deck.**

What's up in the Sky

Nov 4: Daylight saving time ends at 2 a.m. for most of U.S. and Canada.

Nov 7: First Quarter Moon

Nov 11 Dawn: Venus shines very bright to the left of the waning crescent Moon.

Nov 12 Dawn: Watch out for Saturn to the lower left of the thin waning crescent Moon very low in the east-southeast ca one hour before sunset. Binoculars recommended!

Nov 13 : New Moon

Nov 15,16 Dusk: Dim Mars is passed by the waxing crescent Moon low in the southwest.

Nov 17 Predawn: Look out for the Leonid shower which should be strongest (ca 20 meteors per hour under a dark sky) in the early hours until the sky starts to brighten. No Moon!

Nov 20: Third Quarter Moon

Nov 27,27 Dawn: Venus and Saturn are only 1 deg apart, with Mercury to their lower left.

Nov 27 - Dec 12 Dawn: Best time to watch out for Mercury. Mercury rises

more than an hour before the Sun and can be easily located in the east-southeast 6-10 deg lower left of the very bright Venus.

Nov 28 Predawn: The Moon has a penumbral eclipse visible from western North America

Nov 28 Evening: Jupiter is very close to the upper left of the just-past-full Moon.

Nov 28: Full Moon

Dec 2,3 All Night: Jupiter is visible all night and at its brightest and biggest in the telescope!

UPCOMING EVENTS