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LOST TREASURE
OF THE ANDES

PLUS:

Stargazer Siblings

The Herschels' Astounding Astronomy

The Herschels: Siblings Who Swept the Heavens

In 18th-century England, German émigrés William and Caroline Herschel used pioneering telescopes to conduct the first sweeping surveys of the heavens.

Reaching for the Stars

1738

William Herschel is born in Hanover, Germany. Twelve years later, in 1750, his younger sister Caroline will be born.

1772

Caroline Herschel moves to England to live with her brother. There she assists William with his astronomical studies.

1781

William discovers Uranus. George III appoints him as his personal astronomer and grants him a pension.

1783

William and Caroline begin their “sky sweeps,” a project that lasts for 20 years.

1786

Caroline discovers the first of her eight comets. She announces her discovery and receives a pension from the king.

Brother and sister, William and Caroline Herschel left their promising musical careers to become astronomers. Whatever history lost musically, it more than gained scientifically. Until the Herschels, stargazing had largely been limited to observing the sun, moon, and planets visible to the naked eye. With improved telescopes of William’s design, the siblings made the first systematic observations of the stars and nebulae beyond the solar system, setting the course for the modern, scientific discipline of astronomy.

Their chosen profession was a long way from the humble life of the Herschel family in Hanover, Germany. Their father, Isaac, played oboe in the city’s military band, a few steps up from his own father’s position as a gardener. He insisted on a musical education for his 10 children as a means to social advancement. William, 12 years older than his sister, learned to play the oboe, violin, and organ, and followed his father into music. But, as the Seven Years’ War with France closed in on Hanover, William fled to London, arriving in 1758 at the age of 20. He found work as a music

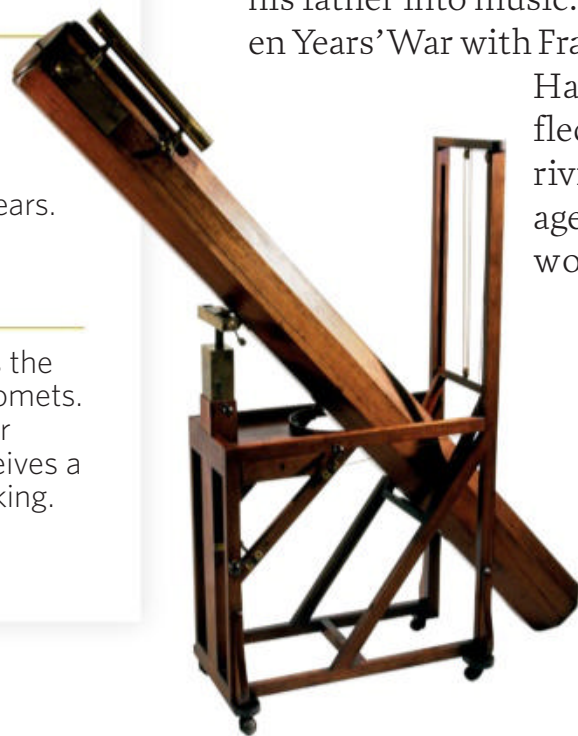
copyist, then tutored and performed until he landed a spot as church organist in Bath in 1766.

Located around 100 miles west of London, fast-growing Bath had a lively intellectual scene at the time. William placed himself in the thick of it. He joined the Bath Philosophical Society, and through lectures, discussions, and readings soaked up the latest findings in science and physics. He studied the relationship between acoustics and mathematics. These interests led to physics, then to optics, which introduced him to astronomy. However great his love for music, it was no match for astronomy and his self-proclaimed mission to learn “the construction of the heavens.”

A Giant Discovery

By the early 1770s William was studying telescope design. To manage his dual commitments to music and astronomy, William invited his 22-year-old sister, Caroline, to join him in Bath after the death of their father. She had been living a cloistered life in Hanover looking after their mother and eagerly accepted the offer, arriving in England in 1772. Also an accomplished musician, she played the harpsichord and sang.

Until the Herschels, stargazing had largely been limited to the sun, moon, and planets visible to the naked eye.



REFLECTING TELESCOPE MADE BY WILLIAM HERSCHEL
SSPL/GETTY IMAGES



RELATIVE VALUES

CAROLINE HERSCHEL'S diaries record her move in 1772 from Hanover to England to assist her brother: "I had to struggle against homesickness and knew too little English to derive any consolation from society." In the following decades she records her integration into English society, her burgeoning interest in William's astronomy, and her own observations. An entry from August 31, 1791, reads: "I began to sweep at 1.30, from the horizon through the Pleiades up as high as the head of Medusa. Afterwards I continued with horizontal sweeps till daylight was too strong for seeing any longer."

WILLIAM AND CAROLINE HERSCHEL.
COLORED LITHOGRAPH BY A. DIETHE
ALBUM/SCIENCE SOURCE/HELLMUT WELLMER

While continuing her musical studies and looking after the household, she worked by her brother's side. Caroline grew equally captivated by the night sky and absorbed her brother's knowledge of astronomy. A working arrangement developed between the two: William made observations while Caroline did the exacting work of cataloging and calculating the locations, an important step toward the modern mathematical approach to astronomy.

The following year, frustrated by the performance of his telescopes, William set out to make one of his own design.

Making a telescope was a team effort, as many of the components came from different sources. Eyepieces, micrometers, tubes and other parts required skilled craftsmen.

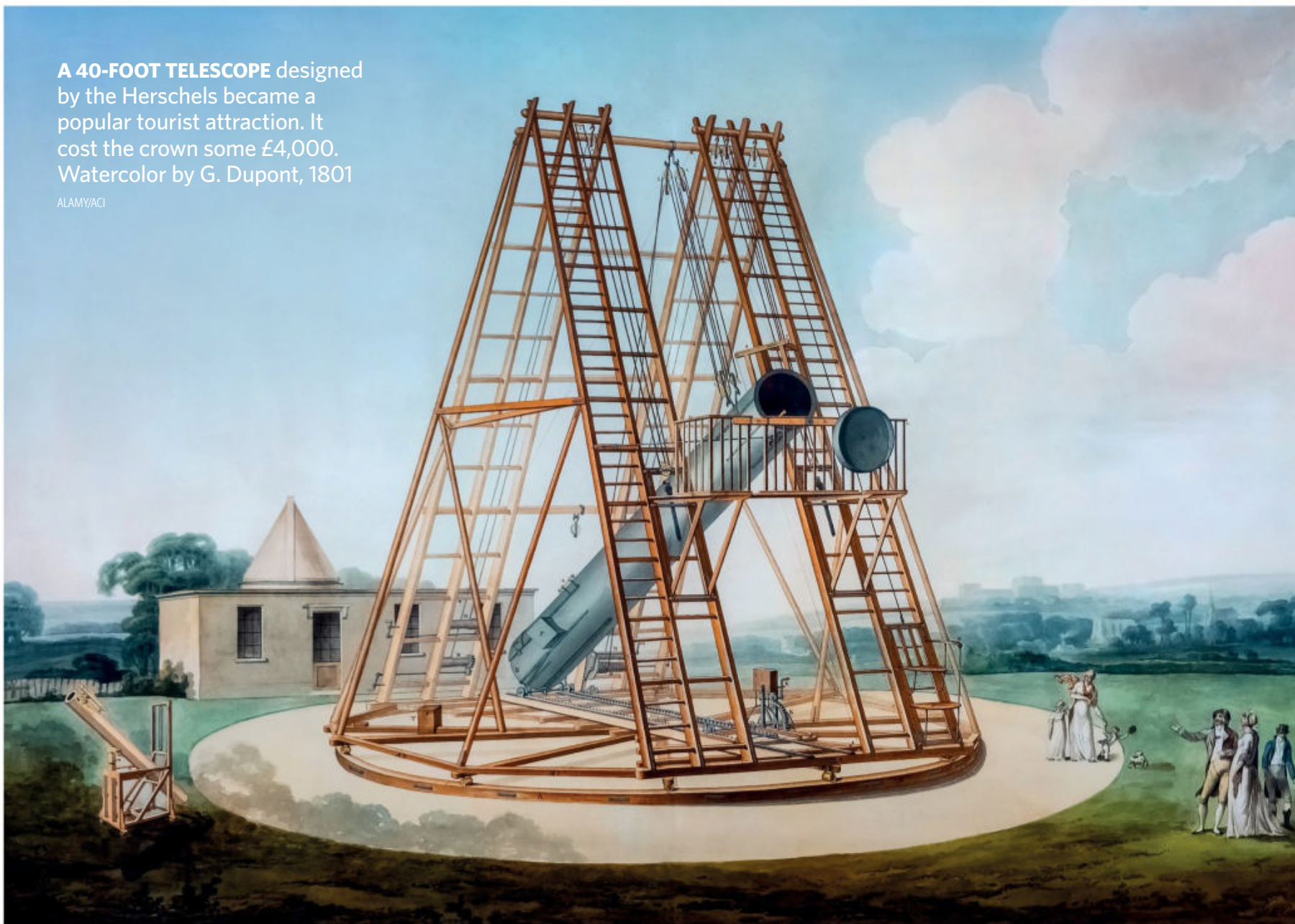
The metal mirrors needed intense polishing since large glass mirrors were not available at the time. Caroline recalled William's commitment to the task in her memoirs. "My time was so much taken up with copying Music and practicing, besides attendance on my Brother when polishing, that by way of keeping him alive I was even obliged to feed him by putting the vitals by bits into

his mouth," she wrote. "This was once the case when at the finishing of a seven-foot mirror he had not left his hands from it for 16 hours together." By the end of 1779, having verified his designs, William was considered the foremost telescope manufacturer of his time.

Two years later, while studying double stars (two stars that appear close together when viewed from Earth), William noted a faint object that moved slowly against background stars over several nights. At first he thought it was a comet, but with further study and confirmation from colleagues, it became clear

A 40-FOOT TELESCOPE designed by the Herschels became a popular tourist attraction. It cost the crown some £4,000. Watercolor by G. Dupont, 1801

ALAMY/ACI



he had found a planet, one of the solar system's ice giants. At first he called it Georgium Sidus, Latin for "George's star," in honor of King George III. Naming the new planet for the British monarch raised hackles in some other countries, so William opted for Uranus, a sky god from Greek mythology.

Jupiter, Saturn, and the solar system's inner planets had been recognized for millennia since they are visible to the naked eye. Uranus was the first planet discovered using a telescope. For his discovery, William won international fame. He was knighted and made court astronomer by the king, with an annual

pension of £200 on the condition he live near Windsor and be available whenever the king wanted to stargaze.

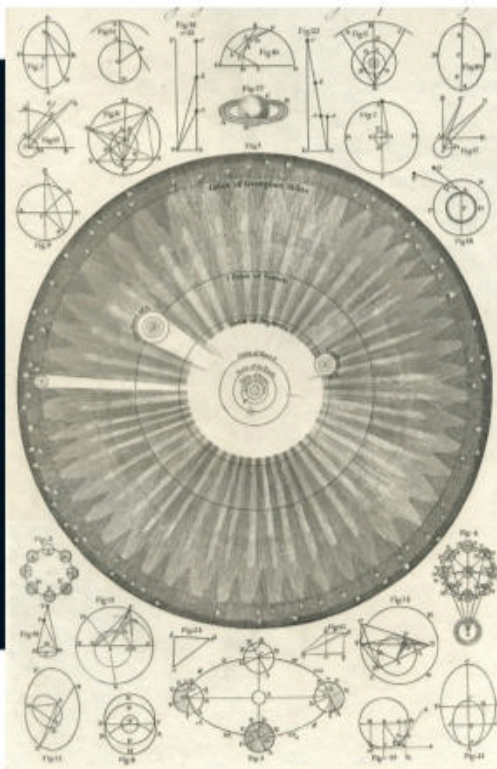
Sweeping the Skies

William and Caroline abandoned their musical careers in Bath and moved near Windsor Castle to take up the life of full-time astronomers. In 1783 they began their path-breaking, 20-year survey of the night sky, called "sweeping," (looking through the eyepiece as the telescope was steadily "swept" from horizon to zenith) to find deep-sky objects like nebulae and star clusters. It was painstaking work. William could not divert his gaze, while Caroline spent hours recording her brother's observations and confirming measurements and angles.

THE SHOCK OF THE NEW

WILLIAM HERSCHEL received the credit for discovering the planet Uranus in 1781, but he initially believed he found something different: a comet. His observations about the new heavenly body were pored over by experts for months. Regarded as an amateur, Herschel's expertise was questioned by some. But his perseverance won the day, and the scientific community accepted that this was indeed a planet.

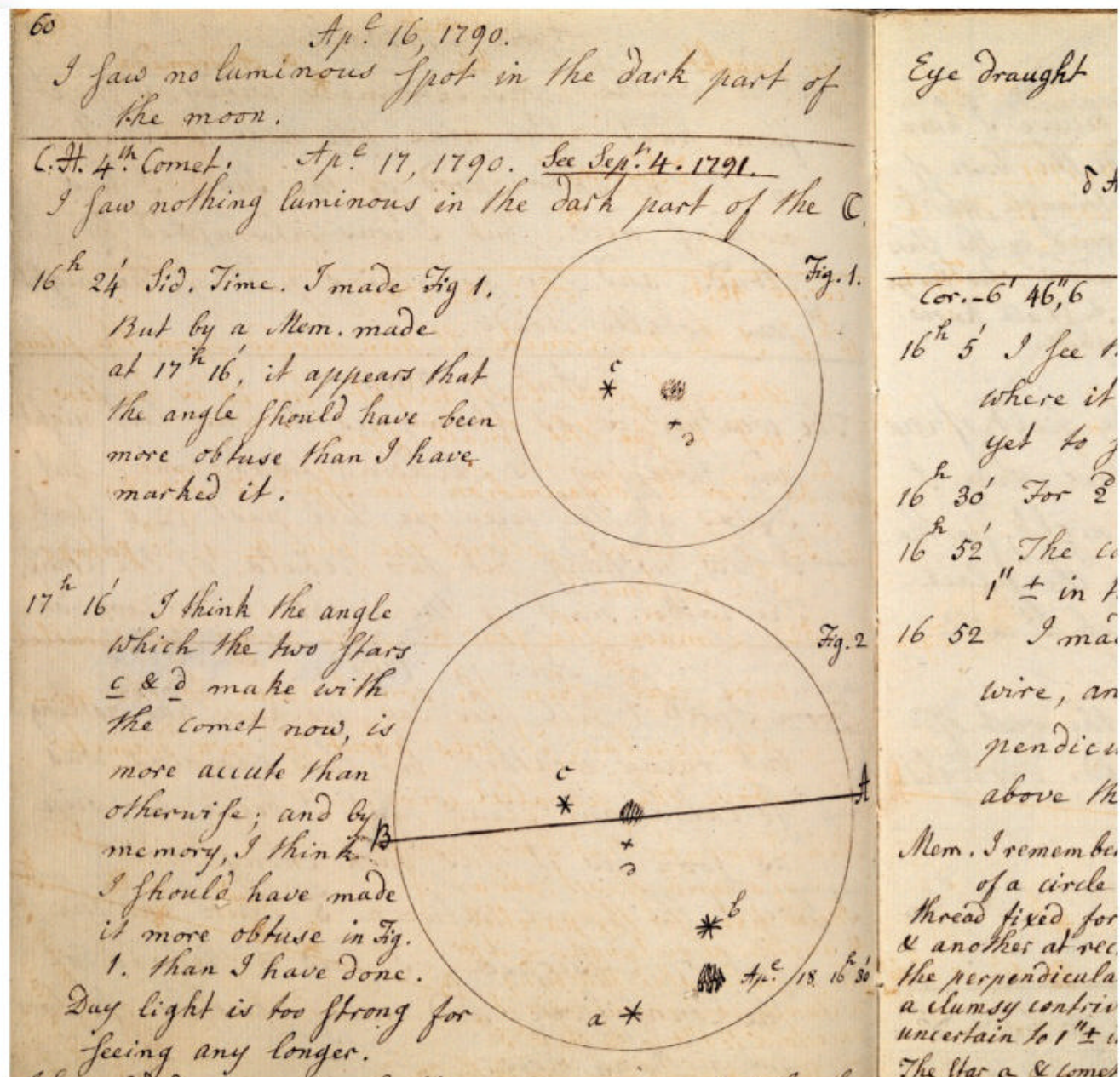
THE SOLAR SYSTEM WITH THE ORBIT OF URANUS WHITEWAY/GETTY IMAGES



CAROLINE'S COMETS

CAROLINE discovered her fourth comet in April 1790. Now known as comet C/1790 H1 (Herschel), its position on discovery was precisely recorded in her notes (right). Five of the eight comets she found were reported in the *Philosophical Transactions of the Royal Society*, a badge of professional acceptance. The then president of the Royal Society suggested that the pension of £50 a year awarded to Caroline by George III should come from Queen Charlotte instead, since Caroline was “the lady’s comet hunter.”

CAROLINE HERSCHEL'S OBSERVATION LOG FROM 1790, IN WHICH SHE RECORDED THE DISCOVERY OF HER FOURTH COMET
SPL/AGE FOTOSTOCK



During this time, Caroline was conducting her own “sky sweeps” and making discoveries. Identified in February 1783, her first find was an open cluster (NGC 2360), nicknamed Caroline’s Cluster, in the constellation Canis Major. That summer, she found NGC 205, a satellite galaxy to the Andromeda galaxy. Caroline’s Rose (NGC 7789), an open cluster in Cassiopeia, followed later that year.

In August 1786 she made history as the first woman to discover a comet. In her letter to the Royal Society describing the discovery, Caroline wrote: “In consequence of the Friendship which I know to exist between you and my Brother I venture to trouble you in his absence with the following imperfect account of a comet.” Despite the self-deprecatory tone, recognition soon followed: The following year, the king recognized Caroline’s key role by awarding her a stipend of £50 a year,

chalking up another first for her, and arguably her most significant: She became the first woman to draw a salary as an astronomer.

Along with her important scientific advancements, Caroline’s uniqueness was in “her ability to get that work recognized,” according to Herschel scholar Emily Winterburn. William’s public acknowledgment of Caroline’s work helped his sister gain acceptance from the scientific community, but Caroline also knew how to win the approval of her male peers by combining scientific rigor with charm and social skill. This balancing act was “an impressive achievement,” Winterburn writes, “and delicately done.”

In 1787, William’s telescopes revealed moons of Uranus and new moons of Saturn two years later. William’s 1788 marriage caused some tension between the siblings, but they continued to work together on

their sky sweeps. William and Caroline surveyed almost the entire sky visible from southern England, compiling a list of 2,500 new sky objects including nebulae, star clusters, and galaxies. Their discoveries were published as the *Catalogue of Nebulae and Clusters of Stars*, which would become the foundation for the *New General Catalogue of Nebulae and Clusters of Stars* (NGC) used today.

Caroline continued to work with her brother until his death in 1822, after which she returned to Germany. She revised William’s three catalogs of nebulae and star clusters, for which she received a gold medal from the Astronomical Society in 1828—a first for a woman. Caroline died in 1848, and her epitaph reads: “The eyes of her who is glorified here below turned to the starry heavens.”

—Carlos Prego Meleiro