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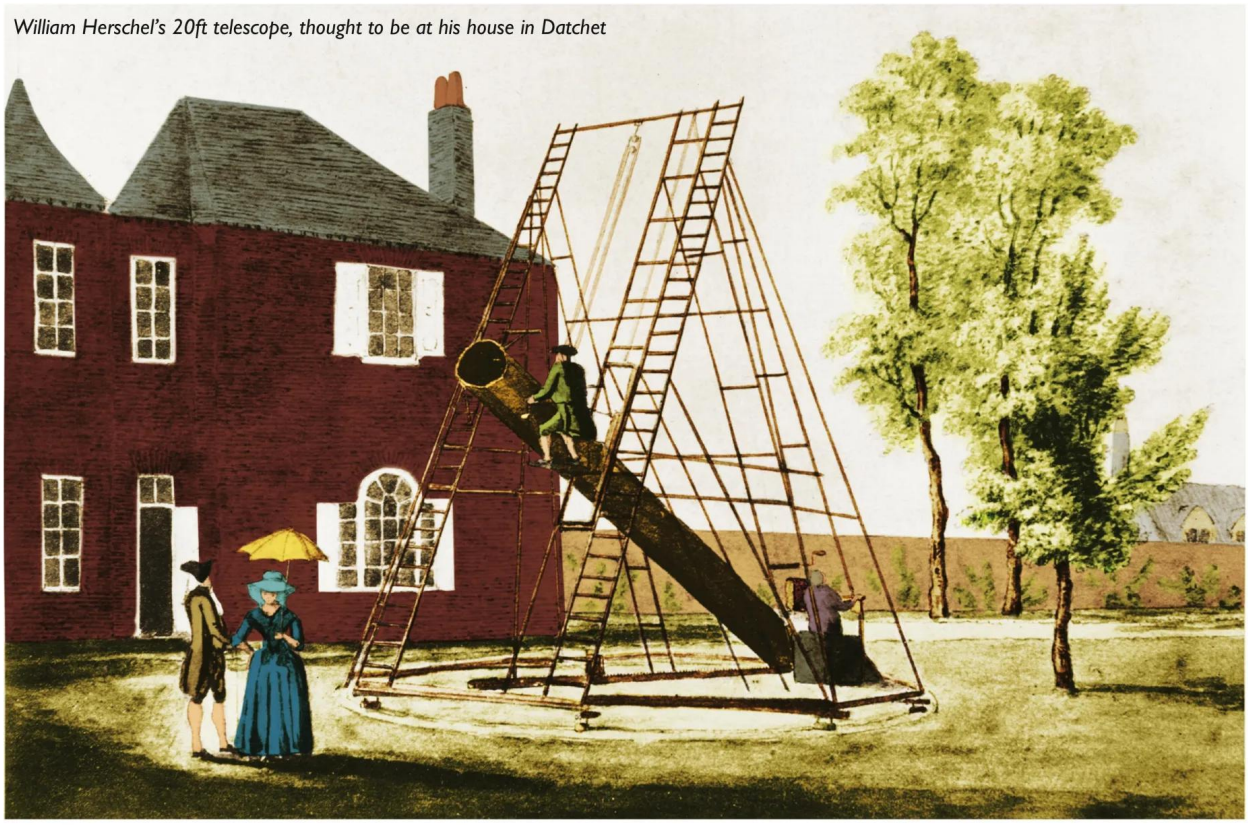

William Herschel's 20ft telescope, thought to be at his house in Datchet

EYES TO THE SKIES

Fiona Young-Brown on the life of comet-finder Caroline Herschel, who was the first woman scientist and an astronomer extraordinaire

THE role of women in science has often been downplayed. Many famous men could not have made their groundbreaking discoveries were it not for wives, assistants and servants who all supported their work, sometimes even carrying out the experiments which would change our understanding of the universe. As the 200th anniversary of astronomer William Herschel's death has been marked in 2022, another date deserves to be marked in 2023. For that is the 175th anniversary of the death of Caroline Herschel, an equally important but oft-ignored member of the scientific community. She was William's sister.

Caroline achieved many notable firsts during her lifetime. She was the first woman to be credited with discovering a comet. Technically, Maria Kirch was first to discover one in 1702, but credit was given to her husband. Caroline was also the first woman to be officially recognised as a scientist, the first to gain honorary membership to the Royal Society, and the first to be given a paid scientific position by King George III. Over the course of her 97-year life, she discovered eight comets and multiple nebulae. Yet she did so in a rather unassuming fashion.

Caroline Lucretia Herschel was born on 16 March, 1750, in Hanover, Germany. She was one of 10 children born into a musical family. Bouts of smallpox and typhus during childhood left her with facial scarring and stunted her growth. In adulthood, she never stood taller than 4 feet and 3 inches. In her memoirs, Caroline recalls that typhus "reduced my strength to that degree that for several months after I was obliged to mount the stairs on my hands and feet like an infant". To the chagrin of her father, she received no formal education. She later wrote that while her father wished her to receive training, her mother was determined that she should receive "nothing farther . . . but to send me to a sempstress to be taught to make household linen".

Her relationship with her mother appears to have been fractious, with Caroline fearing a future in which she was little more than a housemaid. Fortunately, she had more affection from her father, when he was home, and her brother William. She recalls her father taking her into the snowy streets of Hanover to show her the stars. Little did she know how those stars would redefine her future. But first, there would be music.

In 1758, William moved to pursue a musical career in England as a composer and the organist at Bath's Octagon Chapel. Possibly aware that his younger sister faced a bleak future in Germany, in 1772 he wrote to request that she join him in Bath to

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become his assistant. Over the protestations of her mother (William promised to pay for a servant to perform Caroline's household duties), she embarked on the adventure. Once in Bath, Caroline barely had time to catch her breath before her education began. She had to learn English so that she could manage her brother's household. He also tutored her in mathematics and music. The first few months were extremely difficult for her. She spoke little English, had no friends, and scarcely saw her brother. She wrote of her struggles with "homesickness and low spirits". Luckily, their brother Alexander often came to stay with them. She soon began voice training and by 1777 she was performing for the cream of Bath society as a successful soprano, though only in public when her brother conducted.

Throughout her life, and in her memoirs, Caroline frequently deferred to William, describing her role as nothing more than to assist him in his work. This self-effacing nature means that few today remember her accomplishments. Yet Emily Winterburn, author of *The Quiet Revolution of Caroline Herschel*, argues that it was this very behaviour that granted her access to places where women were not welcome.

As much time as Caroline devoted to her musical education, little did she know that, to William, musical success was a means to an end. His earnings and status as a musician allowed him to follow his preferred pursuit: astronomy. Once again, Caroline was hard at work behind the scenes. She learned to polish and grind mirrors, and to perform complex mathematical calculations. The tasks were not something that she enjoyed at first. It seems clear that she missed music, but "I saw nothing else and heard nothing else talked of but these things (mirrors and lenses) when my brothers were together".

The next few years saw another major move for Caroline, one in which she had little say. In 1781, William discovered a new planet, Uranus. For this, he was knighted and appointed the Royal Astronomer and William's, and therefore Caroline's, days were now consumed with the stars. They gave their final musical performance on Whit Sunday in 1782.

Caroline and William worked together in Bath

Left: Etching of Caroline, 1847
Right: Caroline and William at their telescope

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MUSEUM OF ASTRONOMY

On Bath's New King Street, a short stroll from the grandeur of the Royal Crescent and tourist crowds, a rather unassuming terrace of townhouses where the Herschels once lived is home to the Herschel Museum of Astronomy. Caroline lived with William in Bath from her arrival in 1772 until they moved to Slough 10 years later.

While the house in Slough has long since been demolished, No.19 New King Street stands as a museum of their work. The museum's patron is Dr Brian May – a musician and astronomer, like the Herschels. The museum's collection includes a number of musical instruments, as well as telescopes. The workshop holds a collection of tools to demonstrate how Caroline would have worked on grinding the lenses for William's telescopes.

A recent addition to the museum's holdings is Caroline's visitor book from when she lived near Windsor. Signatories include royalty, Lord Byron, and other notable names of the era. Behind is the small garden where William first spotted Uranus. A stone sculpture of the siblings mapping the heavens stands among the flowers.

The Herschel Museum of Astronomy is open Tuesday-Sunday 10am-5pm; herschelmuseum.org.uk

Top: Telescope; Middle: Commemorative plaque; Bottom: The music room

> Just a few months later, the family moved to Datchet, near Slough, to be closer to Windsor. In her private journal, Caroline expressed grave doubts about the move:

"Till now, I had not had time to consider the consequence of giving up the prospect of making myself independent by becoming a useful member of the musical profession . . . But my brother William would have been very much at a loss for my assistance."

As William threw himself into his new passion, conducting a complete survey of the night sky, Caroline was there to assist him. He built her her own telescope so she could better help him. She had little time to herself, but she began to keep a journal noting her own observations in the night sky.

In 1783, Caroline discovered a new nebula, a cluster of stars now named NGC 2360. She went on to discover another 14 nebulae. But a key discovery came in 1786. In her journal she noted that "this evening I saw an object which I believe will prove tomorrow night to be a comet". The next evening's observations confirmed this. She wrote of her findings to fellow astronomer Alexander Aubert, who replied a few days later to congratulate her, declaring, "You have immortalized your name."

Her comets and nebulae were all discovered while William was away travelling and these sweeps were not tasks that he had assigned for her in his absence. Rather, she was choosing to do these. Historians have remarked that this suggests a certain degree of ambition in her own right and despite her modest nature when presenting her findings, these were most certainly Caroline's discoveries.

In 1787, King George III officially appointed Caroline as her brother's assistant, making her the first professional female scientist. She glosses over the significance of this in her journals, simply noting that she was to be paid a salary. The following year, William married. Caroline was no longer required to run the household and moved into her own lodgings. We know little about the decade following the marriage as Caroline later destroyed her journals from this time. We suspect the change in circumstances was difficult for her at first. On the other hand, it gave her more time to devote to astronomy and she made some of her most notable discoveries during this period, including another seven comets. Sir Henry Englefield, a fellow astronomer, wrote to William that she would "soon be the great comet finder". Caroline also took it upon herself to cross-index and update John Flamsteed's existing catalogue of the stars, with 550 newly discovered additions. In 1798, the Royal Society published two of her works.

Family affairs took up much of her time from 1800 onwards. Caroline faced health issues of her own and was frequently required to nurse other family members "according to the old Hanoverian custom". We know little of what she did during this time, although she seems to have snatched what moments she could to continue her work of cataloguing the stars.

On 25 August, 1822, William passed away after a lengthy period of ill health. A distraught Caroline was certain that she should not live much longer. Announcing that "I am a person that has nothing more to do in this world" she moved back to Germany, never to return to England. She destroyed some of her journals and kept few personal records in the following years.

While she expected to live little more than a year beyond William's death, Caroline did in fact live to the ripe old age of 97, continuing her work for as long as she was able and receiving many distinguished visitors at her home. In 1828, the Royal Astronomical Society presented her with a Gold Medal. Sir David Brewster described her catalogue of the stars as "an extraordinary monument of the unextinguished ardour of a lady of 75 in the cause of abstract science".

Caroline died on 9 January, 1848. The inscription on her tombstone reads "The eyes of her who is glorified here below turned to the starry heavens". An asteroid is named for her, along with several comets and the C. Herschel crater on the moon.

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