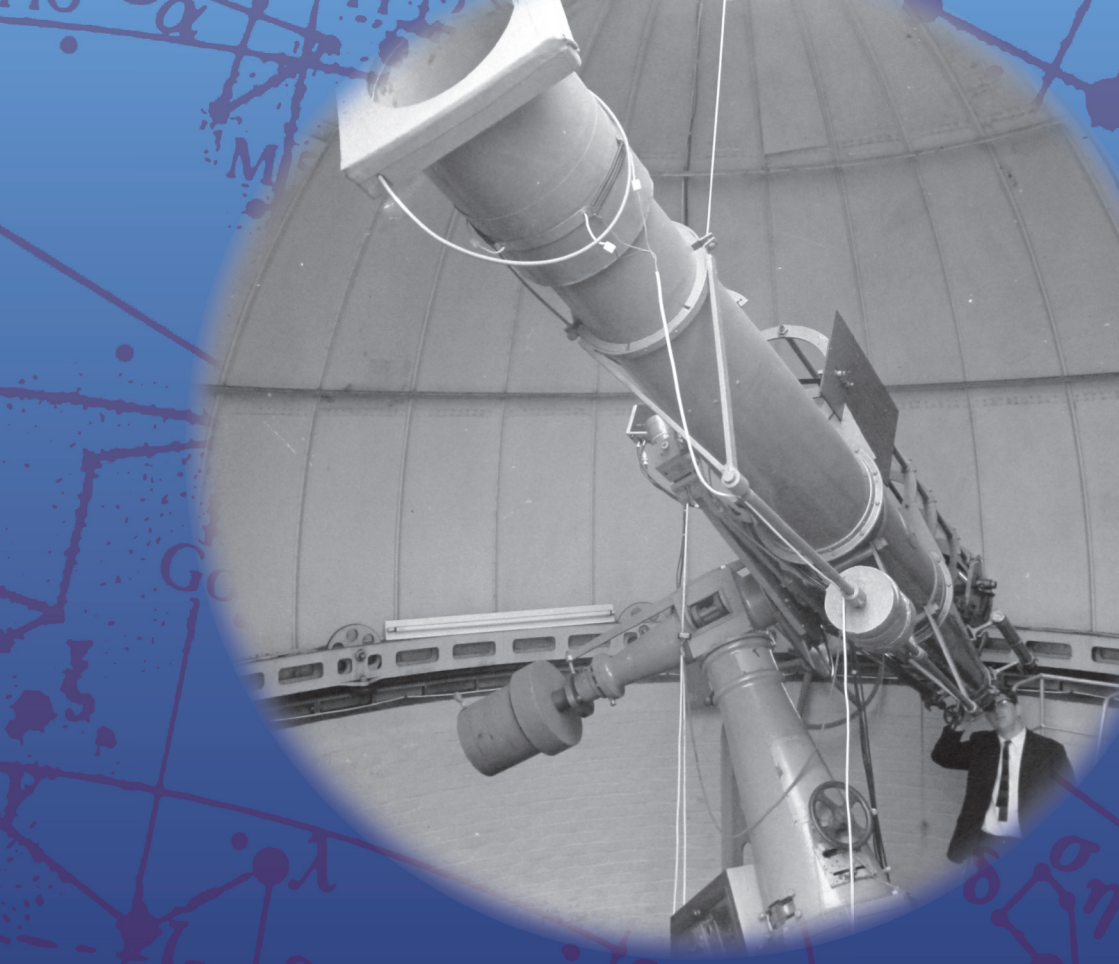

The First Fifty Years of the

Keele Observatory

Ron Maddison

The First Fifty Years of the Keele University Observatory (1962-2012)

2 The First Fifty Years of the Keele University Observatory

Origin and Early History

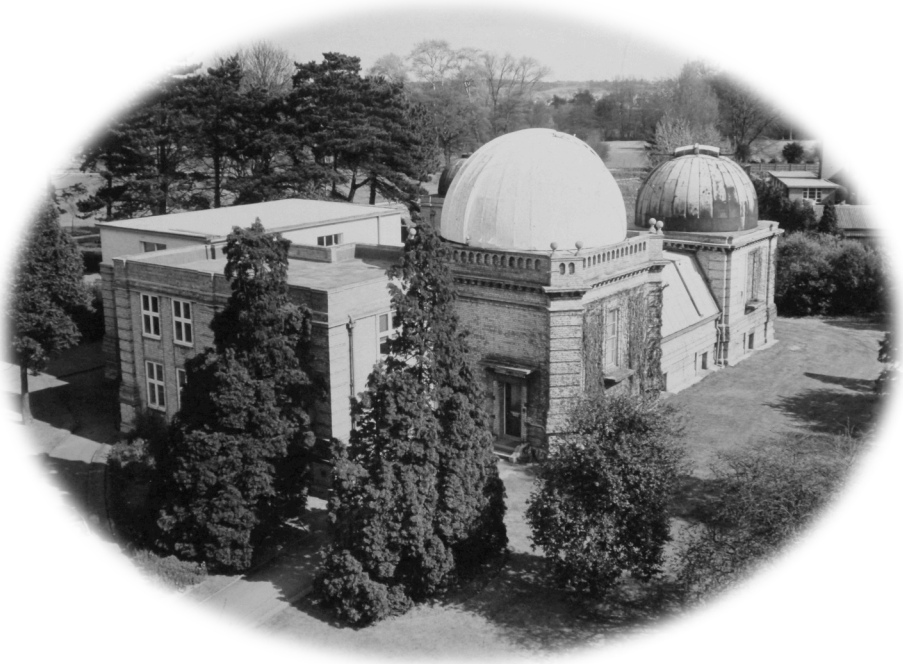

Figure 1 The University of Oxford Observatory, c. 1960.

Way-back in 1874 the University of Oxford Observatory installed a state-of-the-art 12.25" (31cm) Grubb refracting telescope that was to be used for `Astronomical Physics'. This instrument, which was regarded as one of the finest that could be made at that time, was the brainchild of the Rev. Charles Pritchard, who was the Savilian Professor of Astronomy at Oxford. Its main purpose was to be the measurement of stellar parallaxes and Pritchard showed his satisfaction with the instrument in his report to the Royal Astronomical Society in 1875 when he wrote:

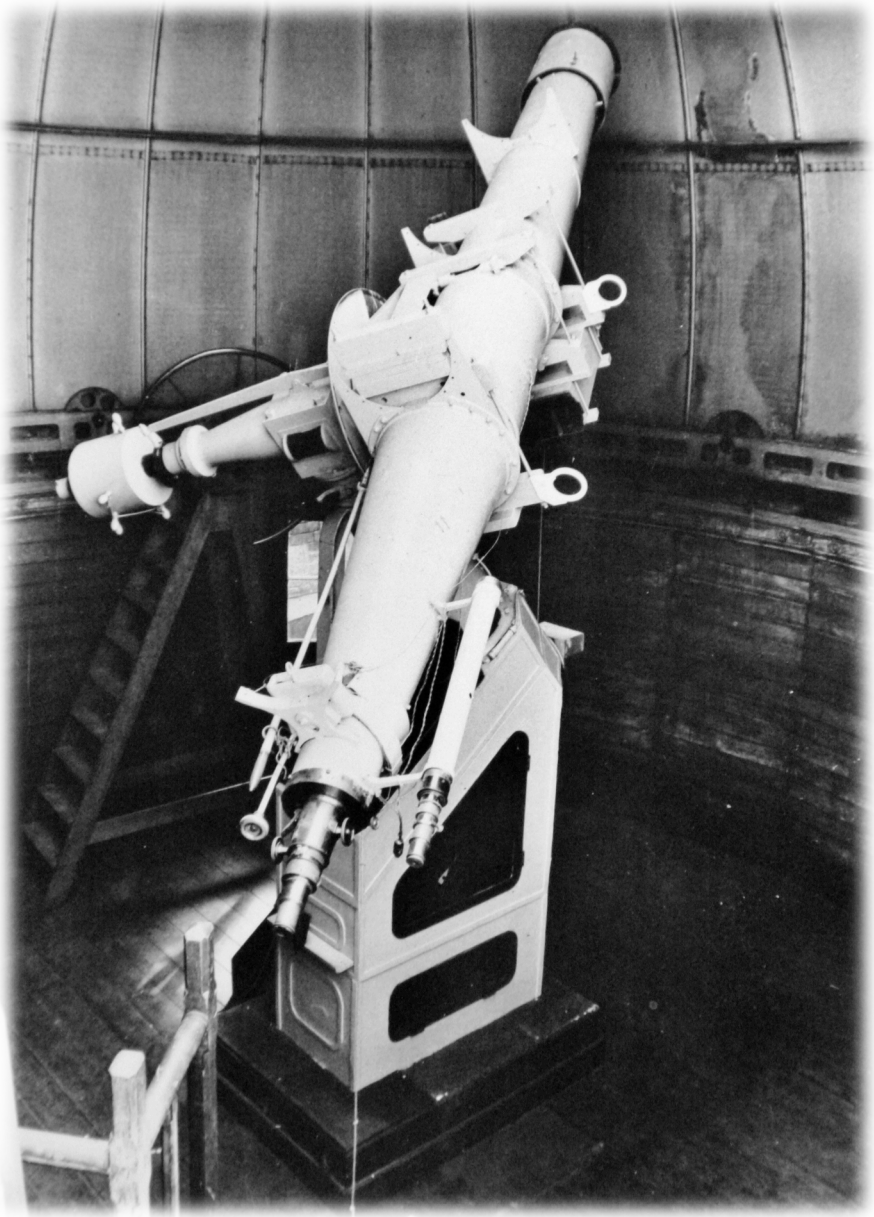

Figure 2 The 12" Grubb refractor at Oxford, c. 1960.

"I may, I trust, be pardoned, for repeating a remark which I believe I have made in this Society before, to the effect that the artists and constructors of these admirable astronomical machines – admirable alike for their ponderous stability, for the smoothness of their motion, and for their adaptation to the most minute delicacy of accurate measurements – claim at our hands a meed of gratitude and honour scarcely if at all less than that which we so gladly accord to the illustrious astronomers who successfully avail themselves of the mechanician's skill. And all honour be also paid to the enlightened munificence of the University of Oxford, who, notwithstanding their comparatively limited pecuniary resources, and the vast and ever increasing variety of claims that are made upon them, have devoted so much encouragement and so considerable a sum to the cultivation of the science which so deeply engages our own sympathies."

It seems that he was quite pleased with it!

Some twelve years later, at a meeting in the Paris Observatory, the plan to produce a comprehensive photographic sky survey (the `Carte du Ciel') was introduced which would use a set of standardized astrographic lenses, of 13" (33cm) aperture and 135" (3.43m) focal length, and this would involve several observatories around the World. The Oxford telescope would become one of them.

The prototype camera, also made by Grubb, was completed in 1892 and was mounted parallel with the Oxford refractor on the same mounting. So, after being used for parallax measurements for 18 years, the Oxford telescope became the visual guide for the first of the `Carte du Ciel' cameras.

For the next 40 years those two instruments, with 17 similar ones around the World, were very successful and productive, and the Oxford camera was also used for several additional momentous observations. One example was the set of observations made by Sir Arthur Eddington of the Solar Eclipse of 1919 that demonstrated Einstein's prediction of the bending of

starlight as it passed the Sun. Another was the accurate measurements made by Sir Harold Spencer Jones in 1930 of the orbit of the minor planet Eros – which led to the determination of the Solar parallax, that established the scale of the Solar System, with unprecedented accuracy.

After the Second World War the growing City of Oxford, and its street lighting, began to encroach on the clear sky of the Observatory which was situated in `The Parks' and, inevitably, the research work became more concentrated on Solar Physics.

But by 1960 pressure on local space and the growth of tall buildings nearby, had also become so great that it was decided to close the main dome and remove the old Grubb refractor to some more suitable site.

The First Years at Keele

Late in the 1940s plans were laid to build a new university college in North Staffordshire that would provide courses that were designed to give education across a variety of disciplines to mitigate against the growing inadequacies of over-specialization. It was an attempt to produce more `rounded' graduates, rather than narrow specialists that were being produced by other establishments at that time. Because this college was unlike any other university, its degrees were to be monitored for several years by the universities of Birmingham, Manchester and Oxford until it was established as a fully independent University of Keele – which happened in 1962.

Much of the following account is from my own record of how the observatory at Keele originated.

I was fortunate enough to be one of the early students at the University College of North Staffordshire from 1953 to 1957 and I found the place most stimulating and appealing. After graduating, and spending three years doing industrial research, I was given the opportunity to return to Keele in 1961 as a Demonstrator in Physics and, since I had always had a consuming interest in astronomy, I took on the responsibility of developing courses in that area of study while I worked for my Ph.D. At that time no other university taught the subject at any introductory level and only a few had post-graduate research interest in astrophysics.

It seemed obvious to me that any study that purported to show the development of modern civilization, from the primitive days of ancient mythology to the age of reason and the scientific method, should have as one of its aims the understanding of the origin and position of the Earth in the context of the rest of the Universe. To teach such a course properly one would need access

to observing equipment of some sort – but nothing was then available on campus.

After a few months, and as a complete surprise, I received a note from the Royal Astronomical Society announcing the imminent availability of the 12" Grubb refractor at Oxford. This seemed to be too good to be true, but I immediately started to search for support from within the University.

Keele University is based on a large rural estate situated about three miles west of the town of Newcastle-under-Lyme and there is a natural hill within the campus that rises to about seven hundred feet above sea level and commands an impressive view of the area known as the `Potteries' that lies in the valley to the east. Local lighting was not obtrusive, electricity and water were readily available nearby, and there was a clear view of most of the sky – particularly in the south. This seemed to be the ideal site for an observatory.

In those days the Head of Physics was the late Prof. David Ingram and he was totally supportive of the project to acquire, and save, this historic Oxford telescope and build such an observatory for it on what has since become known as `Observatory Hill'.

Response to the notice from the R.A.S. was naturally very enthusiastic and it turned out that we were second in a growing line of applicants – and, at first, our prospects did not seem very positive. However, the first in line was a private individual, but the `Board of Visitors' in Oxford preferred to let the instrument go to a place where it would continue to be used in education. So, we were successful in our bid and started to make plans to remove the delicate instrument and prepare the site for it at Keele.

Fortunately, the negotiations with Oxford included the availability of the existing dome which was to be replaced at their site by a conventional roof. A new dome would have been prohibitively expensive and the opportunity to keep the original one made the project feasible.

All this good fortune happened at exactly the right time. Oxford was, and still is, a centre of excellence that had attracted many key figures in astrophysics over many years. Records show that most of the `big names' in the field had visited the Observatory, and all of them would have at least looked at the telescope and even probably looked through that particular lens. The impressive list includes: Walter Baade, Subramanyan Chandrasekhar, Sir Arthur Eddington, Albert Einstein, George Ellery Hale, Ejnar Hertzsprung, Edwin Hubble, Sir James Jeans, Jan Hendrik Oort, Henry Norris Russell, Martin Schwarzschild, Harlow Shapley, Bengt Strömgren, Otto Struve, H.C. van der Hulst, Fritz Zwicky, and a host of others. Such ghosts from the past can have a powerful influence on the aims and attitudes of young students who are entering the field for the first time and who are given the opportunity to use such a significant instrument themselves.

The removal of the telescope was not an easy task because age, and the inevitable corrosion of 87 years of exposure to the elements, had almost welded some parts of the equatorial mounting together. Great care had to be exercised because the heavy cast-iron base was fragile, and repair would have been difficult and expensive, but the instrument was eventually dismantled and placed in storage at Keele until the new site was ready to accept it. Then the dome at Oxford had to be removed, transported, re-assembled and repaired and then lifted onto its new foundation and supporting wall atop Observatory Hill.

The dome was comprised of a ribbed steel cage fixed to a heavy cast-iron base-ring that weighed about six tons. It was covered by a thick papier-mâché composite material like fibre-board that had been waterproofed by several layers of paint and varnish applied over several decades.

Figure 3 Lifting the dome off in Oxford, 1961.

To minimize damage a large crane was used to lift it off the Oxford building, like lifting the lid off a saucepan, and it was then simply cut into two pieces for shipment. Each half filled a large articulated truck which in turn filled those narrow roads between Oxford and Keele. Our original plan was to use a helicopter to lift and transport the dome in one piece, but although the R.A.F. had offered to do it, they pointed out that the dome-base was so heavy that the trip would have to be made in ten mile hops and we would have to cover the cost of fuel and insurance! We gratefully declined the offer because that would certainly have cost more than the entire project!

The heavy work was undertaken by a team of four engineers from the University Workshops under the expert guidance of Mr. Harry Wardell. The new building was just a

Figure 4 Leveling the base ring at the Keele site. Harry Wardell of the University Workshop on the ladder.

heavy concrete foundation on which a cylindrical wall, about twenty-five feet in diameter, was erected that carried the geared cast-iron rail on which the dome ran. The dome was re-assembled on a prepared flattened area adjacent to the building and lifted on by a crane. An inspired improvement, which lasted for over forty years, was the new waterproof covering which was simply the canopy of an old parachute that was doped into position over the still sound papier-mâché outer surface.

Funds were very scarce at the time and a more elaborate building could not be afforded, but the Observatory was completed in 1962 ready to accept the re-furbished telescope. Meanwhile, the instrument had been re-painted and the lens carefully cleaned and examined. During this process an inscribed

Figure 5 The parachute canopy being fitted.

message was found on the cell indicating that it had been corrected and retouched by Cooke, Troughton & Simms Ltd. in 1923.

This completed the first phase of the new Observatory and it quickly became very popular with both students and visitors from the local area. It was a single stark dome in the middle of a field that was shared with sheep and cattle but it housed a beautiful example of the telescope maker's art!

During the next twelve years the Observatory was extensively used in teaching and in establishing astronomy as an important part of the curriculum.

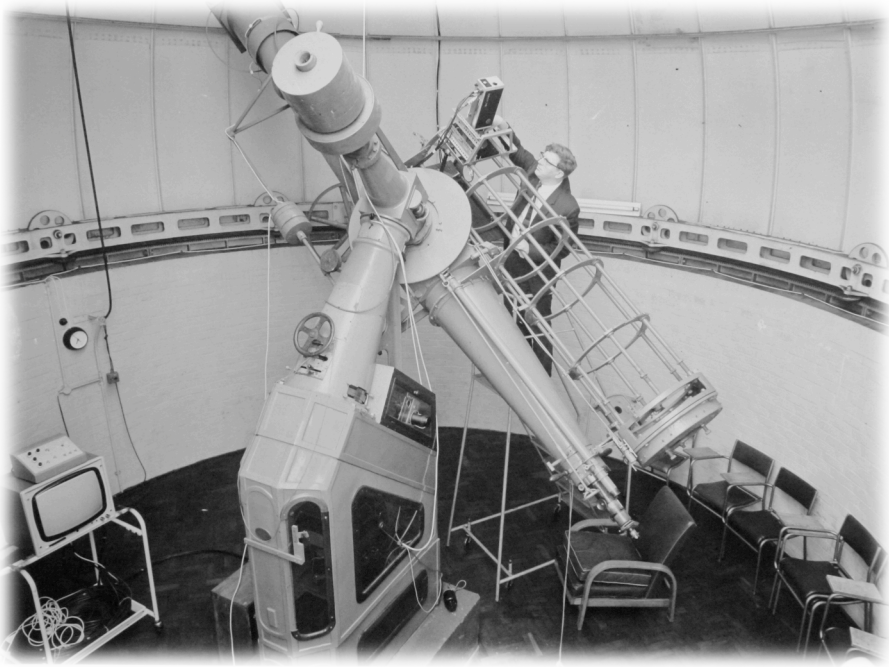

Figure 6 The 12" Grubb refractor plus the 17" Hindle in use for testing a T.V. camera, with Ron on the ladder.

One sad feature of this part of the story is that the `Carte du Ciel' 13" astrographic camera that was fitted by Pritchard in 1892 was not available in 1962. Continued searches have now located its lens and the brackets that held it are still present on the 12" refractor.

At first use was made of the existing brackets on the refractor tube to add another historic telescope to aid in instrumental research. We had acquired a 17" (43cm) Newtonian reflector made by J.H. Hindle of Blackburn in 1939. Its heavy cast-iron mirror-cell was replaced by a sturdy, but light, fibre-glass and resin copy and the tube mounted above the refractor so that its Newtonian eyepiece was positioned directly over the top of the polar axis of the mounting. This arrangement required an extra counterweight below the upper end of the refractor tube,

but it allowed us to mount heavy ancillary equipment, like experimental cameras and detectors, where they would not seriously affect the overall balance of the moving parts. This was at a time well before the invention of C.C.D. detectors when image intensifiers were still large and complicated devices.

In the first decade at Keele several hundred students took part in courses that ranged from introductory through to undergraduate level astrophysics, and many public evening courses were given, which were part of the Extra-Mural activities of the University. These courses combined the fundamental fields of physics, geology, chemistry and biology to produce relatively new studies such as biochemistry, biophysics, astrogeology, geochemistry and astrophysics – all of which attracted enormous support in light of the burgeoning research in those areas.

It was during this period (1966) that we were first invited by the B.B.C. to be the subject of one of Patrick Moore's "Sky at Night" programs that was devoted to education in astronomy. It proved to be the first of many contributions that we were to make over the ensuing years.

Also, at around this time, we acquired a large pair of binoculars, 6" (152mm) aperture × 20 magnification, that were originally sited at the Naval base in Malta during the Second World War. Their value lay in their ability to reveal very faint objects over a field of view of several degrees and they are ideal for viewing comets, large open clusters and nebulae. One drawback is that they weigh about sixty pounds. That problem was ingeniously solved by mounting them in a large frame over an old dentist's chair with counterweights adjusted so that the eyepiece could be safely and comfortably positioned for the seated observer. Rotation and elevation were originally controlled hydraulically but the system has since been much improved using electric motors. The unit is now housed under a

Figure 7 The binoculars. Geof Dudley (in the centre), of the Physics Department Workshop, and Ron (on the right) watch as student Chris Dickenson (on the left) demonstrates.

run-off roof that allows access to most of the sky.

A most valuable asset for the University arrived in 1971 when Dr. Aneurin Evans joined the staff of the Physics

Figure 8 Nye Evans (on the left) and Ron Maddison (on the right), on Observatory Hill in 2010.

Department. He began to assemble a strong research unit in astrophysics which has grown to become an internationally recognized centre of excellence. This currently includes theoretical and observational studies of the evolution of stars and galaxies, one example of which is Keele's operating of the southern station of the Super Wide Angle Search for Planets around other stars (Super-WASP), at Sutherland in South Africa – the site of the largest optical telescope in the world (SALT) in which' construction and exploitation Keele also participates.

Life on Observatory Hill

Figure 9 The finished circular Observatory, c. 1962.

The second stage for the Observatory building arose as the need for extra space had become obvious during those early years. Above all, observers needed somewhere to recover from the bitterly cold winter sessions at the telescope. The icy winds from northern Europe used to whistle across the hill and there was

little protection when the dome was open. The problem was compounded by the body heat of the observers huddled under the telescope. The usually good seeing conditions of the site were frequently disturbed by air currents – to say nothing of the frigid attitudes of those who provided the heat! On other occasions access became almost impossible because cattle and sheep from Home Farm would shelter from the weather on the lee side of the dome. Of course, the door was also on the south side and the animals would stand there doing what they usually do! On one particularly bad day, when visitors were expected within a week or two, I brought the problem to the attention of one of the senior administrators by inviting him to visit the Observatory to see some new equipment that had arrived. He was wearing a nice pair of suède shoes…!

A few days later the dome had been fenced off and a protected access pathway built from the car-park at the bottom of the hill. A few months after that a small `recovery' room and comfort facilities were added that made a big difference to the quality of life for staff and visitors.

Night-time access was quite an adventure before the fenced-off path arrived. I remember once walking up the hill in almost total darkness and whistling to myself to keep up my spirits, when I fell into something that huffed heavily at me, snorted, scrambled to its feet and lumbered off into the distance. I remember that my pulse rate became astronomical and I could not say who was the more alarmed – me or the poor sleeping cow into whose legs I had fallen!

I made the rest of the walk in record time, and it took me a while to regain my composure inside the Observatory!

A Phase of Expansion

As the Observatory grew in popularity, and post-graduate astrophysics became well established, the need for a modern research quality telescope was recognized. Such large instruments are very expensive and are usually placed on high mountains where the `seeing' is of the highest quality. The site at Keele did not match either of those criteria – but it is still necessary to train observers on more affordable and smaller instruments which are still capable of useful work.

One of our supporters and a close friend of mine, Mr. Harry Thornton of the Wirral in Cheshire, who had played an important role in the Lunar Section of the B.A.A. for many years, owned an 18" professionally made reflector. I knew that his advancing years had led him to give up his observing and I approached him to ask if he would consider re-locating it to Keele so that we could develop more serious observing in addition to our teaching work. His reaction was very sad as he explained:

"I would have given it to you if you had asked me earlier, but I gave it away about a month ago to an old colleague."

A few days later I received a telephone call from him. He asked me to go over and visit him because he had some books that he wanted me to have. As usual we spent a wonderful evening together and, as I rose to leave, he gave me an envelope and said, *"I was so sorry about that old telescope – but I hope that this will help you get something that might be more useful."* It contained a substantial donation to buy a complete new telescope.

This was a very generous gift, and as I reviewed what was commercially available, and considered all of the other resources that were open to us in the form of engineering experience and

skills, and the support of so many local enthusiasts, I decided that something better was within our reach.

I telephoned Mr. Thornton and asked if he would mind if I changed the target from a whole, but medium sized, telescope to just the complete set of optics for a much more effective 24" (61cm) reflector. We would then accept the challenge to make the rest of the instrument and its housing ourselves! Without hesitation he agreed enthusiastically.

During the following winter one of the engineers from the local William Boulton Engineering Company, Mr. Eric Birks, had arranged for me to give a short (and modest!) course of six weekly lectures on "The Universe and all its contents" to their administrative staff at the local Post House hotel. Of course, that was not the exact title, but Eric was one of the regular members of our astronomy Extra-Mural meetings and he thought that this would provide an interesting diversion for their staff.

Towards the end of those talks I reviewed our plans for expanding the Observatory and I became aware of considerable interest in the project. The Managing Director could, no doubt, see advantages for the company by getting involved and he offered his support and promised that I would hear from him soon.

After a few discussions and planning meetings he called to tell me that the company would undertake all the steel fabrication of the telescope and its mounting, build a new fibre-glass dome to house it and would provide a lecture room and all the necessary facilities to link the two domes.

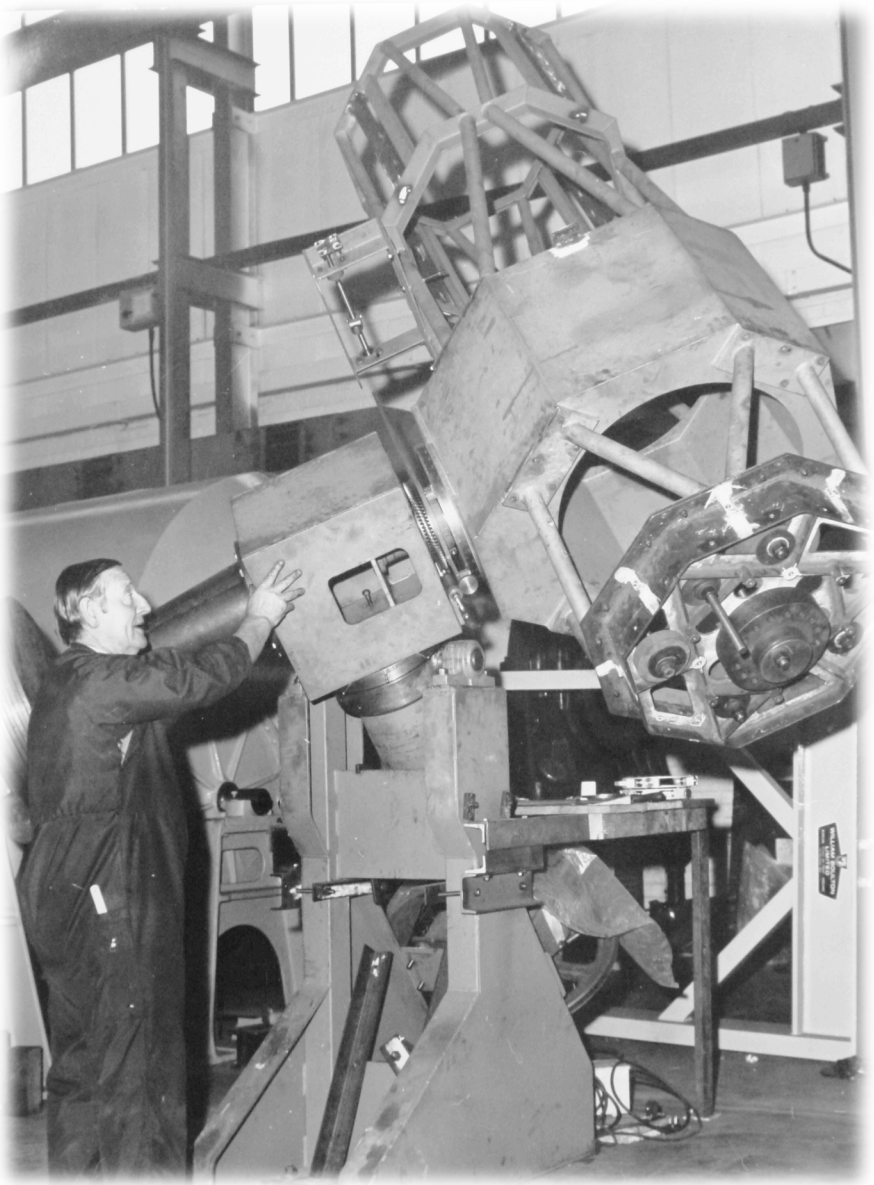

Figure 10 The 24" Thornton reflector being built in the William Boulton workshops, with Chief Fitter Mr. Davenport.

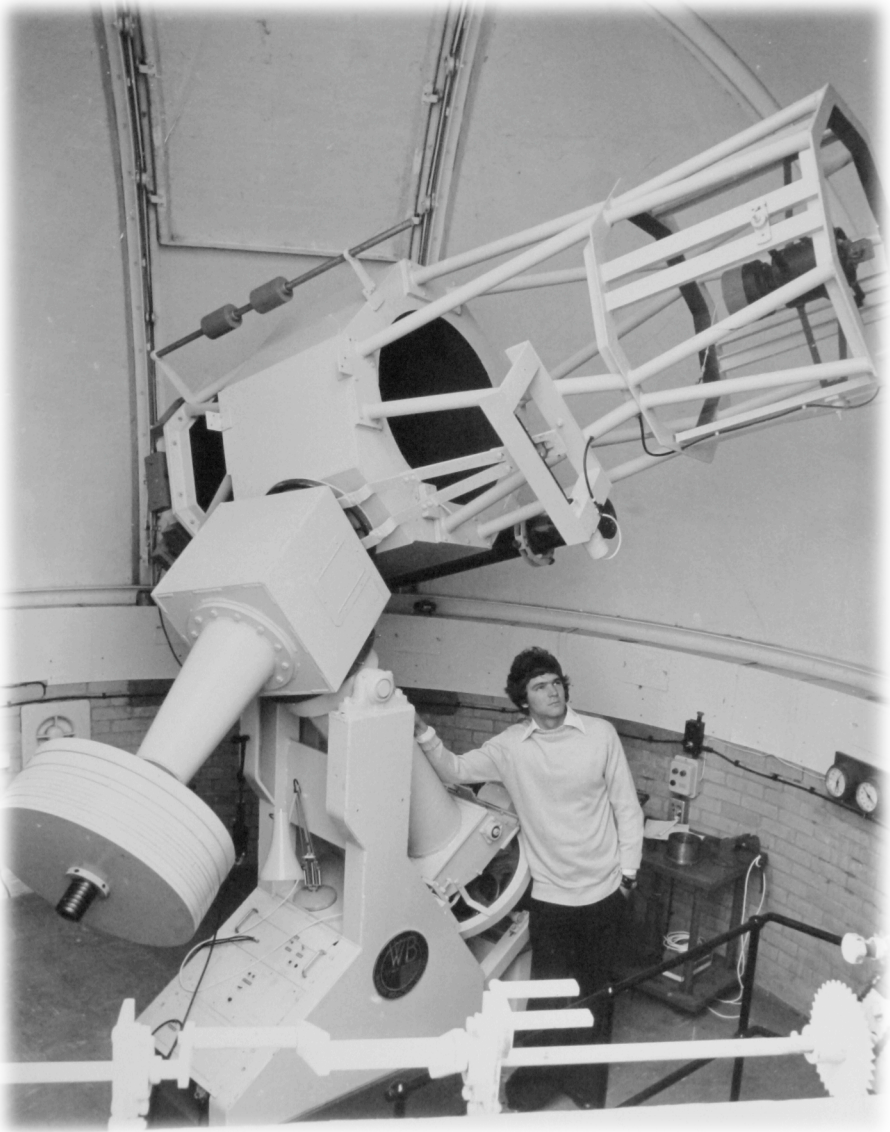

Figure 11 The 24" Thornton reflector at Keele Observatory, with researcher Mike Bode (now Professor and Chair of Astrophysics at Liverpool John Moores University).

At that time we had the support of the William Boulton company, several electrical engineers, professional draftsmen and builders, the Campus Workshops and many general volunteers. The optical components would be made for us by Jim Hysom of Astronomical Equipment Co. of Cambridge and we would then have a quality instrument that would have been financially beyond our grasp for many years to come. In addition the National Engineering Laboratory in Glasgow had agreed to produce for us a very high quality worm and wheel gear for turning the telescope. This was done at a very reasonable price as a training project. The University co-operated in every way and the much improved William Boulton Observatory was completed in early 1975.

Figure 12 The Keele University William Boulton Observatory after its expansion with an additional dome housing the 24" Thornton reflector (on the right) and a connecting lecture room.

The Observatory was officially opened by the Chancellor of the University, H.R.H. Princess Margaret on the 1st of July 1975. This was a most impressive occasion that culminated in a dinner, followed by a concert of chamber music for our guests in Keele Hall.

Figure 13 Opening of the Keele University William Boulton Observatory by the Chancellor, 1st July 1975. From left to right: Ron, Harry Thornton, Chancellor H.R.H. Princess Margaret and Vice-Chancellor Prof. Campbell-Stewart.

I discovered later that most of the costs incurred by the company had been recovered by the sale of two similar domes to an observatory in South Korea!

The Final Quarter of the 20th Century

Progress in observational astronomy during the next decade was prodigious. The electronic revolution improved the detection of faint light so that individual photons could be recorded, and the synchronous motors used for driving telescopes were superseded by digital motors and controls. This was the beginning of the end for chemical astrophotography and even small telescopes became capable of digital photography, sensitive photometry and spectrographic analysis. At first most of these changes were too expensive for small observatories, but nowadays even most amateurs can afford them.

Unfortunately I suffered a series of setbacks in my personal health in the mid-eighties that took me out of circulation for a time, but a team of very enthusiastic and skillful supporters of the Observatory took over and were eager to undertake the necessary running and maintenance of the instruments while I recovered. The 24" had been heavily used in the decade after it was installed and the limits of its original design began to show through. It was important to bring the instrument into line with the new techniques and to upgrade its performance to match.

So, beginning in the mid-eighties the telescope was systematically dismantled and improved to incorporate all the new state-of-the-art additions that were then available.

The team was led by Dr. James Albinson – an astrophysicist, St.John Robinson and Stephen Doody both of whom were well qualified engineers, and there were about a dozen others who contributed enormously to the heavy work involved. It is difficult to calculate the financial value of the

Figure 14 `The Crew', from left to right: Stephen Doody, St.John Robinson and Dr. James Albinson.

contributions that the `Crew' put into the project, but it clearly exemplified the close relationship that existed between the University and the local community.

The project took about four years to complete, but while the 24" was out of service the Grubb refractor continued to be used for public presentations and teaching demonstrations. In spite of the heavy load, it too was serviced and fitted with a new drive, although great care was taken to preserve its antique integrity. It had always been extremely useful for public viewing. Somehow there is a much more realistic appeal when one looks directly through the long tube of a large refractor at the object under study. There is also a strong sense of awe and wonder when using the same instrument that had been used by so many of the `big named' astronomers of the last century!

The upgrading was completed by late 1989 and was celebrated by a memorable Star Party that was organized by Dr.

Albinson and the Crew. A large marquee was set up on the site for catering and well over a hundred guests attended, including the Astronomer Royal, Prof. Francis Graham Smith; Patrick Moore; Pieter Morpurgo, B.B.C. producer of the `Sky at Night'; and the late Paul Doherty, the well-known local artist.

Figure 15 Event at the Star Party: Patrick Moore (on the right) on the xylophone watched by Astronomer Royal Prof. Graham-Smith (on the left) and Ron (in the centre).

One highlight was when Patrick Moore was coaxed into giving us an impromptu recital on a xylophone (that just happened to be there!), and another was when the Astronomer Royal was persuaded to act as auctioneer for a painting that Paul actually produced during the Party.

In early 1991, mainly for reasons of health and on medical advice, I took early retirement to move to a warmer climate. I had been at Keele for 35 years and many senior staff had been offered early retirement to ease financial pressures on the University. I had also been offered a position as Director of the Observatory at the Astronaut Memorial Planetarium and Observatory in Cocoa, Florida, which is comfortably close to the Kennedy Space Center, so I took the opportunity.

My replacement was Dr. Tim Naylor, who joined the astrophysics research group and also continued to develop the Observatory for the next decade. His fine-tuning of the 24" reflector produced a first class observational tool. He also refined the detection equipment so that it could be used for the measurement of minute changes in brightness of individual distant stars that might be caused by the presence of secondary objects orbiting around those stars. In 2001 Tim was appointed to the Norman Lockyer Chair of Astrophysics, and Head of Physics, at the University of Exeter.

In 1993 Mrs. Davies of Penkridge very generously gave the University a fine 8" aperture refracting telescope that dated from the late nineteenth century. The late Mr. Frank Davies had re-mounted the telescope in about 1970 and it was in excellent condition. This instrument, which is still awaiting a permanent covered site, has been heavily used by visitors because of its ease of operation and it has been greatly appreciated.

To replace Dr. Naylor, Mr. Mike Brough was appointed as the new Observatory Superintendent. He was on the staff of the Computer Science Department and had been a student at Keele in the mid-sixties. In his final undergraduate year he had been the cameraman for the B.B.C. during the filming of the `Sky at Night' program about Keele in 1966. He had been an active member of the Astronomical Society and contributed greatly to the development of the computer systems in the Observatory. He also presided over a difficult time when the fabric of the building

was beginning to show serious wear and tear, due mainly to the harsh effects of the weather.

Meanwhile, the contribution made by the `Crew' to the growth and maintenance of the Observatory had been so impressive, over such a long time, that the University honoured them by awarding an Honorary Master of Science degree. This was presented to Mr. St.John Robinson, who represented the group, in 1997.

The Dawn of a New Century

Several astronomical events happened during the next few years that generated enormous public interest. To mention just a few, the most impressive was, perhaps, when the breaking comet called `Shoemaker-Levy 9' collided with the planet Jupiter in 1994 and provided an amazing spectacle as a series of huge scars were formed in its cloud deck. This event attracted hundreds of visitors to the telescope and was covered in detail by television world-wide. In addition there were two very bright comets, `Hyakutake' (in 1996) and `Hale-Bopp' (in 1997). These appearances, alone, generated crowds of visitors, and it was estimated that over one thousand attended in just one week!

However, throughout the nineties there was a noticeable increase in light pollution at the Observatory site. This was partly due to the expansion of the University, but mainly due to the building of a new road near the Observatory. This generated discussion of the possible advantage of relocating the instruments to a better site.

I am reminded that we had the same discussion in 1968. At that time we even got so far as selecting an almost perfect site in the nearby Maer Hills, about eight miles to the south-west of the Keele site. The place was a clearing at the top of a wooded hill in relatively dark surroundings shielded from local lighting. There was an access road and all the necessary services and it housed an old radio tower once used for aircraft navigation.

Negotiations were well advanced with the site owner, but just before we were able to finalize the deal, there was a political demonstration on the University Campus that attracted world-wide attention. This was because the small group of students that were involved chose to get such coverage by parading in the nude in a prominent central part of the Campus! Photographs appeared in newspapers all around the World. The owner of the

Maer Hills was not too pleased and decided that *"Perhaps you should get your own campus under control before we proceed"* – so the matter was dropped and abandoned at that time.

As it happened it was soon realized that the anticipated improvement in observing conditions was actually outweighed by the advantage of having very easy and secure access to the telescopes from within the Campus. Since that time the University has adopted policies that support the notion of `Dark Skies', and a bank of Earth with a fence has been built between the Observatory and the new road that helps to reduce the scattered light pollution.

The renewed interest in finding an alternative site needed a dedicated mobile `site testing' instrument and an ideal 10" Meade Schmidt-Cassegrain telescope was bought for the job.

This portable telescope also had great added advantages for public demonstrations because it can be used unrestricted outside the dome. It also has a modern G.P.S. `Go to' guidance system that allows faint targets to be found automatically at the touch of a button – which saves much time when switching between a variety of targets.

Nevertheless, the main problems that appeared in the nineties were, first, the shortage of space within the lecture room for public presentations, and second, the degradation of the existing accommodation due to age and the heavy usage it had received over the preceding 20 years. As a result much effort was exerted to find support for a major upgrading of the facility.

In 2002 the Observatory was awarded a grant of five thousand pounds towards promoting "The Public Understanding of Science". This was used to buy a specialist Solar telescope, that could, obviously, be used during daylight hours. It works by separating one colour of the Solar spectrum for visual observations which allows direct, and totally safe, viewing of the bubbling `convection cells' and spots of magnetic activity called `sunspots' on the Sun's surface, and of "flames" in its atmosphere called `prominences' and `flares'.

But, in 2008, the University launched a "Key Fund" – the aim of which has been to search for financial support for various `Key' projects within the University that urgently need help. The appeal has been aimed primarily at alumni and Friends of the University – and the response has been very encouraging.

The Observatory was selected as the first annual project for 2008. The aim has been "The Development of the Observatory as a Regional Centre to Provide Visitors, Community Groups, Local Businesses and Schools with `Hands On' Experience of the Research Activities in the Physical Sciences and Astronomy". So far the most important contribution has been the donation of £250,000 from the Wolfson Foundation specifically to improve "The Visitor Experience at the Observatory".

Figure 16 The Keele Earth and Space Observatory after its 2009 refurbishment.

With this good news in hand, plans were drawn up for major improvements and these were implemented throughout 2009. The most important changes included the expansion of the lecture room and the installation of ramps *et cetera* for

wheelchair access; the addition of state-of-the-art visual aid equipment with interactive whiteboards and 3D electronic projection; the repairing and re-covering of both domes; the provision of independent outside access to the 24” telescope dome; improved sanitary facilities; and a small workshop for electronic and mechanical maintenance and construction. The teaching area is also being fitted with facilities for examining images projected directly from the telescopes.

Figure 17 The refurbished lecture room of Keele Observatory.

A new entrance hallway has been added to form an information area where a bronze bust of Sir Patrick Moore F.R.S. is on display. He has always been a valuable supporter of our efforts and was awarded an Honorary Doctorate of Science by the University in 1994. It seems very fitting that someone who has been so totally involved with the presentation and explanation of scientific progress to the public, for more than 60 years, should represent our aims in this way.

Figure 18 The bronze bust of Patrick Moore, on display in the entrance of Keele Observatory.

Throughout much of the refurbishing process the liaison work fell on the shoulders of Mike Brough and he successfully guided progress so that most of it was completed within the year. The original plans included provision of an extra wing that would be devoted to the `Earth' – rather than the `Sky' – hence the whole unit was re-named `The Keele Earth and Space Observatory'. Since then, this addition has been realized instead at Home Farm, which was converted into a modern centre for environmental science – the `Sustainability Hub' – but the intention is for a strong link to be maintained both physically (a short path connects the two sites) and symbolically through coordination of activities and the use of one another's facilities.

The official opening of the refurbished observatory took place on the 2nd of February 2010.

On that day the University was most honoured when Lord Martin Rees, Master of Trinity College Cambridge, Astronomer Royal and President of the Royal Society came to dedicate the expanded Observatory and unveil the plaque commemorating what he referred to as *"a very cheerful occasion".* He entertained the audience with an inspirational seminar on the rôle of astronomy in society –

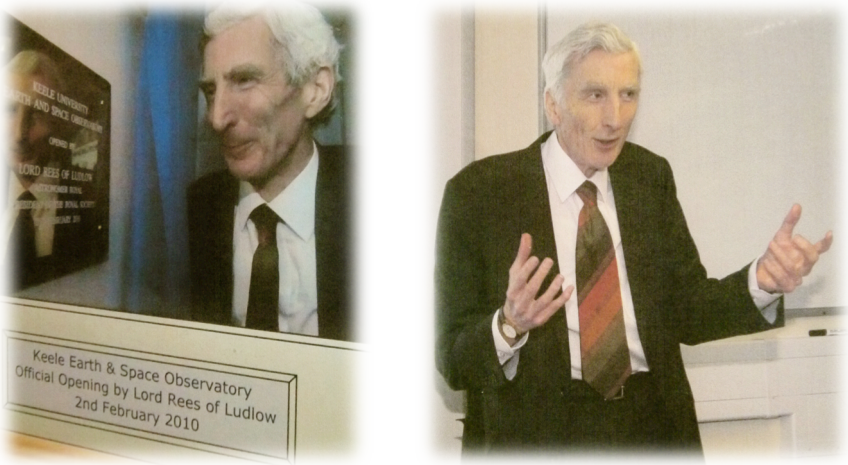

Figure 19 Lord Rees opening the refurbished Keele Earth and Space Observatory.

"We astronomers often remind ourselves that astronomy is one of the oldest sciences, indeed it is probably the oldest science – except, maybe, for medicine – and, as there are probably no doctors here, I can say without giving offence, that astronomy may be the oldest science that did more good than harm!"

He emphasized the value of the vibrant and rapidly developing technology that had led to the recent exciting quest for other planets around other stars, and he ventured that we would probably be teaching students, in the next twenty years, about Earth-like planets around other stars.

And so, under the new directorship of Dr. Jacco van Loon, the old Grubb refractor has a new lease of life after its first 137 years of service, and the newly upgraded 24" reflector embarks on its next 37 years by contributing to cutting edge research which may help to answer the burning question of whether, or not, we are alone in the Universe.

Florida, U.S.A., 2011

Dr. Ron Maddison
Retired Senior Lecturer in Physics at Keele University
Founder of the Keele University Observatory

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Photographs

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