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Giant mirror of Birr

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My interest in infrared, visible and ultraviolet reflection and emission from the moon led me into a search of the literature for papers on the subject. I have strong evidence that moon radiation in the visible and uv pumps certain nonlinear infrared emissions from the sex scents (pheromones) of night flying moths.[1,2] I was surprised to learn that the first published measurements of the moon's surface temperature were accomplished in 1869 by Lord Oxmantown at Birr Castle, Ireland.[3] I had always assumed that S. P. Langley at the Smithsonian observatory had made the first measurements in 1885.[4]

Lord Oxmantown, who later became the fourth Earl of Rosse, was the son of the third Earl of Rosse, the optical genius who built the giant 72-in. reflecting telescope (see sketch on page 1429 of the July 1973 issue of this journal (volume 12) and discovered the first spiral galaxy (the Whirlpool Nebula, M51) in 1845; see Figs. 5 and 6.

Fig. 1. Statue of the third Earl of Rosse in the town square of Birr, Ireland.

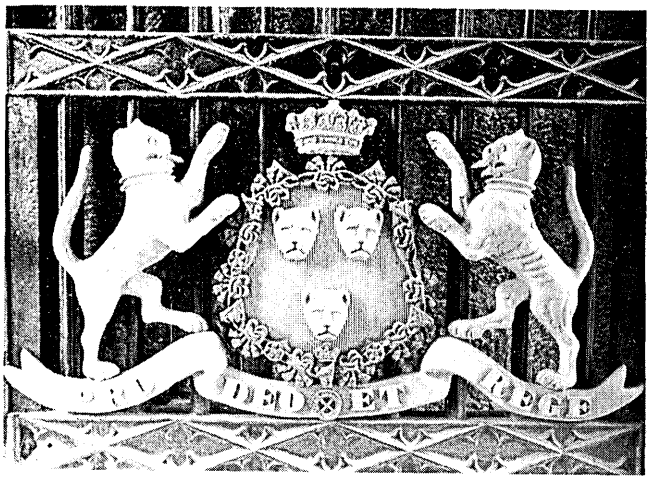

Fig. 2. The coat of arms on the gate of Birr castle. The Countess of Rosse helped cast the giant 72-in. mirror for the telescope. She was a competent sculptor who designed and cast the castle gates and coat of arms.

During a long stay, and on many visits to Ireland, I had heard rumors of a giant telescope but never knew where it was located until I stumbled on Lord Oxmantown's temperature studies. Father Flannan Walsh of Gainesville, Florida, who is from County Offaly, Ireland, told me that he believed part of the remains of the great telescope were still at the Birr Castle demesne in County Offaly.

Ireland is called the land of saints and scholars, but in the minds of most the scholars are literary not scientific. In fact, it is irritating to hear the often repeated remark, sometimes even parroted by the Irish, that Ireland never produced any renowned scientists. Since I was in Ireland gathering data and photographs for a book on science and agriculture in that country we decided to drive to Birr to find out about the present status of the little-known telescope. The photographs in this paper are the results of that visit. Figures 3, 5, and 6 are reproduced with the permission of the present Lord Oxmantown. He is the heir apparent to Birr Castle and the title.

Birr is a pleasant village located on the central plain of Ireland, originally called Parsonstown after the Parsons family who came to Ireland from England in 1590. William, the elder Parsons, was made Commissioner of Plantations and Surveyor General of Ireland and created a barone1620. His younger brother Laurence became Attorney General of Munster and was knighted in 1612. He acquired the land on which the present castle is located. The castle and surrounding lands had previously been in the possession of the O'Carroll family. The township eventually passed to the second Earl of Rosse (a Parsons) who entered the Irish House of Commons in 1782. The second Earl favored complete independence of Ireland from England; he was a dedicated opponent of the Act of

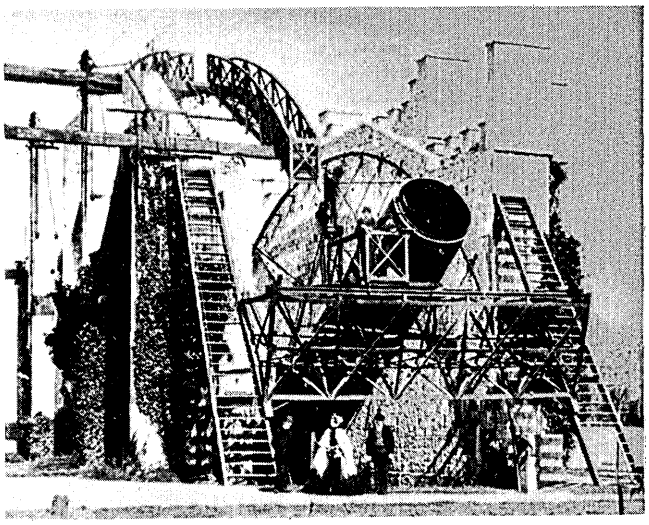

Fig. 3. An 1845 photograph of the 72-in. reflecting telescope at Birr castle.

Union between Great Britain and Ireland. The third Earl of Rosse, the eldest of his three sons, succeeeded to the title in 1841. It was he who designed and built the first giant telescope and 72-in. mirror. During the second Earl's life time, Lord Oxmantown, soon to become the third Earl, had also built a 36-in. reflector telescope on the lawn in front of the Castle.

An account of the Rosse telescopes and the adversities of the Rosse family during the Irish Troubles is documented in a delightful little book by Patrick Moor, the Irish astronomer.[5] He states in the chapter on the castle: *Many accounts of it have been written, but on the whole it seems that the two astronomer-Earls have never received sufficient praise for what they achieved.* The construction of the 72-in. mirror and discovery of spiral galaxies by the father and the subsequent first accurate measurements of the temperature of the moon from earth by the son are indeed optical accomplishments deserving of recognition. It is applied optics at its best.

The present Lord Oxmantown accompanied us to the remains of the telescope. Located in the demesne a short distance from the castle, the walkway to the huge supporting walls of the telescope is through beautiful gardens. The river walk, garden, terraces, and park have been developed and greatly extended by the present Earl and Countess.[6] It is a beautiful setting for one of science's great optical accomplishments.

The 72-in. telescope has been called the Leviathon of Parsonstown. The light collecting power of this mirror allowed man to see further into space than ever before.

The first trials with the 72-in. speculum occurred in 1845. Messier 51, the Whirlpool Nebula, was described and drawn in that year. In 1846 a second spiral galaxy Messier 99 was discovered and drawn. By 1848 observations were taking place on a regular basis, and by 1850, fourteen separate spirals were discovered. The third Earl died in 1867, and the same year the fourth Earl made his first attempts to measure the temperature of the moon with his father's smaller 36-in. telescope.

The third Earl began his experiments in 1827, and the mirror was cast on the castle grounds by local craftsmen. In those days large specula had to be cast from metal containing the proper amount of tin. Since the metal was very brittle there were endless failures before Rosse and his Irish workmen succeeded. The mirror was so large that it had to be cast from three separate crucibles. More than 2000 cubic feet of turf (peat) were utilized to fuel a single crucible. When the furnace was not in use by the telescope makers, Lady Rosse utilized it to sculpt and cast the castle gates (Fig. 2). She was also a pioneer photographer and one of the founders of the Irish Photographic Society—a remarkable lady in her own right.

Lord Oxmantown showed us the furnace in the castle moat where the casting was accomplished. The speculum was polished at the base of a tall tower adjoining the castle. It was placed at the base of the tower and polished until the face of a watch, attached to a flagstaff at the top, reflected with high enough resolution to read the numbers. Sometimes the page of a newspaper was utilized for the job.

Most of the work on the telescope was completed by 1845, and it was officially dedicated at a ceremony where Dean Peacock of the Church of Ireland walked through the length of the barrel carrying an umbrella over his head to demonstrate the size of the tube. Unfortunately, the great famine struck Ireland that year so the telescope was not used regularly until 1848 when the hardships of the famine abated. At that time the speculum had to be removed and polished again as the weather had deteriorated the surface.

The fourth Earl was a competent mechanical engineer and developed tracking drives for both the 72-in. and 36-in. telescopes. He mounted his drive on the 72-in. in 1869. In a

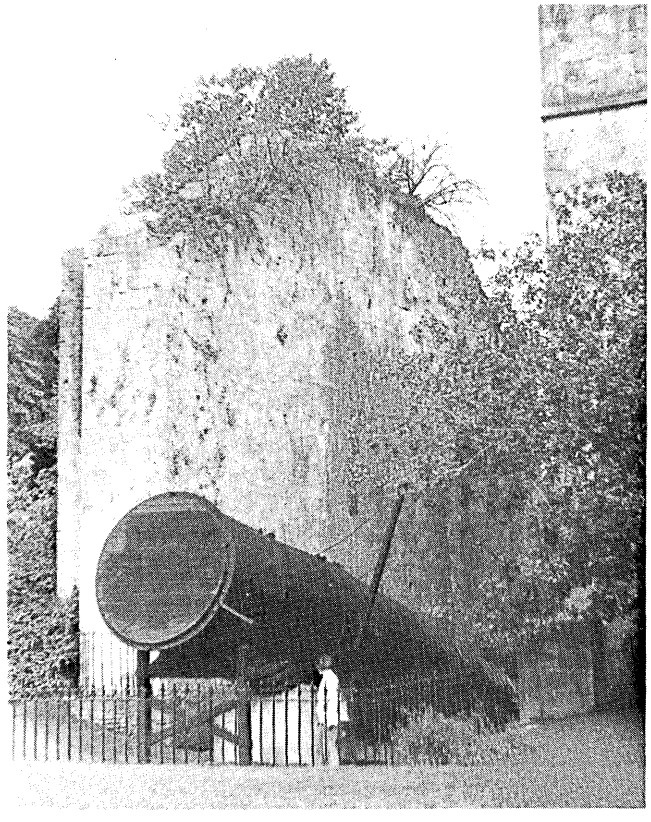

Fig. 4. The author's wife stands in front of the great telescope. The remains include the supporting walls and giant wooden barrel. The original 72-in. mirror is preserved in the Science Museum in London.

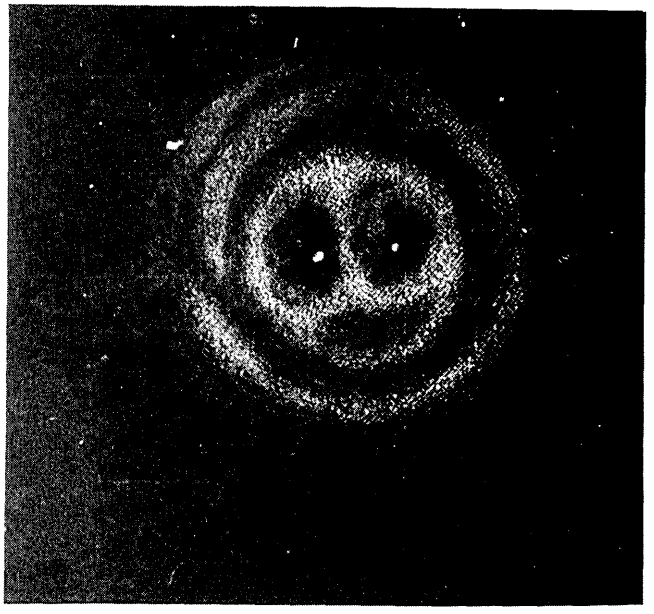

Fig. 5. Rosse's original drawing of the owl Nebula in Ursa Major.

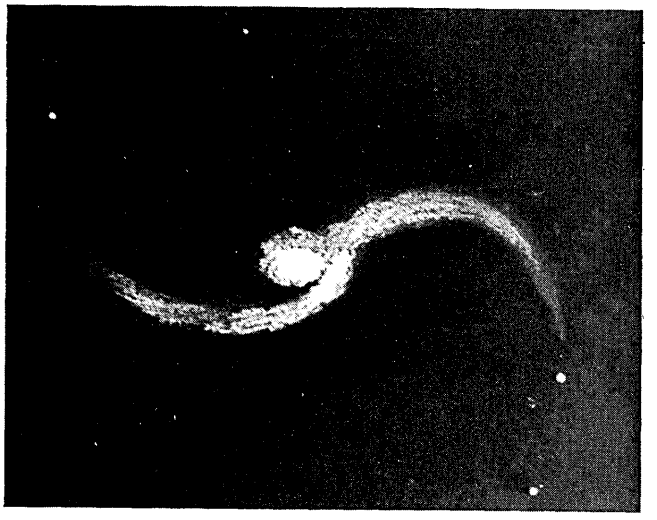

Fig. 6. Original drawing of M1061 Spiral Nebula.

paper on the Great Nebula in Orion (1867)[3] Oxmantown discussed the results obtained with his spectroscopic equipment. He was well aware of the impact the new science of spectroscopy would have on astronomy.

Since he had difficulty mounting his spectroscope in the 72-in. telescope he reverted to using the original 36-in. unit built by his father. The tracking drive he developed for the 36-in. was extremely efficient. His temperature graphs were also accurate. However, Rosse's measurements were rejected on the basis of the work by Langley in 1885.[4] Langley concluded that the moon's surface never rose above the temperature of freezing water. In 1939 Pettit and Nicholson measured temperatures from −110°F to +150°F at Mount Wilson observatory.[7] In 1930 Walter Goodacre, Director of the Lunar Section of the British Astronomical Association, stated that Langley's results were better than Rosse's, but as time passed and techniques were perfected, it became obvious that the measurements of the fourth Earl were correct and Langley's results wrong. The results of the work of Pettit and Nicholson agreed very well with Rosse's early results.

The 72-in. telescope was used intermittently until 1908 when the fourth Earl died. At that time the huge instrument was dismantled, and in 1912 the speculum was sent to London's Science Museum. All that remains at the site is the 56-ft long, 7-ft wide barrel and supporting walls (Fig. 4).

Lovell[5] has pointed out that the 72-in. telescope is a monument to the Earl's skill in engineering and optics and that a drawing made by Rosse of the Nebula, Canes Venatics, ten million light years away, is of far greater clarity and shows the spiral form better than a photograph taken a century later with the 200-in. telescope at Mount Palomar. The Birr mirror was to remain the undisputed collector of cosmic light for over half a century. The accomplishments of the Irish Rosses of Birr should cause us to reflect on the genius of these early scientists who designed, built, and researched their optics by themselves with no help whatsoever from great institutions.

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Patents see facing page

4,016,427 5 Apr. 1977 (Cl. 307–88.3)

Apparatus for producing efficient second harmonic generation and frequency mixing.

A. SZILAGYI, A. HORDVIK, and H. R. SCHLOSSBERG. Assigned to The U.S.A. as represented by the Secretary of the Air Force. Filed 21 Jan. 1976.

Reflection losses in harmonic generation and frequency mixing can be minimized by orienting the crystal to take advantage of Brewster's angle-zero reflectivity. S.F.J.

4,017,807 12 Apr. 1977 (Cl. 331–94.5 C)

Electronically controlled digital laser.

L. D. HUTCHESON and R. S. HUGHES. Assigned to the U.S.A. as represented by the Secretary of the Navy. Filed 23 Feb. 1976.

A means is described for obtaining discrete (digital) frequency output from a dye laser via an acoustooptic beam deflector and a Lyot filter. S.F.J.

4,019,151 19 Apr. 1977 (Cl. 330–4.3)

Multiple pass laser amplifier system.

K. A. BRUECKNER, S. JORNA, and N. K. MONCUR. Assigned to KMS Fusion, Inc. Filed 28 Apr. 1974.

A laser amplification method is claimed for increasing the energy extraction efficiency from laser amplifiers while reducing the energy flux passing through a flux-limited system by decomposing a linearly polarized light beam into multiple components, passing these through the amplifier in delayed time sequence, and recombining the amplified components into an in-phase, linearly polarized beam. S.F.J.