BAA Update

Meeting of the Historical Section

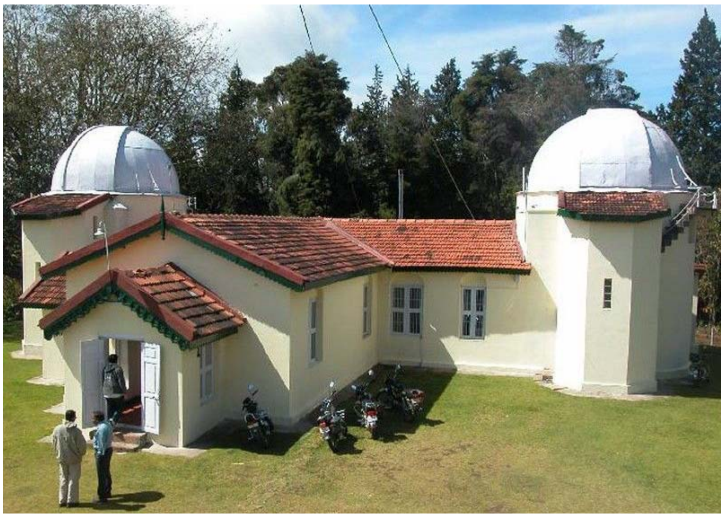
held at the Institute of Astronomy, Cambridge, on 2010 November 27

On 2010 November 27, the first meeting of the recently re-launched Historical Section was held at Cambridge. Although the Historical Section was founded as long ago as 1930, it has had no meetings in recent memory and this may have been the first Section meeting ever! All the speakers managed to get to Cambridge and the meeting attracted a healthy turnout, despite the increasingly inclement weather across many parts of the UK.

The meeting had twentieth-century astronomy as its theme. The Section's new Director, Mike Frost, opened proceedings, and then introduced the first of the day's main speakers, Bob Marriott, BAA Curator of Instruments and Director of the Instruments and Imaging Section, who spoke about the life of Mary Evershed (1867–1949), the founder of the Historical Section and a highly respected astronomer and author in the early twentieth century. Born Mary Ackworth Orr, her father died when she was just three years old, but the family was well-to-do and Mary received an excellent education from a governess. Her interest in astronomy began when she was very young. The family later lived in Germany, Italy, and Australia, and during her years 'down under' Mary wrote *An Easy Guide to Southern Stars*, with an introduction by John Tebbutt.

On returning to Britain in the 1890s, Mary went on eclipse expeditions organised by the fledgling BAA, and on the 1896 trip to Norway she met her future husband, the solar astronomer John Evershed. They married in 1906, and the following year they moved to India, where John became Assistant Director at Kodaikánal Observatory, of which he was appointed Director in 1911. While there he discovered the 'Evershed effect' – Doppler shifts caused by the radial flow of gas in sunspots. Meanwhile, Mary carried out important research on solar prominences, publishing her results both on her own and with her husband.

Mary also became an authority on Dante Alighieri, the mediaeval Italian poet, particularly on the many astronomical allusions in Dante's *Divine Comedy* – a poem describing a journey through Hell, Purgatory and Heaven. In 1914 she published a book, *Dante and the Early Astronomers*, whose place in the scholarly literature on Dante became assured when the poem was later translated by the well-known crime novelist Dorothy L. Sayers. John Evershed retired from Kodaikánal in 1923, and the couple went to live in Ewhurst in Surrey, where they continued their solar work in their own private observatory. Mary continued her researches into the history of astronomy, founding the BAA Historical Section in 1930 and compiling *Who's Who in the Moon*, an index of the various scientists and other historical figures after whom lunar craters and other features are named.



Kodaikánal Observatory's first building, dating from 1899. *Photograph courtesy Rajeev Singh.*

Mike Frost then introduced Jeremy Shears, who described the life of Felix de Roy (1883–1942), a charismatic Belgian newspaper editor who was Director of the BAA Variable Star Section from 1922 to 1939. De Roy showed an interest in science from a very early age and was talented in science and mathematics at school, though in the event he chose a career in journalism, in which he was also very successful. He worked on several major Belgian newspapers and by the eve of the First World War was editor of *La Métropole* in Antwerp. In 1905 he helped found the Astronomical Society of Antwerp, a major association of amateur astronomers, and the following year he joined the BAA. Variable stars were his main interest from the beginning; during the course of his life he made some 91,000 variable star estimates.

At the beginning of the First World War, Belgium was invaded by the Germans and quickly fell to the German army. De Roy, along with a number of his fellow countrymen, fled to Britain. (It was to protect Belgian neutrality that Britain declared war on Germany in August 1914, so many Belgians saw the British Isles as a natural place of refuge.) He barely escaped from Antwerp in time before it fell. During the war, de Roy lived near Croydon and continued production of his newspaper from abroad. He also carried on his variable star observations; the most notable of these was his independent discovery of Nova Aquilae in 1918, which peaked at magnitude 1.4 and became the brightest nova of the twentieth century. While in England he forged close working relationships with many BAA members; one of them, Fiametta Wilson, lent him a 3½-inch refractor, which enabled him to continue observing, as he had had to leave his own telescope behind in Belgium.

In 1922, when back in his native country, he was appointed director of the BAA Variable Star Section. The day-to-day administration of the Section was done by UK-based members, first A. N. Brown, then W. M. Lindley, while de Roy concentrated on analysing and publishing the observational results. Within months of becoming Director, he organised a Section meeting, travelling to Sion College in London for the occasion. He published regular Section reports in the BAA *Journal* and also prepared a major BAA *Memoir* on observations of long-period variables. De Roy also pioneered international cooperation in variable star work, attending meetings of the International Astronomical Union and forging close links with the American Association of Variable Star Observers, sending them regular monthly reports and being given honorary membership of that organisation in 1928.

War and enemy occupation returned in May 1940, and this time de Roy had to spend the war in Belgium (although he briefly fled to France in the summer of 1940). The Nazi regime commandeered his house and imposed severe food rationing, which may have been responsible for a sharp deterioration in de Roy's health. He died from pneumonia in May 1942, aged just 58.

During the lunch break, Lee Macdonald gave a guided tour of the historic 12-inch Northumberland refractor at the Cambridge University observatory – famously, the telescope with which Neptune was *not* discovered! Lee then gave the first formal talk of the afternoon session, on how the

98-inch (2.5m) Isaac Newton Telescope came to be built in the cloudy countryside of Sussex, where it remained for twelve years before being moved to La Palma. The INT had its origins at the end of the Second World War, when leading British astronomers were considering how to rebuild UK astronomy. They felt that Britain had lost the lead in observational astronomy to the USA, and wanted British astronomers to have a telescope large enough to compete with the big American instruments, such as the 100-inch at Mount Wilson. They also thought that a big telescope in this country was essential if observational and theoretical astronomers were to work together effectively, and that the British climate did not necessarily render such a large instrument ineffective. The government, for their part, saw a big telescope as a prestige project. In the summer of 1946 £100,000 of government funding for a 100-inch telescope was secured in an incredibly short time, and the project was underway.

It was soon decided to locate the new telescope at the Royal Observatory's new home at Herstmonceux in Sussex, and the Board of Management responsible for designing and building it was headed by the Astronomer Royal of the time, Harold Spencer Jones, who was chiefly a positional astronomer and had no experience of giant telescopes; moreover, he also had to deal with moving the rest of the observatory from Greenwich to Herstmonceux. The project soon ran into technical difficulties, partly because the astronomers wanted to build two telescopes in one – a Schmidt camera for wide-angle photography, which could be converted into a conventional Cassegrain reflector for spectroscopy when the giant corrector plate was removed. No convertible telescope of anything like this size had ever been tried before. The 80-inch corrector plate proved to be beyond the capabilities of the finest optical glassworks, and designing a tube capable of maintaining the optical components in collimation to the stringent tolerances required by the design posed insuperable engineering problems.

This stalemate persisted until 1956, when Richard Woolley took over as Astronomer Royal. Woolley was an observational astrophysicist who had set up a 74-inch telescope at Mount Stromlo Observatory in Australia, so unlike Spencer Jones he had much practical knowledge of large telescopes. Soon after entering office, he quickly abandoned the dual-purpose design and began drawing up plans for a conventional Cassegrain telescope. But then the project was delayed by a further two years, due to government funding cuts caused by a severe economic crisis, and it was only in 1959 that designs were finally submitted and a contract to build the instrument given to Grubb Parsons of Newcastle upon Tyne, a firm which by then had built a number of large telescopes across the globe. The INT was finally completed in 1967.

There are three broad reasons why the INT took so long to build and why it was built at such an unsuitable location as Herstmonceux. Firstly, both the government and the scientists themselves saw it more as a prestige project than one of scientific utility; this does much to explain the dogged persistence with the unworkable dual-purpose design. Secondly, Spencer Jones was not an ideal leader for the project. Finally, the sheer difficulty of travelling long distances abroad in 1946, and the fact that the telescope was designed by astronomers of an older generation who were not used to regular travel, meant that there was no realistic choice of overseas location for the INT.

Speakers at the Historical Section meeting. *From left to right:* Lee Macdonald, Mike Frost, Jeremy Shears, Bob Marriott, Simon Mitton, Jacqueline Mitton. *Photo by Mike Frost.*

Next in the afternoon session, Jay Tate described Project 'Drax' – how a disused Schmidt telescope at Cambridge was being brought back to life at the Spaceguard Centre in the Welsh Marches in order to search for near-earth objects (NEOs) – asteroids and comets whose orbits come close to that of the Earth and which pose a potential impact hazard. The Spaceguard Centre is a small but growing observatory, the work of a small group of dedicated amateur astronomers. It has several telescopes and a small planetarium. As well as astronomical education and outreach, it is also actively involved in the search for NEOs. It receives no government funding and relies wholly on volunteers and generous donations by various businesses.

The Centre's ability to search for NEOs received a massive boost in 2007 when the Institute of Astronomy at Cambridge University (the site of today's meeting) offered to donate a 61cm (24-inch) Schmidt camera which it no longer needed. The Schmidt has a true photographic field of 5°, making it an ideal instrument for surveying the skies in order to detect NEOs. Built in 1950, it was used at Cambridge for important research in the 1950s and '60s, but increasing light pollution meant that it fell into disuse; it was last used at Cambridge in 1985–'6 to take plates of Halley's Comet. The telescope was, however, still in very fine condition when Tate and a team of enthusiasts came in June 2009 to dismantle it and load it onto a truck to be transported to Wales.

Dismantling the venerable instrument proved to be quite a hair-raising process, involving a 42-ton crane. The tube was removed easily enough through the slit of the dome, but it proved impossible to separate the fork mounting from the base assembly without risking permanent damage to it, so both parts had to be hoisted out of the dome as a single piece, weighing five tonnes. To make matters worse, the base was wider than the dome slit, so it required some careful persuading before it came out. The removal was witnessed by many members of the IoA staff, including the Astronomer Royal, Lord (Martin) Rees.

The telescope components were safely delivered to a site near the Spaceguard Centre, where they are being stored, and groundwork has started for the telescope's new dome. At Cambridge the Schmidt used glass photographic plates 15cm (6 inches) across, but for the twenty-first century it will need a CCD camera. A CCD chip of this size is impossible, and in any case would not work properly on the Schmidt's curved focal plane, so it is planned to install a series of smaller CCD chips instead. But none of this can happen without funding: of the nearly £60,000 total cost of the project, some £37,000 is still needed, so the Spaceguard Centre is actively seeking donations. The speaker concluded by expressing determination that this obstacle will be overcome and that one day the project will succeed.

Dr Jacqueline Mitton, a former Editor of the BAA *Journal*, then presented a fascinating biography of Maria (pronounced Mar-EYE-ah) Mitchell (1818–'99), the earliest woman professional astronomer in the United States. Maria Mitchell was born on Nantucket Island and lived there until 1861. Her parents were staunch Quakers, although they were not particularly 'strict' parents as such. Her father was responsible for regulating ships' chronometers and collaborated with both the academic and naval worlds – including William Cranch Bond, the first Director of Harvard College Observatory. He was interested in astronomy and encouraged young Maria, who began observing the sky with her father from the age of twelve. It was thought locally that women should have a good education because, Nantucket being a seafaring community, women often had to take on men's jobs when the latter were away. At the age of eighteen, Maria was invited to become the librarian at the new Nantucket Athenaeum. Here she used a generous allocation of private study time to read books by the mathematicians Gauss and Laplace, and continued observing the sky at night in the hope of discovering a comet, then a prestigious feat that was recognised internationally.

In October 1847 Maria achieved her dream, discovering a comet 5° above Polaris, and her father reported the discovery to Bond at Harvard. Maria was awarded a gold medal for comet discovery that had been instituted by the Danish monarchy. The discovery brought her much publicity perhaps because she was a woman – and drew attention to her extraordinary abilities, which lay in both the observational and mathematical sides of astronomy. She computed the ephemeris for Venus that appeared in the first edition of the US Nautical Almanac, published in 1855; as she was paid for her contribution, she became the first paid US woman astronomer. Then, in 1861 Matthew Vassar, a wealthy brewer, built Vassar College in Poughkeepsie, New York, as a university for women. Many were not keen on having women as faculty members of the new institution, but Vassar himself insisted on having Maria Mitchell as professor of astronomy.

Mitchell's time at Vassar was not always easy. The 12-inch refractor of the university's observatory had many technical problems, which were not solved until near Mitchell's retirement in 1889. She also had many teaching commitments, and so had little time for research. She was, however, adored by her female students, although there were few opportunities in astronomy for them in the 19th century. However, the example of Maria Mitchell may have inspired Edward Pickering to employ women as 'computers' – people to do calculations – at Harvard from 1875, and some of these became important astronomers in their own right. Among 20th century Vassar College graduates is Vera Rubin, who discovered evidence for dark matter by studying galactic rotation curves. Most of Mitchell's successors at Vassar were female, and the current Maria Mitchell Professor of Astronomy, Debra Elmegreen, is President of the American Astronomical Society, the US' body of professional astronomers.

Jacqueline's husband Dr Simon Mitton rounded off the day with a talk on the life and work of Sir Fred Hoyle, one of the 20th century's most colourful and controversial astronomers. Hoyle was born in a village near Bingley, Yorkshire, in 1915, the son of a textile salesman. He showed scientific interests from an early age, though his school career was chequered early on, and he once played truant for five weeks, unbeknown to his parents. However, he won a scholarship to his local grammar school and began to shine academically during his last two years there. With the help of a scholarship from his local education authority, Hoyle was admitted to Cambridge University to read Natural Sciences, but switched to Mathematics after just two weeks. He quickly proved to be an outstanding student, skipping the second year of the course and becoming the highest-placed student in his third year. Later, he became a research student in nuclear physics with Paul Dirac as his supervisor. This suited both parties, as the introverted Dirac did not like supervising, and Hoyle was too independent to need close supervision. In 1940, Hoyle was engaged by the Admiralty to do secret radar research. He made a major contribution to the war effort by developing a method of finding the range and altitude of incoming enemy aircraft, which is said to have saved numerous lives in the eastern Mediterranean.

In 1944, Hoyle went on an official trip to the United States, and while there found an excuse to visit Mount Wilson Observatory in California. There he met the German astronomer Walter Baade, who was under house arrest at the observatory as an enemy alien. Baade, who was doing pioneer work on stellar populations and extragalactic astronomy, stimulated Hoyle's interest in supernovae and stellar 'nucleosynthesis' – the formation of chemical elements in the stars. At this time, how elements heavier than hydrogen and helium had been formed in the universe was still a mystery. After the war, Hoyle concentrated on the problem of how carbon is produced in stars. He noted that carbon has an excited state at a certain energy level, and persuaded Willy Fowler, a physicist at the Kellogg Radiation Laboratory in California, to use a reactor to test Hoyle's theory that this excited carbon could be produced in stars. The experiment proved Hoyle's theory correct. Working in collaboration with Fowler, and the husband-and-wife team of astronomers Geoffrey and Margaret Burbidge, Hoyle worked out how some 240 isotopes are produced in stars in the abundances observed by astronomers. The resulting paper, affectionately nicknamed 'B^2FH' (Burbidge, Burbidge, Fowler, Hoyle), is a landmark achievement in stellar astrophysics. Archival research suggests that it was Hoyle who did the theoretical astrophysics, the Burbidges who provided the astronomical data and Fowler the experimental nuclear physics.


Fred Hoyle as a young man.

Also in the years after the war Hoyle developed his 'steady state' theory of the universe, along with two former wartime colleagues, Hermann Bondi and Thomas Gold. The three scientists proposed a theory which suggested that the universe is continually filling up with new matter as it expands. This model dispensed with the fashionable idea that the universe had exploded out of a point source at some finite point in the past – what Hoyle disparagingly called the 'Big Bang' theory. He first used the phrase 'Big Bang' in 1949 in a series of radio broadcasts called 'The Nature of the Universe'. These were later published as a book, which generated huge public interest (as well as some controversy), and sales of this book earned Hoyle six times his university salary in 1950 alone!

The steady state theory seemed to solve a problem posed by the Big Bang model, which suggested that the universe was younger than many of its stars. What was needed was observational proof. This led Hoyle into conflict with the Cambridge radio astronomer Martin Ryle, who strongly distrusted theoretical astronomers. Ryle's first two surveys of the radio sky tended to agree with Hoyle's theory, but they were later found to be flawed. Ryle's third radio survey was correct, and this time the counts of radio galaxies agreed with the Big Bang theory. Ryle's announcement of the results of his third survey was deliberately stage-managed to humiliate Hoyle. The final blow to the steady state theory came in 1965, with the discovery of the cosmic microwave background radiation left behind by the Big Bang.

Hoyle caused much controversy in Cambridge science. In the late 1950s, it was decided to set up two mathematics departments in the university, and Hoyle was assigned to the Department of Applied Mathematics and Theoretical Physics (DAMTP). But Hoyle had a habit of taking long periods of research leave in California, without doing any teaching in Cambridge, and this did not impress the authorities at DAMTP. Hoyle decided to try to set up a centre in Cambridge dedicated to research in theoretical astronomy. After many negotiations he achieved his aim, and the Institute of Theoretical Astronomy opened in 1967, attracting leading scientists from around the world to do cutting-edge research in astrophysics. When, in 1972, the university merged the new institute with the astronomical observatories into a new Institute of Astronomy, Hoyle did not get the directorship and resigned in protest, never to hold a full-time university position again. But the Institute of Astronomy lives on to this day and is now one of the world's greatest astronomy departments.

A fascinating display of papers and photographs that had belonged to Fred Hoyle was brought to the meeting by Katie Birkwood of St John's College, Cambridge, of which Hoyle was a Fellow.

The meeting was felt to be very enjoyable and it is hoped that it will be the first of many successful Historical Section meetings.

Lee Macdonald