The Telescopes of John Henry Reynolds of Harborne, Birmingham, England: An Outstanding Grand Amateur

Dr Ron Maddison

Past President, Antique Telescope Society[1]

This contribution was stimulated by a list that appeared in the *Newsletter of the Society for the History of Astronomy* issue **16** for July 2008. The list, on page 21, under the heading of 'Grand Amateur British Observatories' does not include the name of J.H. Reynolds, although his contribution to that area of interest was truly remarkable.

JOHN Henry Reynolds (1874–1949) was a contemporary of George Ellery Hale and, indeed, he also shared a similar lifestyle. However, I have chosen to start the story in 1935 because, for me, that was a particularly significant year. In that year, for example, the 74-inch reflecting telescope by Grubb Parsons at the David Dunlap Observatory in Toronto was completed and saw first light. That instrument is now seriously threatened by deteriorating observing conditions around that huge city, and its future is uncertain, but it has had a distinguished career in astrophysical research and is housed in a very impressive Observatory that remains a rare example of architectural beauty that is well worth visiting on that score alone. Also, at the beginning of 1935, the 200-inch Pyrex disc had just been successfully cast and had started the long annealing process that culminated in the Hale Telescope at Palomar. That instrument initiated, and dominated for several decades, the new era in deep sky studies which have become the basis of modern astrophysics. Another event in that year was that I also saw first light! I came out of the annealing oven in January of 1935, and although you won't see any connection between that fact and the other two events, you might with the last one, namely that in that year J.H. Reynolds, a remarkable amateur astronomer in England, was elected as President of the Royal Astronomical Society. For me that had implications which would not emerge for some years.

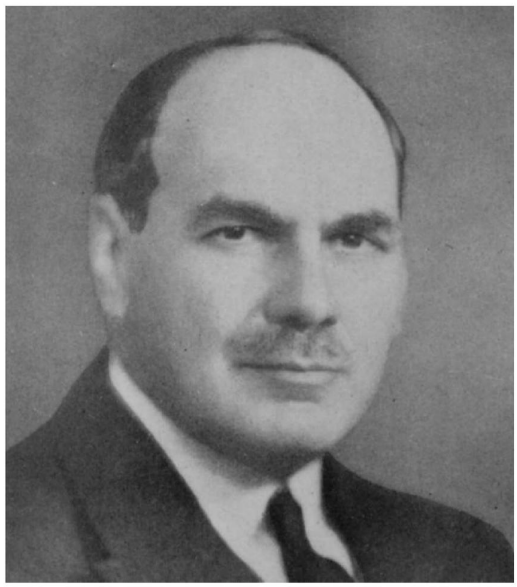

Fig. 1. John H. Reynolds, President of the RAS, 1935-39. *Courtesy of the Royal Astronomical Society–Presidential portrait.*

J.H. Reynolds was the son of a very prominent citizen of Birmingham, England. His company was a major producer of metals in a city that was proud of its thousands of small engineering businesses, and by any standards he was a very successful and wealthy industrialist. Ironically, today he is remembered mainly for the valuable contributions he made to astronomy in the first half of the twentieth century which were generated by his all consuming fascination with telescopes and nebulae.

My interest in Reynolds was aroused just after the Second World War when I was about 12 years old. I had acquired a science textbook at school, written by F. Sherwood Taylor, which featured a beautifully detailed photograph of Jupiter. The picture credit was to 'J.H. Reynolds, taken with a 28-inch telescope in his observatory in Harborne'. That took me completely by surprise because I lived in that small suburban village of Harborne and knew nothing of this observatory! So, like anyone would, I started a 'dome search' and soon located the Reynolds dome less than a mile from my home. It was in the back garden of an imposing three-story Victorian house and was surrounded by flowers and rose bushes. I soon discovered that it had been empty for 21 years. In fact it was actually being used to breed rabbits, and I was more than a little disappointed to find that I had missed the primary activity by such a clear margin. However, I also discovered that the doctor who had been present at my birth, and who was our respected family practitioner, was the son-in-law of J.H. Reynolds – so there was a tenuous connection after all. As I grew during the next few years I became increasingly aware of the fact that when I asked him astronomical questions, they were always answered in depth and in detail, as one would expect from such a close association with such an authority as the recent President of the Royal Astronomical Society (RAS).

The reason why the old observatory had closed was that, even in the 1920s, the street lighting had begun to encroach on seeing conditions and the telescope had to be moved to a more effective site. Even though observation was abandoned from the Harborne observatory J.H. Reynolds continued to analyse photographs from other observatories in all parts of the world by installing a Hartmann Microphotometer in his house. As an amateur he followed in the tradition of Hale and acquired personal equipment that would have done credit to any professional observatory. While he was President of the RAS he hosted many international guests in the house called Low Wood and it became a meeting place for many of the big names in astronomy of that period.

Reynolds' principal work in astronomy began in 1902 when he made his first visit to Egypt. It was a particularly good summer and he was most impressed by the clear air and fine seeing conditions. No doubt he was also keenly interested in the archaeological work of the time – as was George Willis Ritchey (1864-1945) who was also visiting Egypt at about that time. I do not know whether the two actually met in Egypt but it is clear that they did meet at some time during this period while Ritchey was visiting Europe; Reynolds never visited the United States.

At this time very little work had been done on nebulae in the southern hemisphere and the advantage of Cairo is that observations can be made from that latitude as far South as declination minus 40°. This observational potential so impressed Reynolds that he decided to design and build a suitable large telescope which he would then present to the Egyptian government. It happened that an unused 30-inch mirror and cell made by Dr. Andrew A. Common

(1841–1903), and a matching flat, were in the possession of an electrical engineer in Leeds by the name of F.W. Dickinson and both were available for such a project.[2] This had been a matching mirror to the 30-inch Thompson equatorial telescope made for Greenwich and Reynolds bought the complete system for the princely sum of eighty pounds. In those days the exchange rate was about five dollars to the pound, so the total cost in United States currency was in the region of four hundred dollars. While designing the telescope, Reynolds had clearly consulted the paper by Ritchey that describes much of the design work for the 60-inch Mount Wilson reflector that would be completed in 1908.[3] I now have Reynolds' personal copy of this paper, which contains a few notes of his own, and the similarities between the two instruments are very clear. Both telescopes have unperforated primary mirrors in heavy cells which allow the use of short-arm forks. They can both be used at the prime and Newtonian focus positions and were frequently used in what Dr. Donald Osterbrock called the folded Cassegrain configuration. This combines the classical Cassegrain secondary with a tertiary flat mounted just in front of the primary mirror to divert the converging beam of light to the side of the tube. In England we still prefer to call this the Cassegrain-Newtonian System.

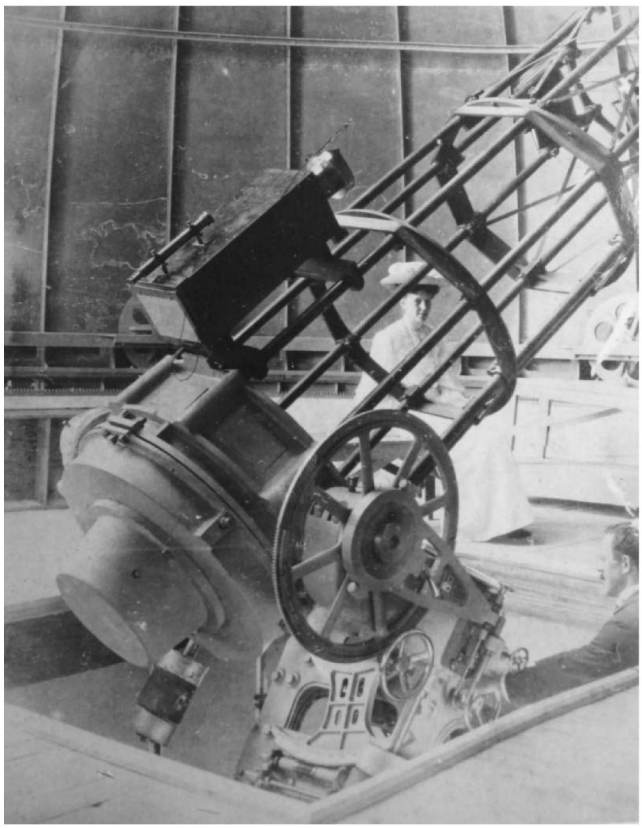

Fig. 2. The 30-inch Reynolds reflector at Helwan, Cairo. Mrs Reynolds is seated on the far side.
Courtesy of Miss Elizabeth Morton, from personal collection – Reynolds family.

By August 1905 the new 30-inch reflector had arrived for installation in an existing dome at the Helwan Observatory which is a few miles south of Cairo, and it became the first large modern telescope capable of observing a considerable part of the southern sky. The first photographs were exposed in 1907. The value of the work that was carried out in the next few years, much of it by Reynolds himself, was highlighted by Paul Hodge in a recent review article on 'The Andromeda Galaxy'. He wrote:

> A remarkable study by J.H. Reynolds in 1913 provides an interesting lesson – that more complete and accurate data do not necessarily lead to more accurate understanding. Reynolds did a rather modern-sounding analysis of the structure of Andromeda by measuring the plate density of an image as a function of distance from the centre. He found that the resulting curves showed that the image was made up of a central bulge and wings. Reynolds used this piece of evidence, remarkably advanced for its time, to support the hypothesis that M31 was a reflection of gas and dust illuminated by a central star, with the nucleus being the star. Several years later he published a discussion of the structure of M31 that recognized its true nature.[4]

It was this first survey work from Helwan by Reynolds that gave rise to the notion of a 'zone of avoidance' where spiral nebulae, as they were then called, did not appear to exist close to the plane of the Milky Way. Reynolds suggested that this may be an illusion caused by obscuring material in the plane of the Milky Way, but he did not make the distinction between galaxies and nebulae since the true distance scale had not been determined at that time.

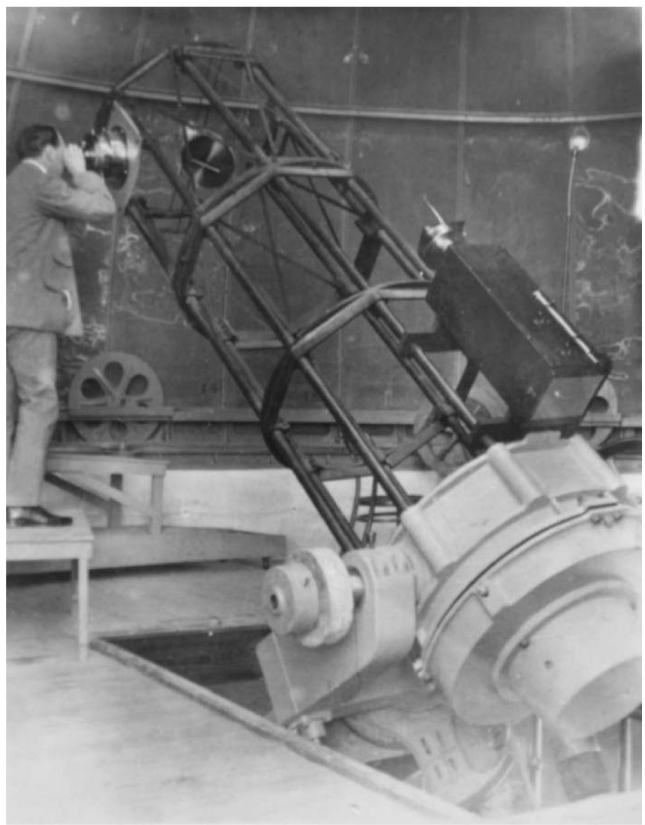

Fig. 3. J.H.R. at the Newtonian eyepiece, Helwan.
Courtesy of Elizabeth Morton.

However, it is gratifying that Paul Hodge recognized the contribution that Reynolds as an amateur made to this work.

The field of astrophysics has since been professionalized and the chances of an amateur making such an enormous contribution today are relatively very small – as are the chances of an amateur ever again being elected President of the Royal Astronomical Society! The last amateur to serve as President was the equally remarkable Dr W.H. Steavenson in 1955 – more than half a century ago!

By 1910 it was realized that the Helwan mirrors needed upgrading and a new flat was ordered from George Willis Ritchey.

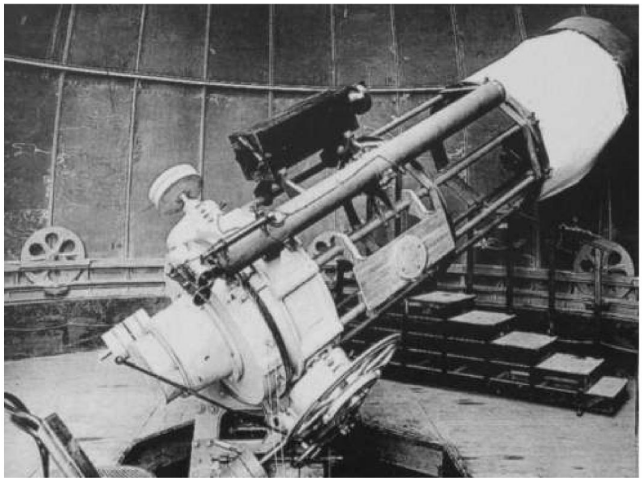

Fig. 4. 30-inch Reynolds Telescope at Helwan. The 5-inch Tulley refractor is the finder telescope.
Courtesy of Elizabeth Morton.

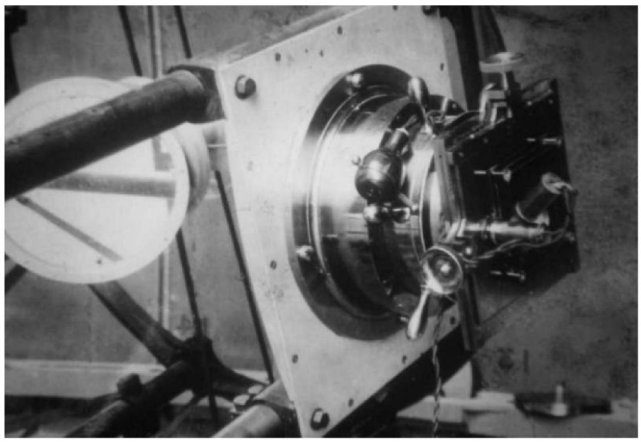

Fig. 5. The double-slide plate-holder on the 30-inch Reynolds Telescope.
Courtesy of Elizabeth Morton.

This secondary mirror was made and fitted in early 1911 while Ritchey continued to work on the new 30-inch primary. This was ready in 1914 and further engineering improvements were made as the new primary was fitted. The fork system was modified so that the cell and counterweights would clear the base, thus allowing the instrument to be aimed directly at the North Polar Region. The original Common mirror was returned to Birmingham.[5]

An interesting feature of this first Reynolds telescope is its finder which can clearly be seen in Figure 3. This was a fine 5-inch refractor made by Charles Tulley (1761-1830) in about 1825. Henry King quotes Sir James South (1785-1867), who commissioned the telescope from Tulley, as writing that 'it is the finest in existence'.[6] Unfortunately, I have not been able to verify that this refractor still exists and would be grateful for any further information anyone might have about it. One of the most useful accessories fitted to the 30-inch was a double-slide plate-holder similar to the one that had been made for the 40-inch refractor at Yerkes by G.W. Ritchey in 1900.[7] This was a device invented by A.A. Common at the end of the Nineteenth Century for improving the accuracy of guidance during long photographic exposures. Rather than moving the whole telescope to correct image drift, fine guiding could be achieved using two fine micrometer hand screws, in right ascension and declination, to move just the photographic plate and eyepiece to keep the image centred and stable.[8]

After the Helwan telescope had been successfully set up in 1907, Reynolds began to make plans for his own observatory at Harborne.[9] The dome was to be 24 feet in diameter and would house a 28-inch reflector based on the Helwan design. Reynolds ground and figured the 28-inch mirror himself, drawing on his own extensive experience as a young man when he had made several smaller mirrors that were of acceptably good quality and were much admired by his colleagues in the Royal Astronomical Society. Telescope maintenance at Harborne involved the whole family. Mrs. Kennerley, Reynolds' second daughter, wrote: 'My father used to silver the mirror of his 28-inch telescope himself with the help of the gardener, my mother and any of his family available, quite an occasion! A white apron and rubber gloves were worn'.[10]

Fig. 6. The observatory at Low Wood, Harborne, Birmingham.
Courtesy of Elizabeth Morton.

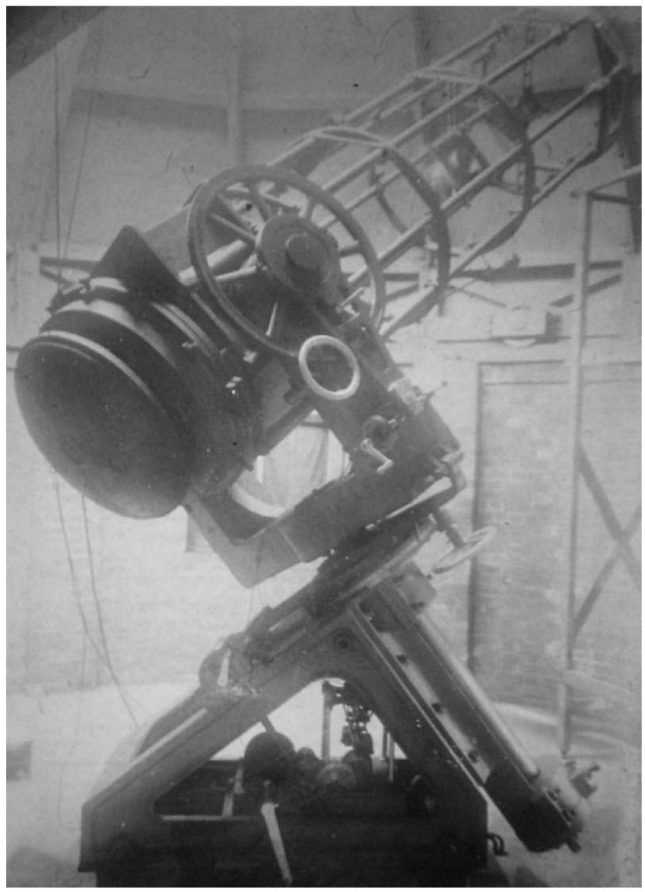

Fig. 7. The 28-inch reflector at Low Wood began work in 1911.
Courtesy of Elizabeth Morton.

The drive mechanism for the 28-inch was weight driven and regulated by means of a classical expanding governor similar to those made by Warner and Swasey Co. for their large instruments in the late nineteenth century and which were adopted by so many later manufacturers. Since the telescope was frequently used at the Newtonian focus a heavy observing platform was fitted to the inside of the rotating part of the dome so that access to the eyepiece ceased to be a problem. This arrangement is similar to that used with the Crossley 36-inch reflector at Lick Observatory and also the 74-inch David Dunlap reflector in Toronto, Canada.

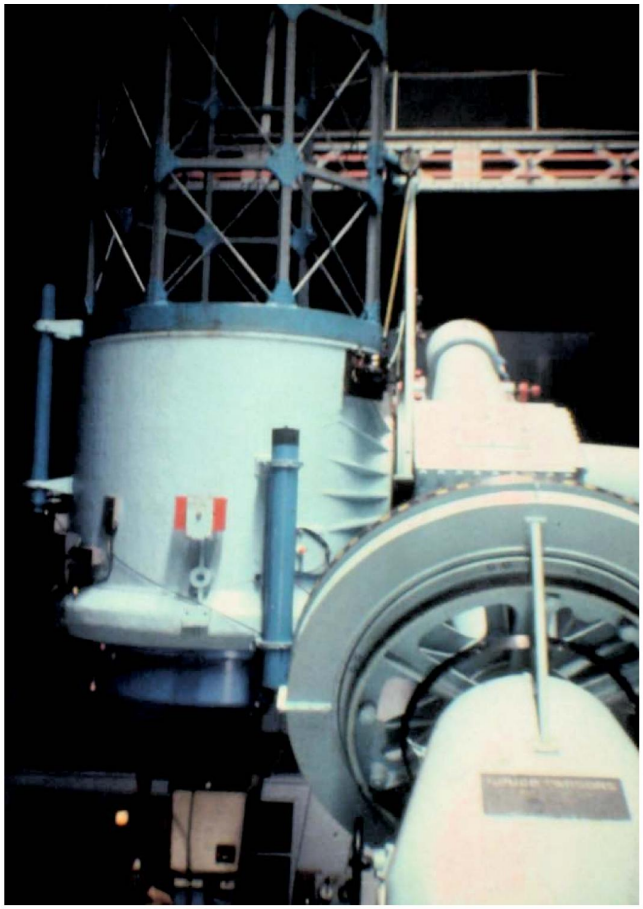

Fig. 8. The 30-inch at Mount Stromlo in the 1970s. Sadly it was destroyed by fire in 2003.
Courtesy of Prof. A.W. Rodgers, Mount Stromlo and Siding Springs Observatories, Canberra, Australia.

Eventually, in 1920, Reynolds replaced his own 28-inch primary with the 30-inch Common mirror which had been brought back from Helwan. However by 1924, as mentioned earlier, the City of Birmingham had expanded to the point where light pollution prevented much of the highly sensitive photographic work that Reynolds was doing from the Low Wood site, so with characteristic generosity he decided to donate the telescope for use at a better place. He chose the young Commonwealth Solar Observatory, which later became the Mount Stromlo and Siding Spring Observatories, near Canberra in Australia. At that time there was no big telescope in the southern hemisphere. Set up in 1927-30, and applied to photoelectric photometry, the 30-inch was to dominate that field until the 74-inch Grubb-Parsons instrument, that matched the David Dunlap reflector, was set up at the same site in 1956.

The Mount Stromlo Reynolds Telescope brought the original Common mirror back into service and the instrument was in steady use

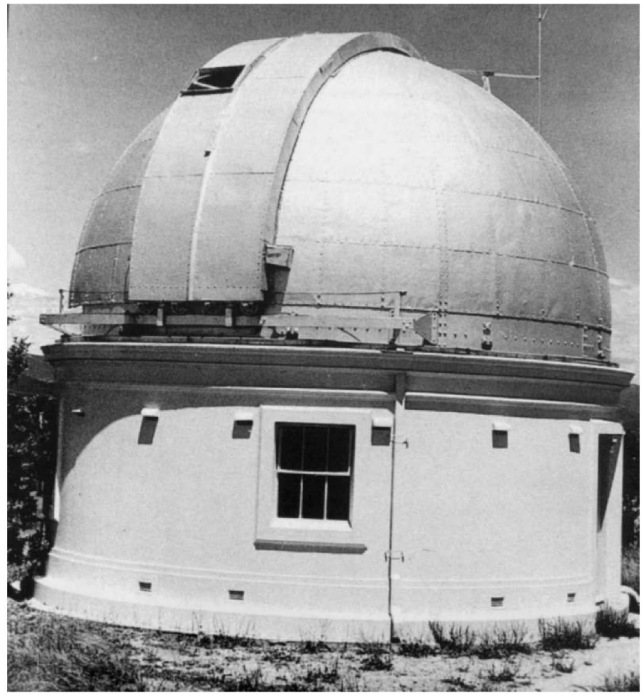

Fig. 9. Dome of the 30-inch Reynolds Telescope at Mount Stromlo.
Courtesy of Elizabeth Morton.

for almost a quarter of a century, after which it was extensively refurbished in 1979. Most of the open parts were covered with protective panels and major improvements were made to the drive.[11] Sadly this part of the story was brought to an abrupt end on the18th of January 2003 when a forest fire severely damaged the whole facility. The list of instruments destroyed is depressing. It includes the 74-inch Grubb reflector, the 50-inch Great Melbourne reflector, the 30-inch Reynolds reflector, the 9-inch Oddie refractor and the 26-inch Yale-Columbia refractor.[12]

The Low Wood Observatory in Birmingham closed in the mid-twenties and the 28-inch Reynolds mirror languished there for the next 30 years until it was bought by the Dunsink Observatory near Dublin to be used by Michael Smyth for a photometric project on certain variable stars. That mirror was made from ordinary plate glass and was only about three and a half inches thick. Its original cell was not capable of preserving a high resolution figure, but the set-up was quite adequate as a flux collector for photometric work. After being refigured by Cox, Hargreaves and Thompson in London, England, it was reattached on an old Grubb equatorial mounting on top of the old Observatory building and used to complete the project. There it remained for about a decade until deterioration of the dome led to its disuse and eventual closure. The telescope was dismantled and, I believe, the old mirror remains in the observatory. Who knows what may lie ahead for this interesting relic of a bygone age? Maybe, one day, a new active support system might give it new life.

Not only did J.H. Reynolds provide and use these pieces of expensive hardware to help solve some of the most intriguing problems in astronomy, but he also played an important part in the social activity of a prestigious scientific society and brought together many minds whose combined power was formidable.

In 1950, in his Obituary notice for J. H. Reynolds, Dr. Martin Johnson, Reader in Astrophysics at the University of Birmingham, wrote:

> Astronomers from many countries came to Birmingham to visit the Reynolds at the house called Low Wood. It is easy to recall scenes, grave and gay [I should remind the reader that

> this was the vocabulary current in 1950!] over many years. Eddington, in Birmingham to give a lecture, ill and only kept on his feet by the skilled ministrations of Mrs Reynolds, who is never dismayed by anything; Jeans, more engrossed in testing the fine organ in the house than in the lecture he was to give; Dyson, the Astronomer Royal, Jackson of the Cape, and many others occasioning the familiar call from Reynolds; 'We have a visitor here from a great Observatory, will you come along and be introduced?'. Perhaps the most vivid picture is of de Sitter from Leiden, most fascinating of astronomers, arguing in the Low Wood music room about relativistic cosmology and his dislike of nineteenth-century music, until Reynolds set out to convert him by playing the organ chorale preludes which Brahms had written at the end of his life.[13]

Reynolds was indeed a man who attracted affection, and the last duty he undertook was to attend one of the regular lectures which were endowed at the University of Birmingham, of which he was a governor. Martin Johnson recalls:

> When Professor Dingle, an old friend (and a relativistic cosmologist) came to give the Norman Lockyer Lecture in Birmingham on November 22nd 1949 Reynolds demanded medical permission to accept the University's invitation to honour the gathering, and in discussion at the end of the lecture he attacked with exhilarating vigour the uncertainties about galactic distribution ... he still had a knack of throwing out questions and challenges to the theoreticians of the day... he sat down having, as usual thrown a sobering and unanswerable problem into the arena, and as the audience dispersed, a few of them noticed that he was apparently tired and dozing off to sleep where he sat. No-one realized for some minutes that he had actually spoken his last word.

When Dr. Hugh Morton, Reynolds' son in law, died in 1980, I received a little package from his widow. It contained a few items that belonged to her father. One that I cherish most is an 1814 print (with the original frame and glass from the period) of William Herschel. I am very proud to have had this tenuous acquaintanceship with Reynolds, a gentleman I regard as one of the unsung heroes of our subject.

Although this paper was first published in 1995, a new book by David Block and Kenneth Freeman entitled *Shrouds of the Night* (2009) has an entire chapter devoted to the work of John Reynolds. This chapter clearly gives credit to Reynolds for the important contributions that he made to the study of the morphology of galaxies. His correspondence with Edwin Hubble shows that the inspiration behind the famous 'tuning fork classification' was clearly due to suggestions made by John Reynolds.

My original intention with this paper was to review the contributions to instrumental astronomy that were made by this remarkable man. However, having done a little of that, I feel I should add something about some of the other aspects of his influence upon national astronomy. John Reynolds was a Fellow of the Royal Astronomical Society for fifty years and a member of its Council for thirty years. His very successful career in business qualified him perfectly to assist in the running of the RAS and he became its Treasurer for seventeen of those years, which included steering the society through the rigours of the Second World War. He was elected President of the RAS from 1935 to 1937. It is clear, from his obituary notice by Harold Knox-Shaw, who knew him very well, that he was regarded by contemporaries as the 'doyen of British amateur astronomers' and 'was a kindly man, calm and dependable, the very best of companions'.[14] And yet, even though he was an amateur, his own personal observations and analyses of his own photographic, photometric and spectrographic measurements put him squarely in the same category as most active professional astronomers of the time.

His philanthropic support of astronomical research at Oxford University matches that of Warren De la Rue of half a century earlier. De la Rue gave his famed 13-inch photographic reflector to Oxford University Observatory in 1849. In 1904 Reynolds had originally offered the 30-inch reflector to Prof H.H. Turner at Oxford – but circumstances prevented the acceptance of the offer at the time and thus it went to Helwan instead. In the late nineteen twenties Reynolds paid for a new spectroscopic instrument for Cambridge University in order to enhance their, by then, dominant astrophysical work.

In short, John Henry Reynolds was one of the very last Grand Amateurs in Britain whose influence was felt around the world. Not only did he inspire the work of such practitioners as Edwin Hubble (1889-1953) in his study of the Nebulae, he even inspired an impressionable teenager who was just entering the world of science, by means of one of his beautiful photographs that had been printed in a school textbook!

Notes and References

1. This is an updated version of an article that appeared in the *Journal of the Antique Telescope Society*, 8 (Spring- Summer 1995), pp. 12-16
2. Dickenson, F.W., private letter to J.H. Reynolds, May 1902. From the collection of Elizabeth Morton (Reynolds family).
3. Ritchey, G.W., 'On the Modern Reflecting Telescope and the Making and Testing of Optical Mirrors', *Smithsonian Contributions to Knowledge,* vol. 34 (1904, Smithsonian, Washington), pp. 10-11.
4. Hodge, Paul, 'The Andromeda Galaxy', *Mercury,* 22, 4 (July-August 1993), pp. 99-108.
5. Knox-Shaw, H., 'Helwan Observatory, Egypt', *Monthly Notices of the Royal Astronomical Society*, 75, 4 (Feb., 1915), p. 297.
6. King, H.C., *History of the Telescope* (Charles Griffin and Co., London, 1955), pp. 194 and 200.
7. Ritchey, G.W., 'On the modern reflecting telescope and the making and testing of optical mirrors', *Smithsonian Contributions to Knowledge*, 34, 3 (1904, Smithsonian), p. 51.
8. Common, A.A., 'Note on an Apparatus for correcting the Driving of the Motor Clocks for large Equatorials for long Photographic Exposures', *Monthly Notices of the Royal Astronomical Society*, 49, 5 (March 1889), pp. 297-300.
9. [Knox-Shaw, H.], 'The Late Mr. John Henry Reynolds', *Royal Observatory Helwan, Special Notice* (Cairo University Press, 1950), p. 3.
10. Kennerley, J., (daughter of J.H.R), personal communication, September 7, 1993.
11. A.W. Rodgers – Director of Mount Stromlo and Siding Springs Observatories, personal communication, August 22, 1991.
12. Orchiston, Wayne., 'The Mount Stromlo Fires', *News Report*, Feb. 21, 2003, Australian National University (http://www.mso.anu.edu.au/info/fire/orchiston).
13. Johnson, M. C., 'John Henry Reynolds', *Monthly Notices of Royal Astronomical Society*, 110, 2 (1950), pp. 131-33.
14. Knox-Shaw, H., 'John Henry Reynolds', *Observatory*, 20, 854 (Feb. 1950), pp. 30-31.

The author

Dr. Ron Maddison taught Physics and Astronomy at Keele University for 30 years before leaving to be Director of the Observatory at the Astronaut Memorial Planetarium and Observatory in Cocoa, Florida, for a further 11 years. He is a past President of the International Antique Telescope Society and now lives in retirement in Cocoa, Florida.