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William Herschel's Extraordinary Night of Discovery



Mark Bratton

Recreating the legendary sweep of April 11, 1785

There's little doubt that William Herschel was the most significant astronomer of the 18th century. His accomplishments included the discovery of Uranus, infrared radiation, and four planetary satellites, as well as the compilation of two extensive catalogues of double and multiple stars. His most lasting achievement, however, was his exhaustive search for undiscovered star clusters and nebulae, a key component in his quest to understand what he called “the construction of the heavens.” In Herschel’s time, astronomers were concerned principally with the study of solar system objects. The search for clusters and nebulae was, up to that point, a haphazard affair, with a total of only 138 recorded by all the observers in history. Even the celebrated Charles Messier, responsible for the discovery of 40, regarded nebulae as nuisance objects to be avoided during the search for comets.

By contrast, William Herschel systematically searched for nebulae, using the most powerful telescope in existence up to that time, an 18.7-inch speculum reflector. Between 1783 and 1802, he surveyed the sky on 401 nights, conducting 1,112 sweeps and cataloguing 2,500 separate objects, almost all of them original discoveries. He surveyed almost the entire sky north of -33° declination, and published three catalogues of objects in 1785, 1789, and 1802. These catalogues were the forerunners of J. L. E. Dreyer’s *New General Catalogue of Nebulae and Clusters of Stars*, printed in 1888.

Herschel’s interest in nebulae was piqued by two developments. One was his systematic examination of the clusters and nebulae catalogued by the French comet hunter, Charles Messier, in 1782 and 1783. Herschel’s 6.2-inch (“7-foot”) and 12-inch (“Small 20-Foot”) reflectors were superior to any of Messier’s telescopes, and he was delighted to discover that many of the objects that Messier considered “nebula without stars” were resolved

clearly with his instruments. As we will see, he did make occasional errors in interpretation, despite the superior optics; for instance, he thought that the planetary nebula M57 was a ring of stars.

The other factor contributing to Herschel’s interest was the success of his sister, Caroline, in her study of the sky. He had built her a small telescope, encouraging her to search for double stars and comets. She located Messier objects and more, occasionally finding star clusters and nebulae that had escaped the French astronomer’s eye. Over the course of a year of observing, she discovered about a dozen star clusters and galaxies, occasionally noting in her logbook: “Messier has it not!” William realized that if Caroline could find new objects with her small telescope, a larger instrument, deliberately designed to search the skies, would reveal many more. In 1783, he embarked upon the construction of his 18.7-inch aperture, 20-foot telescope, the most effective instrument of its era.



William Herschel, 1738-1822



Caroline Herschel, 1750-1848

SKY ARCHIVES (2)

William's telescope, the so-called Large 20-Foot, was ready in the fall of 1783, but because he was working alone and the instrument was somewhat difficult to use, initial results were disappointing. In mid-December 1783, he modified his search method. First, he set up the telescope as a transit instrument, aiming it at the meridian. He hired an assistant to slowly raise and lower the telescope by 2–3° of declination while the sky's diurnal motion brought new stars into the field of view. He used an eyepiece with a magnification of 157× and a 15' 4" field of view. When necessary, he used a higher magnification to confirm his sightings. Typically, he studied the sky for an hour or more at a time, pausing only when clouds intervened or he needed to reset the telescope for some other reason. Each one of these sessions was called a "sweep"; a typical night involved three or four sweeps.

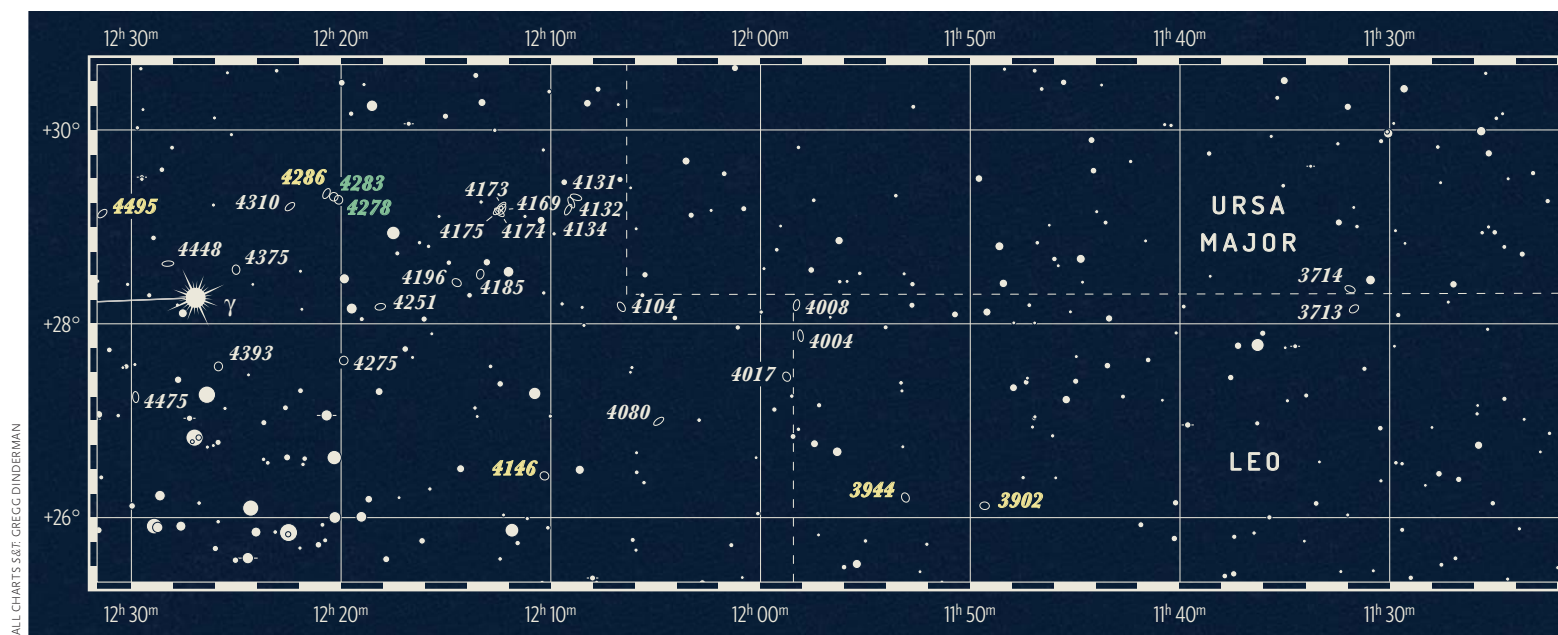
William's second modification to his method was his employment of Caroline, who recorded in a register the positions and other details of the discoveries he made at the eyepiece. She used John Flamsteed's catalogue (volume 3 of the *Historia Coelestis Britannica*) to identify reference stars. This allowed William to spend all his time at the telescope. These changes in strategy bore immediate results. The small team soon found that the sky was teeming with undiscovered star clusters and nebulae, waiting to be revealed.

Fully half of Herschel's discoveries were made in 1784 and 1785. He ardently searched on every clear night and even when conditions were far from ideal. He often discovered a dozen objects in a single night; on some nights, he noted many more. By spring of 1785, he and Caroline were closing in on 1,000 new objects. But on April 11, 1785, they enjoyed a night of discovery never approached nor equaled in the annals of visual astronomy.

The sweep that night began near the modern-day border between Leo and Leo Minor, at approximately 10^h 00^m RA, with the north-south sweep covering about 2½ degrees, centered at about +28° declination (epoch 2000.0). The first object encountered was not only the faintest of the night, but one of the faintest in Herschel's entire catalogue. **NGC 3196** is a high surface brightness, lenticular galaxy, so very small and remote that William described it as "extremely faint, a little extended, a little doubtful." Care and patience are needed to pick up this 14th-magnitude fuzzy; it's situated immediately west of a quite dim field star, which may help in locating it. The galaxy's high radial velocity implies a distance of about 675 million light-years.

Herschel next encountered a loose quartet of galaxies: **NGC 3245**, **NGC 3265**, and **NGC 3277** in Leo Minor, and **NGC 3274** in Leo. The first three galaxies are part of a group associated with NGC 3254 immediately to the north, discovered by Herschel a month earlier. A glowing oval of light oriented north-south, NGC 3245 is the brightest of the three objects. NGC 3274, a fuzzy elongation to the south of NGC 3245, is likely a small spiral galaxy with an irregular outer structure.

Close to twenty minutes passed before Herschel came upon another loose clump of galaxies. **NGC 3380**, **NGC 3400**, **NGC 3414**, **NGC 3418**, and **NGC 3451** all have similar radial velocities and likely form a gravitationally bound system about 60 million light-years away from us. Visually, NGC 3414 is the brightest and most interesting of the group, displaying a bright core with faint, bar-like extensions embedded in a hazy outer envelope. The extensions flare slightly as the distance from the core increases, and it's possible that this is a polar ring galaxy. Its peculiar extensions caught the attention of Halton



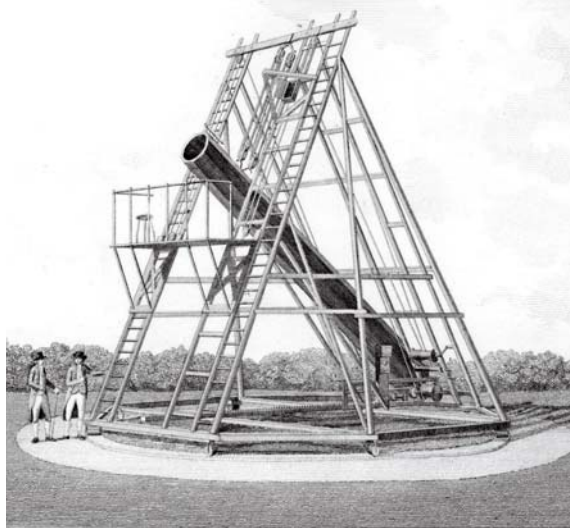
Arp; he catalogued the galaxy as Arp 162 in his *Atlas of Peculiar Galaxies* (1966).

Herschel encountered the last of the Leo Minor galaxies just a few minutes later. **NGC 3486** and **NGC 3510** probably form a wide physical pair, but morphologically they are quite different from each other. NGC 3486 is a large, graceful, multi-arm spiral that appears quite ethereal visually; the bright core is surrounded by a grainy outer shell with ill-defined edges. NGC 3510 is a wispy, low surface brightness object that Herschel described as “faint, much extended, 1.5’ long but very narrow.” Almost 1° south of this object is the close pair **NGC 3504** and **NGC 3512**. Both galaxies are bright (11th and 12th magnitude, respectively), and large-aperture telescopes will show the bar and inner structure of NGC 3504 well. Two low surface brightness arms emerge from the bar to form a pseudo ring around it.

A harbinger of things to come next occurred as Herschel encountered three faint members of a distant galaxy cluster. **NGC 3527**, **NGC 3550**, and **NGC 3552** are among the brightest members of the Abell 1185 galaxy cluster in Ursa Major, some 400 million light-years away from Earth. Herschel classified all three as very faint. NGC 3527 is a face-on barred spiral, while NGC 3550 and NGC 3552 are both ellipticals. Two condensations, very likely companion galaxies, appear in the outer halo of NGC 3550, one to the northeast, the other to the southwest. In a medium-aperture telescope, these objects appear as faint, unresolved extensions, but observers may be able to resolve the companions in large-aperture instruments.

Another gap of 20 minutes followed before Herschel came upon another wide physical pair. **NGC 3713** (in Leo) and **NGC 3714** (in Ursa Major) are both faint, though condensed, objects lying about 300 million light-years away

THE LARGE 20-FOOT TELESCOPE. The configuration of Herschel's reflector changed with time; this engraving, published by the astronomer in 1794, shows the system of pulleys manipulated by an assistant to adjust the declination.

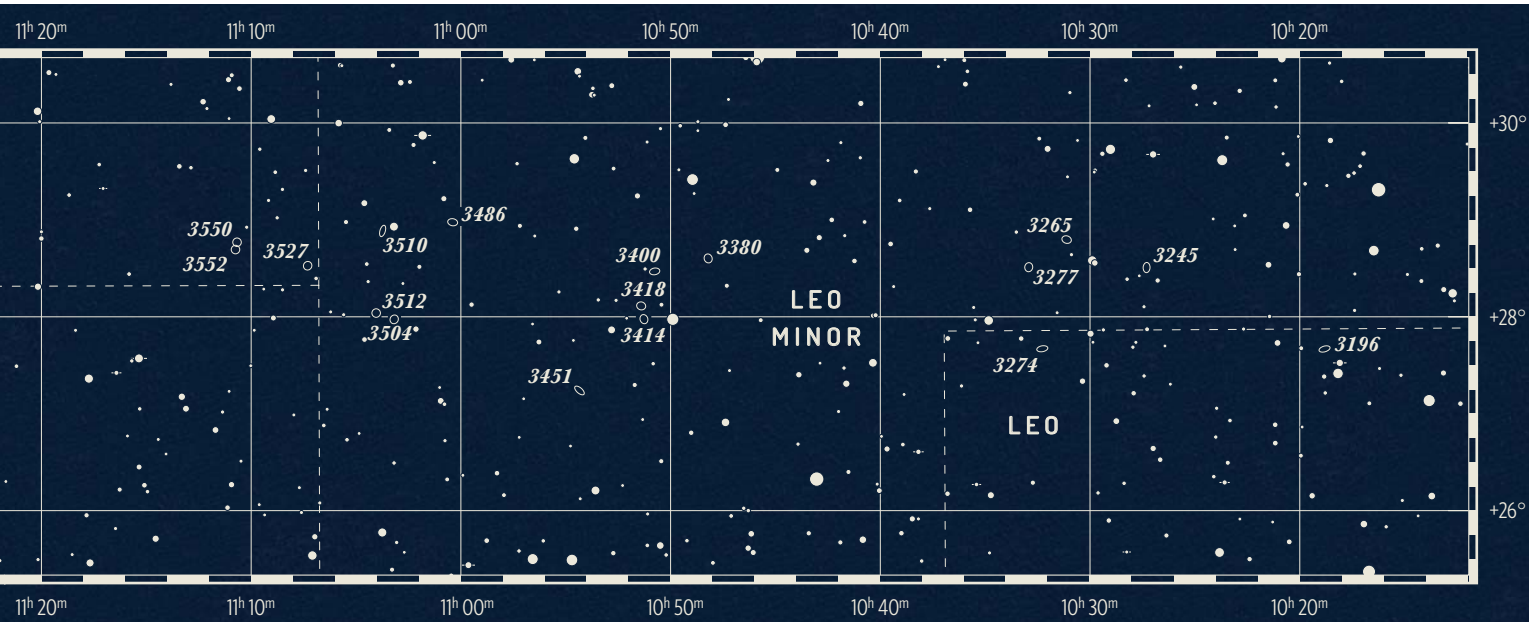


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from us. William had difficulty resolving NGC 3714 and described it to Caroline as “extremely faint. 240 (magnification) left it doubtful.”

Up to this point the Herschels had had a productive night, recording 19 new nebulae at a steady pace. Things were now about to get quite busy, though, as William was about to discover 25 objects in less than 40 minutes.

The first three discoveries were **NGC 4004**, **NGC 4008**, and **NGC 4017**, all part of a large, loose group of galaxies. NGC 4004, shining at magnitude 13.6, is a



peculiar spiral with mottled and distorted arms. Large-aperture telescopes may reveal some of this structure. A fainter, elliptical companion, IC 2982, lies immediately west of NGC 4004, though it was not detected by Herschel. NGC 4008 is a brighter, though uninspiring lenticular object. NGC 4017, paired with NGC 4016, presents as an intriguing barred spiral that may be interacting with an irregular companion. Herschel may have seen some structure in NGC 4017, calling it: “Faint, pretty large, extended, brighter towards the following side.” Together, these two galaxies are also known as Arp 305.

After chalking up **NGC 4080** and **NGC 4104** in modern Coma Berenices, things became hectic for the Herschels. Two compact quartets came into view in quick

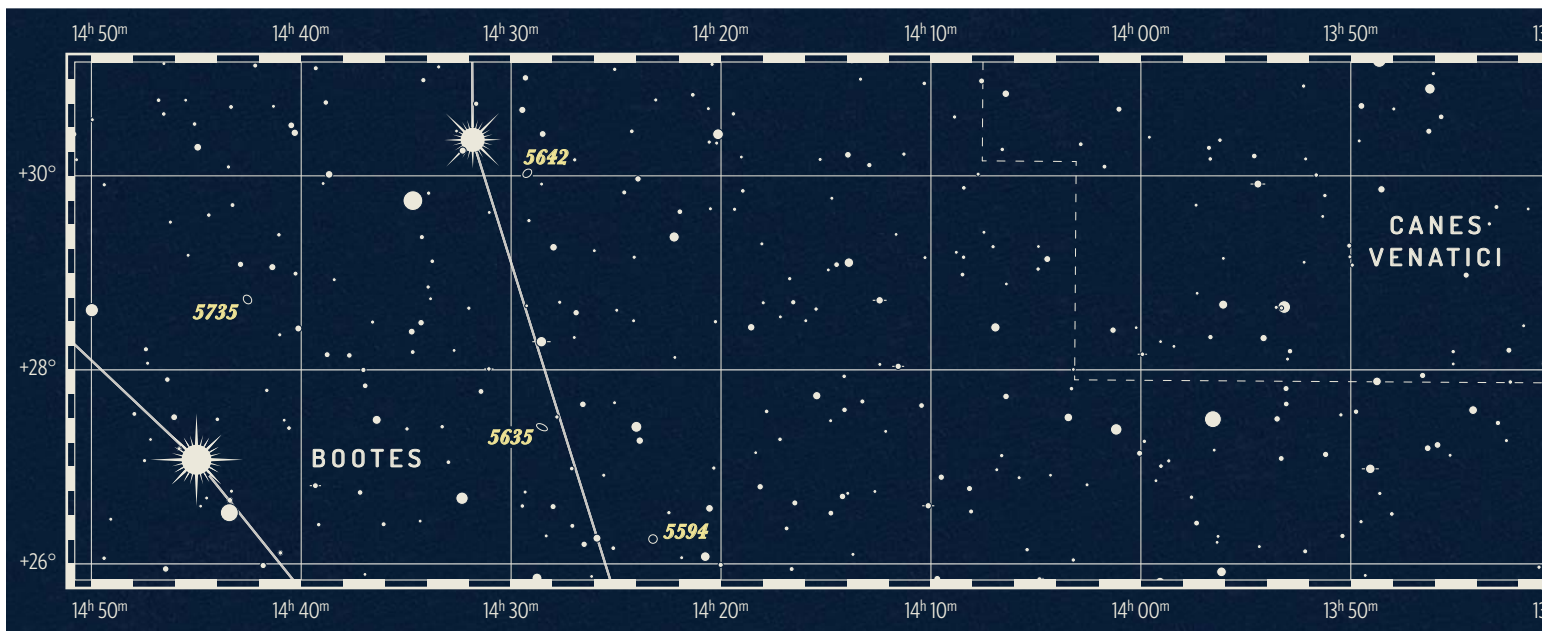
succession. The first was a linear triplet formed by **NGC 4131**, **NGC 4132**, and **NGC 4134**. The brightest and most southerly object was the inclined, multi-arm spiral NGC 4134. The other two galaxies were fainter and in the register, Caroline wrote, “Two of three, the place is that of II. 371 [NGC 4134]. Both very faint, much extended. A 4th suspected.” This fourth object may have been MCG +5-29-24, a faint galaxy with an elongated, relaxed spiral form, immediately east-northeast of NGC 4132.

Less than four minutes later, the Herschels recorded all four members of what is now known as the **Hickson 61 galaxy group**. The description of the faintest three objects reads, “Three of a quartile. The place is that of II. 372 [NGC 4173]. All very faint, very small and all within 3'.” **NGC 4169**, probably the easiest to spot of “the quartile,” is a lenticular galaxy that creates an oval glow in the field of view. **NGC 4173**, the largest, but also the most challenging target in the group, may not be a true member, as its radial velocity is almost 3000 km/s less than that of the other galaxies.

Sweeping south, William came upon another wide physical pair of galaxies, **NGC 4185** and **NGC 4196** — and something of a mystery as well. Herschel noted a third object, **NGC 4209**, which he described as “faint, pretty small.” Yet, no galaxy exists at the recorded position. Conventional wisdom assumes that NGC 4209 duplicated the observation of NGC 4185, even though Herschel described that galaxy as “faint, large, brighter to the middle.” The NGC authority Wolfgang Steinicke equates NGC 4209 with a faint star at the recorded position. Considering that William might have been rushing things at this point (recording ten nebulae in only four minutes), it’s easy to imagine him mistaking a faint star for a small nebula. According to Dreyer’s *The Scientific Papers of Sir*



COMA BERENICES. Objects labeled in yellow were discovered during Herschel's previous sweeps. Green labels mark objects he inadvertently duplicated in his catalogue.

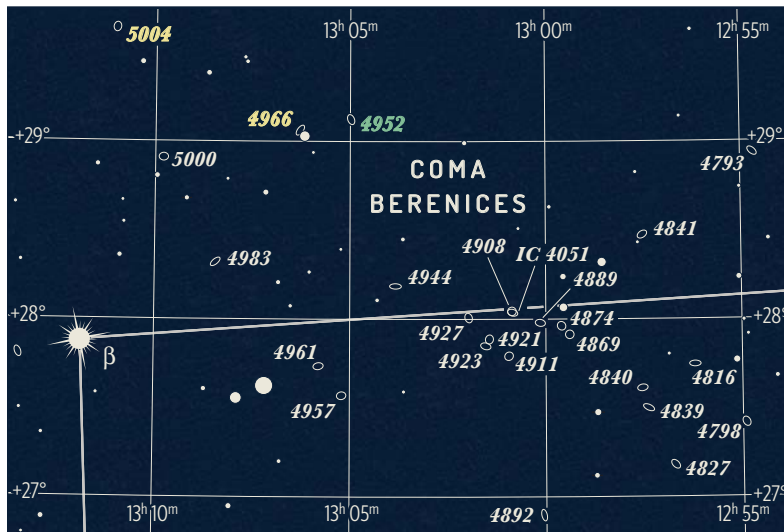


William Herschel, the Herschels recorded the position of NGC 4209 as crossing the meridian 1 minute 18 seconds of time after NGC 4196, just 2 minutes to its north. One minute six seconds of time following, and about 15 minutes south, of NGC 4196 lies the faint galaxy NGC 4211, discovered by Édouard Stephan and described in the *New General Catalogue* as “very faint, extremely small, much brighter to the middle.” It’s difficult to reconcile the discrepancy in declination, unless William or Caroline made a recording error, but could NGC 4211 be Herschel’s missing object?

Two more objects followed quickly — the bright lenticular galaxy **NGC 4251** and the face-on spiral **NGC 4275**. Sweeping north, Herschel fell into confusion again. He recorded two fairly bright galaxies, **NGC 4278** and **NGC 4283**, thinking they were new objects. However, one month earlier in a sweep two degrees to the north, he had already come upon these two galaxies, as well as a fainter one to the east, NGC 4286. The Herschels didn’t notice their error because the two sweeps relied on different field stars as reference points.

Five more galaxies followed in quick succession: **NGC 4310**, **NGC 4375**, **NGC 4393**, **NGC 4448**, and **NGC 4475**. For modern observers, two stand out. NGC 4448 is a bright, barred galaxy with an inner ring structure that may be visible in very-large-aperture telescopes (8- to 10-inch scopes will reveal a glowing oval, with features faintly articulated), while NGC 4393 is a large, low surface brightness spiral with very faint, nebulous knots scattered across its spiral arms.

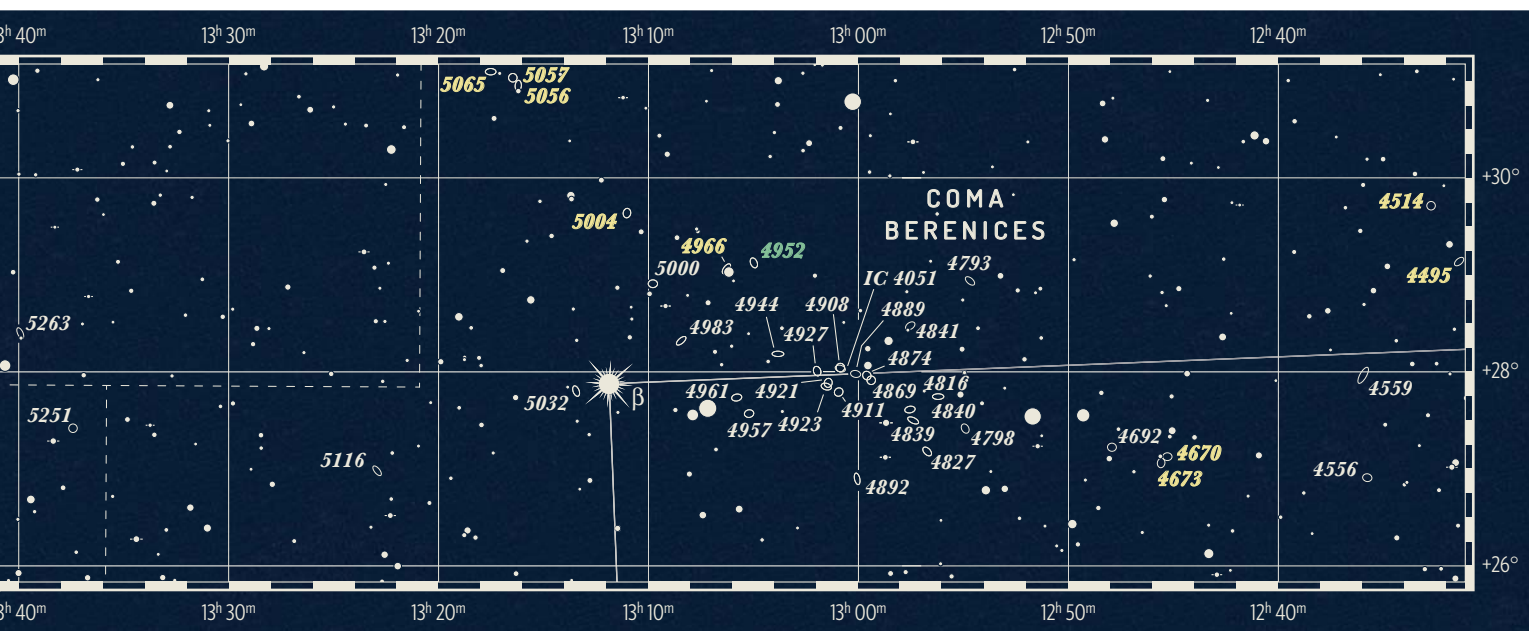
William next observed **NGC 4556** and **NGC 4559**. While NGC 4556 appears nondescript, NGC 4559 has the distinction of being a large spiral galaxy, the brightest object recorded that night. William described it as “very



COMA CLUSTER. Herschel spotted NGC 4952, 4966, and 5004 in earlier sweeps of Coma Berenices. Even so, a wealth of galaxies awaited discovery on April 11, 1785.

bright, very large, much extended north preceding, south following, 10 or 12’ long, four stars in it.” A large aperture instrument reveals the elongated form and the spiral sweep of the arms.

William was now on the verge of sweeping through the heart of the Coma Cluster of galaxies, **Abell 1656**. Skimming the northeast outskirts of the cluster the previous month, he had discovered NGC 4952 and NGC 4966 on March 13th. Now he approached the cluster from the west, where **NGC 4692**, a small and faint elliptical, stood in isolation from the group as a whole. He followed this discovery with the bright spiral **NGC 4793**, a non-Coma Cluster galaxy almost two degrees to the north. Swinging to the south, he picked up another Abell 1656 member,





The face-on barred spiral galaxy NGC 4921 in Abell 1656 displays a bright core surrounded by a large low surface brightness halo.

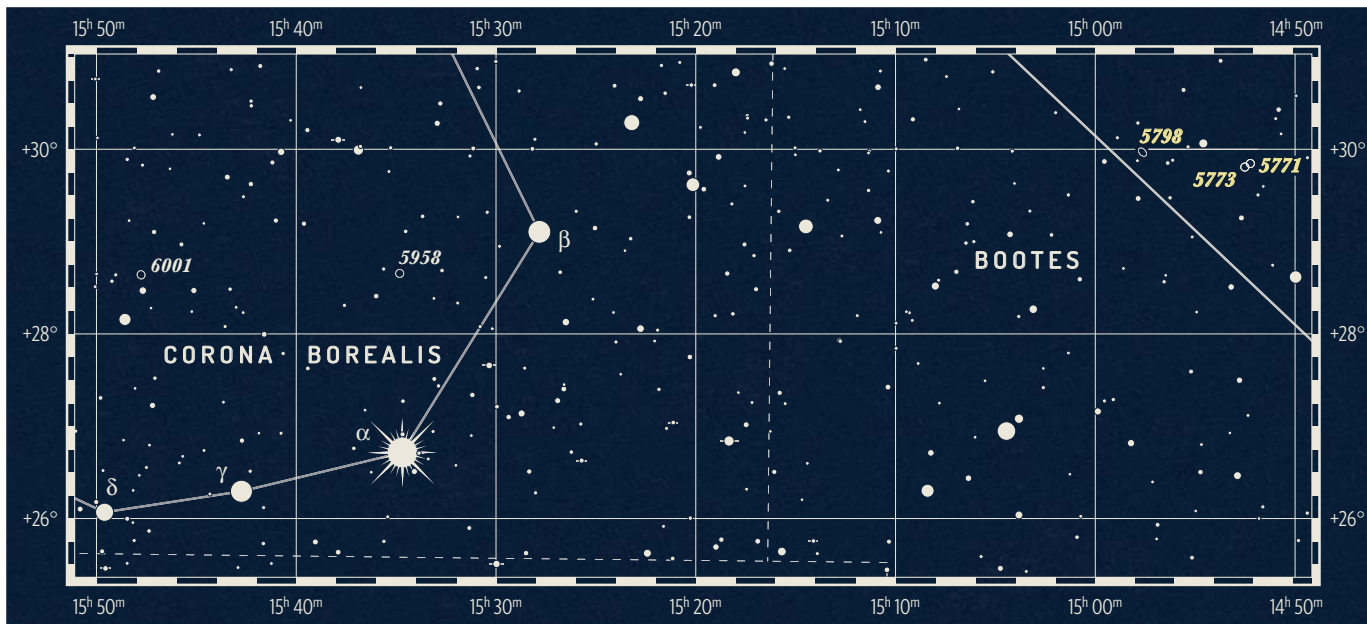
NGC 4798, and things once again became busy for the observing team. Fifteen cluster members were recorded during the next eight minutes. **NGC 4816**, **NGC 4827**, **NGC 4840**, and **NGC 4841** all appear similar visually; they're classed as either lenticular or elliptical galaxies, with NGC 4841 having a very slightly smaller and fainter companion immediately northeast. **NGC 4839**, a giant

elliptical galaxy, measures as one of the largest in the cluster. William laconically described all these galaxies as "faint, pretty large."

Swinging into the heart of the Coma Cluster, William noted two galaxies that present modern observers with an intriguing viewing challenge. **NGC 4869** and **NGC 4874** were recorded together and described as, "Two. The time taken between them." Both were recorded as class II objects (faint), though visually, NGC 4874 appears larger and brighter. A much fainter object, NGC 4872 appears embedded in the outer halo of NGC 4874 to the southwest. Until recently, it was presumed that NGC 4872 was the galaxy described by William. The confusion stems from Heinrich d'Arrest's explorations of this same region in 1864. Observing two galaxies at the same position, d'Arrest concluded that the faint NGC 4872 was William's discovery; he thus recorded NGC 4874 as a new object.

A little more than 1° south of NGC 4874, William observed **NGC 4892**, an edge-on spiral galaxy located well away from the main concentration of the cluster; visually, it appears as an extended oval of subtle light, just following two brighter field stars.

IC 4051, another victim of mistaken identity, lies just east of **NGC 4889**. It now seems clear that IC 4051, a discovery credited to Guillaume Bigourdan and Hermann Kobold in Dreyer's *Second Index Catalogue*, and NGC 4908, credited to Heinrich d'Arrest, are one and the same object — Herschel's Class III object III 363. To confuse matters even more, in his *General Catalogue*, John Herschel equated III 363 with a galaxy he discovered, h1510 (NGC 4894), an error carried over into Dreyer's *New General Catalogue*. As Dreyer noted, "This region is so very crowded that it is not easy to identify a very faint nebula." All editions of *Uranometria 2000.0* plot NGC



4908 as a separate object, immediately north of IC 4051, but observers wishing to view the correct Herschel object should locate IC 4051, the southernmost object in a chain of four galaxies.

Three more Herschel discoveries stand south of IC 4051. **NGC 4921** is the largest and most brilliant of the three, a face-on barred spiral with a bright core in a diffuse outer spiral structure. Immediately south-southeast of it shines **NGC 4923**, a concentrated lenticular galaxy. The third object is **NGC 4911**, a high surface brightness, compact spiral. Northeast of NGC 4921 is the edge-on lenticular galaxy **NGC 4927**. A roughly similar distance to its northeast is another lenticular, the slightly larger and more luminous **NGC 4944**. William described the galaxies together as, “Three. The two following pretty near each other. The south preceding about 8’ distance. The time is that of the two.”

At this point, William left behind the main concentration of the Coma Cluster, though a few of its outliers remained to be recorded in the register. The first of these, the aforementioned **NGC 4952**, was another case of a previously discovered object being identified as a new one when a different reference star was used to determine its position. But a look $1\frac{1}{2}^\circ$ to the south of NGC 4952 revealed another Coma Cluster member, the elliptical galaxy **NGC 4957**. To its northeast was a much closer spiral galaxy, **NGC 4961**.

The final three outlying Coma Cluster members, arrayed around the bright star Beta (β) Comae, were all described as very faint objects. **NGC 4983** is the smallest of the trio; in photographs, it shows a probable barred spiral with a bright core and a faint outer disk. **NGC 5000** and **NGC 5032** are nearly face-on barred spiral galaxies with inner ring structures.

The pace now slowed dramatically for the Herschels as observable objects thinned out considerably. Three widely separated faint galaxies came into view: **NGC 5116**, **NGC 5251**, and **NGC 5263**. Of the three, NGC 5263 may be the most appealing target, a small nearly edge-on galaxy to the east of the spectacular globular cluster M3. One can imagine William’s sense of relief as the large, bright cluster came into the eyepiece, a brilliant object appearing after a hectic night of observing dozens of fainter objects.

Herschel was now entering a section of sky that he’d swept on May 17th of the previous year, recording the large, loose globular NGC 5466 as well as the faint galaxies NGC 5635 and NGC 5735. He found nothing new this night until, more than 90 minutes later, he spotted **NGC 5958**, then **NGC 6001**, two small, faint face-on spiral galaxies in Corona Borealis. The long night of discovery was at an end.

As the accompanying table shows, the final tally was remarkable, with 74 objects recorded during the marathon session. Perhaps we should pause to acknowledge the remarkable persistence and determination of Caroline,

One Amazing Night: Herschel’s Spring Success

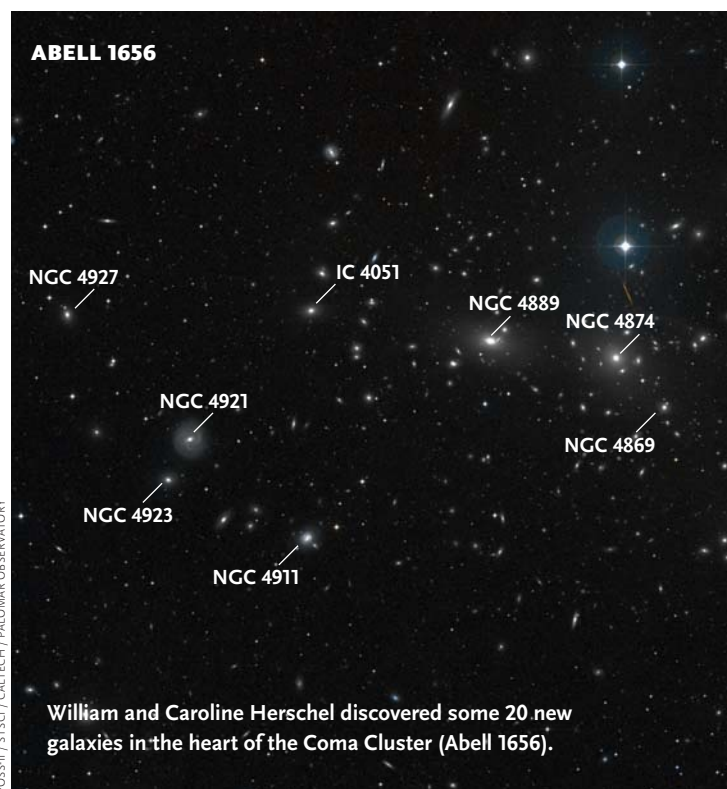
NGC	Herschel No.	Con	Mag (v)	Size	RA	Dec
3196	III 348	Leo	14.9	0.3' × 0.2'	10 ^h 18.8 ^m	+27° 40'
3245	I 86	LMi	10.8	3.2' × 1.8'	10 ^h 27.3 ^m	+28° 30'
3265	III 349	LMi	13.5	1.3' × 1.0'	10 ^h 31.1 ^m	+28° 48'
3274	II 358	Leo	12.6	2.1' × 1.0'	10 ^h 32.3 ^m	+27° 40'
3277	II 359	LMi	11.7	1.9' × 1.7'	10 ^h 32.9 ^m	+28° 31'
3380	II 360	LMi	12.7	1.7' × 1.3'	10 ^h 48.2 ^m	+28° 36'
3400	II 361	LMi	13.4	1.3' × 0.8'	10 ^h 50.8 ^m	+28° 28'
3414	II 362	LMi	10.9	3.5' × 2.6'	10 ^h 51.3 ^m	+27° 59'
3418	II 363	LMi	13.4	1.4' × 1.1'	10 ^h 51.4 ^m	+28° 07'
3451	II 364	LMi	13.1	1.7' × 0.8'	10 ^h 54.4 ^m	+27° 14'
3486	I 87	LMi	10.5	7.1' × 5.2'	11 ^h 00.4 ^m	+28° 58'
3504	I 88	LMi	11.8	2.7' × 2.1'	11 ^h 03.2 ^m	+27° 58'
3510	II 365	LMi	12.3	4.0' × 0.8'	11 ^h 03.7 ^m	+28° 53'
3512	II 366	LMi	12.9	1.6' × 1.5'	11 ^h 04.1 ^m	+28° 02'
3527	III 350	UMa	13.9	1.0' × 0.9'	11 ^h 07.3 ^m	+28° 32'
3550	III 351	UMa	13.2	1.0' × 1.0'	11 ^h 10.7 ^m	+28° 46'
3552	III 352	UMa	14.5	0.6' × 0.5'	11 ^h 10.7 ^m	+28° 42'
3713	II 367	Leo	13.3	1.2' × 0.8'	11 ^h 31.7 ^m	+28° 09'
3714	III 353	UMa	13.3	0.5' × 0.4'	11 ^h 31.9 ^m	+28° 21'
4004	III 354	Leo	13.6	1.8' × 0.6'	11 ^h 58.1 ^m	+27° 53'
4008	II 368	Leo	11.8	2.5' × 1.3'	11 ^h 58.3 ^m	+28° 12'
4017	II 369	Com	12.7	1.8' × 1.4'	11 ^h 58.8 ^m	+27° 27'
4080	III 355	Com	13.9	1.2' × 0.5'	12 ^h 04.9 ^m	+27° 00'
4104	II 370	Com	12.2	2.6' × 1.5'	12 ^h 06.7 ^m	+28° 10'
4131	III 356	Com	13.3	1.3' × 0.7'	12 ^h 08.8 ^m	+29° 18'
4132	III 357	Com	14.0	1.1' × 0.3'	12 ^h 09.0 ^m	+29° 15'
4134	II 371	Com	13.1	2.2' × 0.9'	12 ^h 09.2 ^m	+29° 11'
4169	III 358	Com	12.3	1.8' × 0.9'	12 ^h 12.3 ^m	+29° 11'
4173	II 372	Com	13.3	5.0' × 0.7'	12 ^h 12.3 ^m	+29° 13'
4174	III 359	Com	13.6	0.8' × 0.3'	12 ^h 12.5 ^m	+29° 09'
4175	III 360	Com	13.4	1.8' × 0.4'	12 ^h 12.5 ^m	+29° 10'
4185	II 373	Com	12.3	2.6' × 1.9'	12 ^h 13.4 ^m	+28° 31'
4196	II 374	Com	12.9	1.2' × 0.9'	12 ^h 14.5 ^m	+28° 25'
4209	II 375	Com	—	Non-existent	12 ^h 15.4 ^m	+28° 28'
4251	I 89	Com	10.6	3.6' × 1.5'	12 ^h 18.1 ^m	+28° 11'
4275	II 376	Com	12.8	0.8' × 0.7'	12 ^h 19.9 ^m	+27° 37'
4278	I 90 = II 322	Com	10.2	4.1' × 3.8'	12 ^h 20.1 ^m	+29° 17'

Angular sizes and separations are from recent catalogs. Visually, an object’s size is often smaller than the cataloged value and varies according to the aperture and magnification of the viewing instrument. Right ascension and declination are for equinox 2000.0.

One Amazing Night: Herschel's Spring Success

NGC	Herschel No.	Con	Mag (v)	Size	RA	Dec
4283	II 323 = II 377	Com	12.1	1.5' × 1.5'	12 ^h 20.4 ^m	+29° 19'
4310	II 378	Com	12.3	2.2' × 1.2'	12 ^h 22.4 ^m	+29° 13'
4375	II 379	Com	13.0	1.6' × 1.4'	12 ^h 25.0 ^m	+28° 34'
4393	III 361	Com	12.2	3.2' × 3.0'	12 ^h 25.9 ^m	+27° 34'
4448	I 91	Com	11.2	3.9' × 1.4'	12 ^h 28.3 ^m	+28° 37'
4475	III 362	Com	13.5	2.0' × 1.0'	12 ^h 29.8 ^m	+27° 15'
4556	II 380	Com	13.2	1.2' × 1.0'	12 ^h 35.8 ^m	+26° 55'
4559	I 92	Com	10.0	10.7' × 4.4'	12 ^h 36.0 ^m	+27° 58'
4692	II 381	Com	12.8	1.3' × 1.3'	12 ^h 47.9 ^m	+27° 13'
4793	I 93	Com	11.9	2.8' × 1.5'	12 ^h 54.7 ^m	+28° 56'
4798	II 382	Com	13.2	1.2' × 0.9'	12 ^h 54.9 ^m	+27° 25'
4816	II 383	Com	12.8	1.3' × 1.1'	12 ^h 56.2 ^m	+27° 45'
4827	II 384	Com	12.8	1.4' × 1.3'	12 ^h 56.7 ^m	+27° 11'
4839	II 386	Com	12.1	4.0' × 1.9'	12 ^h 57.4 ^m	+27° 30'
4840	II 385	Com	13.9	0.7' × 0.7'	12 ^h 57.5 ^m	+27° 37'
4841	II 387	Com	13.1	1.6' × 1.0'	12 ^h 57.5 ^m	+28° 29'
4869	II 388	Com	13.8	0.7' × 0.7'	12 ^h 59.4 ^m	+27° 55'
4874	II 389	Com	12.2	1.9' × 1.9'	12 ^h 59.6 ^m	+27° 58'
4889	II 391	Com	11.9	2.9' × 1.9'	13 ^h 00.1 ^m	+27° 59'
4892	II 390	Com	13.8	1.3' × 0.3'	13 ^h 00.1 ^m	+26° 54'
IC 4051	III 363	Com	13.2	1.0' × 0.9'	13 ^h 00.9 ^m	+28° 00'
4911	II 392	Com	13.2	1.4' × 1.3'	13 ^h 00.9 ^m	+27° 47'
4921	II 393	Com	12.3	2.5' × 2.2'	13 ^h 01.4 ^m	+27° 53'
4923	II 394	Com	13.7	0.8' × 0.8'	13 ^h 01.5 ^m	+27° 51'
4927	III 364	Com	13.8	0.8' × 0.6'	13 ^h 02.0 ^m	+28° 00'
4944	II 395	Com	12.9	1.7' × 0.6'	13 ^h 03.8 ^m	+28° 11'
4952	II 396 = III 303	Com	13.0	1.8' × 1.1'	13 ^h 05.0 ^m	+29° 07'
4957	II 397	Com	13.1	1.2' × 1.0'	13 ^h 05.2 ^m	+27° 34'
4961	II 398	Com	12.8	1.6' × 1.1'	13 ^h 05.8 ^m	+27° 44'
4983	III 365	Com	14.0	1.1' × 0.7'	13 ^h 08.5 ^m	+28° 19'
5000	III 366	Com	13.4	1.7' × 1.4'	13 ^h 09.8 ^m	+28° 54'
5032	III 367	Com	12.8	2.1' × 1.1'	13 ^h 13.5 ^m	+27° 48'
5116	III 368	Com	12.9	2.0' × 0.7'	13 ^h 22.9 ^m	+26° 59'
5251	III 369	Boö	13.9	0.7' × 0.7'	13 ^h 37.4 ^m	+27° 25'
5263	III 370	CVn	13.4	1.6' × 0.4'	13 ^h 39.9 ^m	+28° 24'
5958	II 399	CrB	12.7	1.0' × 1.0'	15 ^h 34.8 ^m	+28° 39'
6001	III 371	CrB	13.7	1.0' × 1.0'	15 ^h 47.8 ^m	+28° 39'

Angular sizes and separations are from recent catalogs. Visually, an object's size is often smaller than the cataloged value and varies according to the aperture and magnification of the viewing instrument. Right ascension and declination are for equinox 2000.0.



William and Caroline Herschel discovered some 20 new galaxies in the heart of the Coma Cluster (Abell 1656).



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who faithfully recorded positions and descriptions for each and every object, writing them down in her register with a quill pen! Unfortunately, William didn't recognize the cluster of nebulae he'd discovered, even though he recorded 23 of them. Discovery of the Coma Cluster is generally credited to Heinrich d'Arrest, who noted the group of faint nebulae in 1865.

Accepting that NGC 4209 doesn't exist, and that William had discovered NGC 4278, NGC 4283, and NGC 4952 previously, that still gave the Herschels a total of 70 newly discovered galaxies, an unprecedented accomplishment, and one never equaled by any of the 72 nineteenth-century visual observers who subsequently contributed to Dreyer's *New General Catalogue*. The only observer to come close was John Herschel, who recorded 38 new objects, 34 of them in the Large Magellanic Cloud, on December 23, 1834. Even more remarkable: there are 7,093 independent objects in the *New General Catalogue*, eliminating duplicate entries, nonexistent objects, and entries associated with single, double, or multiple stars. Fully one percent of those 7,000+ objects were discovered on one night, April 11, 1785, by one of the greatest visual observers of all time. ♦

Mark Bratton is the author of *The Complete Guide to the Herschel Objects* (Cambridge University Press, 2011).