



Part 1

Handbook

1 Charles Messier

Charles Messier lived and worked during a pivotal point in visual astronomical history. He was one of the first comet hunters, discovering new comets over a span of four decades, and recording nearly every observable comet during his career.

His comet hunting resulted in an extensive knowledge of the night sky, enabling him to organize a catalog of galaxies, clusters and nebulae. This list of heavenly wonders, known as the Messier Catalogue, has become one of the most popular lists of its kind. It includes many of the brightest and best-known objects in the night sky. Yet the 110 marvels are few enough that even the beginning amateur astronomer of today can find them all, or nearly all, of them in one night.

Born on June 26, 1730, in Lorraine, France, Charles was the tenth of twelve children.¹ His father died when he was eleven. Three years later, in early 1744, the young Charles observed the brilliant multi-tailed comet of 1744. A month after his eighteenth birthday, in July 1748, he observed an annular solar eclipse from his home town. In October 1751 he went to Paris in search of a new life. His skill in penmanship and drafting landed him employment as a record keeper at a small observatory at the Hotel de Cluny. One of his first tasks was copying maps of the Great Wall of China and of the City of

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Figure 1.1

Charles Messier, 1771. Courtesy of Dr Owen Gingerich.

what was then called Pekin.² Other duties included surveying, making maps of the local area, recording sunspots and compiling meteorological data. His employer, Joseph Nicholas Delisle, gave Messier the position of ‘Depot Clerk of the Navy’.

As time went on, Messier was trained to use various telescopes at the observatory to obtain and record exact positions of heavenly bodies. His first documented observation was of the planet Mercury’s transit of the sun on May 6, 1753. By 1757 he was searching for a comet famously predicted to return by Edmond Halley. His search was based on Delisle’s calculations of the comet’s likely position, and was carried out with a 1.5 meter focal length reflector. The diameter of the telescope’s mirror was about 0.2 meter, but, being made of metal, it reflected little light and gave poor images.

It was during this period, in 1758, that Messier conceived of his now famous celestial catalog. While tracking yet another comet of that year, Messier noted a strong resemblance between this comet and a nearby nebula. This object, now known as the Crab Nebula, had been discovered twenty-seven years earlier by John Bevis. It occurred to Messier that a catalog giving positions and descriptions of such comet look-alikes would help prevent confusing them with the real thing.

Meanwhile, Messier continued his quest for Halley’s Comet, not knowing at the time that Delisle’s calculations were flawed and were misdirecting his search. On Christmas night, 1758, an amateur astronomer in Germany, Johann Palitzch, was the first to find Halley’s Comet. Messier would find it nearly four weeks later, on January 21, 1759. News of Messier’s find was withheld by Delisle until April 1, long after the comet faded into the evening sky and reappeared in the morning sky. It is not known why Delisle failed to publish Messier’s observation in a timely manner, but the practical result was general skepticism of Messier’s claim to have found the comet ten weeks earlier. Messier later wrote that the delay in the announcement was one of the biggest disappointments in his life.

Johann Palitzch found no more comets, but Messier continued searching until, by 1801, he had discovered or co-discovered twenty comets. These comet discoveries brought Messier fame and distinction, along with allowing him the pleasure of viewing the night sky through a telescope.

Messier used more than a dozen telescopes during his observing

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Table 1.1. **Comets discovered by and credited to Charles Messier.**

The comet designation and comet name are followed by the discovery date, with the month followed by the day and year. The position is in 2000 coordinates and indicates the position of the comet at discovery. The magnitude is the brightness of the comet when found. Elongation is the number of degrees the comet was from the sun as seen from the Earth. Next we see if the comet was found in the morning or evening sky. The instrument indicated is either a telescope (T) or the unaided eye (U).

Comet	Comet name	Disc. date	RA	Decl.	El.	Mag.	Sky	Inst.
C/1760 B1	Messier	01/26/1760	10:56	-15.8	133	5.5	M	T
C/1763 S1	Messier	09/29/1763	16:28	-6.0	59	5.0	E	T
C/1764 A1	Messier	01/04/1764	15:47	+57.7	91	3.0	M	U
C/1766 E1	Messier	03/09/1766	1:23	+16.2	34	6.0	E	T
C/1769 P1	Messier	08/09/1769	2:27	+13.0	101	5.5	M	T
D/1770 L1	Lexell	06/15/1770	18:25	-16.6	169	7.0	E	T
C/1771 G1	Messier	04/02/1771	2:48	+21.3	31	4.5	E	U
C/1773 T1	Messier	10/13/1773	10:27	+5.5	47	4.5	M	T
C/1780 U2	Messier	10/27/1780	11:49	+12.9	46	7.0	M	T
C/1785 A1	Messier–Mechain	01/08/1785	2:20	+5.3	103	6.5	E	T
C/1788 W1	Messier	11/26/1788	11:19	+46.3	96	6.0	M	T
C/1793 S2	Messier	09/28/1793	16:21	+13.9	60	6.0	E	T
C/1798 G1	Messier	04/13/1798	3:30	+24.2	31	6.0	E	T

career. To search for Halley's Comet in 1757–9 he used a reflector with a mirror of about 0.2 meter diameter. He had access to other instruments in the observatory, including a refractor with a lens of about 10 cm, a focal length of 1.1 meter, and a magnification of 120×. This refractor seemed to be his favorite instrument, and was used for much of his observing.

Table 1.1 lists the thirteen comets that were discovered first by Charles Messier.³ One, Comet Lexell, was discovered by Messier, but carries the name of the orbit calculator, Anders Lexell. This particular comet had a short orbital period until it passed too close to Jupiter in 1779. This changed the orbit, and the comet is now lost.

Table 1.2 includes seven additional comets found by Messier shortly after other discoverers found them.⁴ Under present regulations, a comet can carry the names of as many as three discoverers if their verified independent discovery is made shortly after the original find. According to these rules it seems unlikely that any of these comets would also bear Messier's name. In four cases

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Table 1.2. **Comets independently discovered by Charles Messier.**

The comet designation and comet name are followed by Messier's discovery date. The position, magnitude and elongation are for the time Messier found the comet. 'Sky' indicates morning or evening sky, and 'Late' denotes the number of days Messier's find followed the original discovery.

Comet	Comet name	Disc. date	RA	Decl.	Mag.	El.	Sky	Late
C/1758 KI	De la Nux	08/14/1758	5:40	+28.5	7.0	60	M	80
P/1758 Y1	Halley	01/21/1759	23:43	+3.0	3.0	53	E	27
C/1760 AI	Great Comet	01/08/1760	7:57	-17.6	2.0	140	M	1
D/1766 GI	Helfenzrieder	04/08/1766	2:50	+26.0	2.5	27	E	7
C/1771 AI	Great Comet	01/10/1771	8:41	+3.2	5.0	156	M	1
C/1779 AI	Bode	01/19/1779	19:27	+29.8	5.0	51	E	13
C/1801 NI	Pons	07/12/1801	6:45	+72.3	6.5	51	M	1

too much time had elapsed. In two more there were so many nearly simultaneous discoveries that assigning credit to a single observer was impossible. In such cases, the comets, appearing quite bright and spectacular, were called 'Great Comets'. In the final case there were several independent discoveries on the same night as Messier's, one night after Pons found this, his first, comet.

A look at Charles Messier's comet discoveries can give us an insight into his comet-hunting activities. It is interesting to note that seven of his twenty finds were made during January. This was despite the fact that in Paris the cloudiest months are December and January; and January has the greatest number of days of precipitation (twenty) and the coldest temperatures.⁵ He seemed to sweep equally the morning and evening sky, with the morning comets found at a greater elongation than those found in the evening sky. Whether this was caused by his sweeping (or sleeping!) habits, or from horizon height differences, we do not know. He was also not afraid to sweep through the Milky Way, where many stars and nebulae tend to mask new comets; nor did he shy away from areas containing galaxies. From his latitude of +48.8 degrees, he searched from the North Pole to roughly -20 degree declination.

In Table 1.3 we take a look at the significance that Messier played in the field of comet hunting during his lifetime. Most of his comets were found in his first fifteen years of searching, while nearly half of the objects listed in his Catalogue were recorded sometime later, between 1778 and 1781 (Table 1.4).

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Table 1.3 **Comets discovered during each five-year interval, 1758–1802.**

The total number of comets discovered is given for each five-year period. The number discovered by Messier also includes his independent finds. The number found by others includes the seven comets which Messier found independently that do not bear his name, plus the one bearing his name along with Mechain's (1785 AI).

Years	# Found	# By Messier	# By others	Other discoverers
1758–1762	5	4	4	Klinkenberg
1763–1767	4	4	1	Helfenzrieder
1768–1772	5	4	1	Montaigne
1773–1777	2	1	1	Montaigne
1778–1782	5	2	4	Bode, Mechain
1783–1787	7	1	7	Mechain, C. Herschel
1788–1792	6	1	5	C. Herschel
1793–1797	6	1	5	C. Herschel
1798–1802	6	2	5	Mechain, Pons
Total	46	20	33	

Charles Messier received many awards during his lifetime. In January 1763 he barely missed being elected to the French Academie Royale des Sciences. On December 6, 1764, he became a foreign member of the Royal Society of London. He was also elected member of the Russian Academy of Sciences. In 1769 he earned membership in the Berlin Academy of Sciences. In 1771, he was finally elected to the Paris Academy of Sciences. By then he was also Astronomer of the Navy, Director of the Observatory at Cluny, and a member of the Royal Academy of Sciences. From 1785 to 1790 he held the post of editor of the French journal *Connaissance des Temps*. In 1806 he received the Order of the Cross from Napoleon. These honors were all in recognition of his careful comet hunting, comet observing, and his cataloging of nebulae.

On November 26, 1770, Charles Messier married Marie-Francoise de Vermauchamp. They had met shortly after Messier arrived in Paris. On March 15, 1772, she gave birth to a son (Antoine-Charles), who died at the age of eleven days. Messier's wife died three days earlier, on March 23, 1772.

On November 6, 1781, Messier suffered an 8 meter fall into an ice cellar. This occurred during the daytime, not at night as some have reported. Severe injuries resulted, and Messier was sidelined for

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Figure 1.2

Comet Hale-Bopp, imaged on March 19, 1997, by Don Machholz.



nearly a year. His first return to the observatory was to observe the transit of the sun by the planet Mercury on November 9, 1782. Perhaps this transit brought back memories of his first official observation, the transit of Mercury twenty-nine years earlier.

During the last decade of the eighteenth century, France was in political turmoil. Science became less important, and those who were politically on the wrong side of the establishment suffered. Messier did less and less observing.

In later years Messier lived by himself, then with his sister and his brother. After they passed away, he lived with a widowed niece, and in 1815 he suffered a stroke. Two years later he contracted dropsy, and after an illness of only a few days, he died on the night of April 11/12, 1817, at the age of eighty-seven.

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Table 1.4 **Charles Messier timeline.**

For each year, we see the comets discovered by Messier and the Messier Objects he observed. Then we discover the other activities going on in Messier's life and in the lives of those around him.

Year	Comets found	Obj. found	Other activities
1756			
1757		M32	Begins search for Halley's Comet
1758	1758 K1	M1	Palitzch finds Halley's Comet
1759	Halley's		
1760	1760 A1, 1760 B1	M2	Delisle retires
1761			Observes transit of Venus
1762			Lacaille dies
1763	1763 S1		Almost elected to Academy of Science
1764	1764 A1	M3–M40	
1765		M41	Made Member of Royal Society of London
1766	1766 E1, 1766 G1		
1767			Ocean trip, away from Paris May–Aug.
1768			
1769	1769 P1	M42–M45	First Catalogue written
1770	1770 L1		Married; elected to Academy of Science
1771	1770 A1, 1771 G1	M46–M49, M62	First Catalogue published, M1–45
1772		M50	Wife and son die
1773	1773 T1	M110	
1774		M51, M52	Introduced to Pierre Mechain
1775			
1776			
1777		M53	Messier sees 'specks' crossing sun
1778		M54, M55	
1779	1779 A1	M56–M63	
1780	1780 U2	M64–M79	Second Catalogue published, M1–68
1781		M80–M106, M108–M109	Final Catalogue published; injured in fall; Uranus discovery
1782		M107	Observes transit of Mercury
1783			Herschel begins listing objects
1784			
1785	1785 A1		
1786			Herschel's first catalog published
1787			
1788	1788 W1		

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Table 1.4 (cont.) **Charles Messier timeline.**

For each year, we see the comets discovered by Messier and the Messier Objects he observed. Then we discover the other activities going on in Messier's life and in the lives of those around him.

Year	Comets found	Obj. found	Other activities
1789			The Storming of the Bastille
1790			
1791			
1792			
1793	1793 S2		'Year of Terror' in France
1794			
1795			
1796			
1797			
1798	1798 G1		
1799			
1800			
1801	1801 N1		First asteroid discovered

Notes

- 1 Jones, Kenneth Glyn, *Messier's Nebulae and Star Clusters*, First Edition (1968). Published by American Elsevier Publishing Co., NY, p. 377. Contains an extensive study of Messier's life and the Messier Objects.
- 2 Mallas, John, and Kreimer, Evered, *The Messier Album*, First Edition (1978). Published by The Nimrod Press, Boston, MA, p. 1. Includes a chapter on Charles Messier, entitled 'Messier and His Catalogue', written by Owen Gingerich. It first appeared in the magazine *Sky and Telescope* in Aug./Sept. 1953 and Oct. 1960.
- 3 Kronk, Gary W., *Comets: A Descriptive Catalogue*, (1984). Published by Enslow Publishers, Box 777, Hillside, NJ 07205, pp. 18ff. Contains interesting descriptions of comets and comet discoveries up to the end of 1981.
- 4 Marsden, Brian G., and Williams, Gareth V., *Catalogue of Cometary Orbits*, Tenth Edition (1995). Published by the Smithsonian Astrophysical Observatory, 60 Garden St, Cambridge, MA, 02138. An official listing of all known comets with orbital elements and official names.
- 5 Sperling, Bert, *Best places* at www.BestPlaces.net. Contains climate and weather for hundreds of locations, including Paris, France.

2 The Messier Catalogue

Lists of non-stellar heavenly bodies – galaxies, clusters and nebulae – were common in Messier’s time. Ptolemy compiled one of the earliest such lists in the second century AD.¹ Tycho Brahe had published a list of six nebulae in 1601, as did Edmond Halley in 1715. Abbe Nicholas-Louis de la Caille (Lacaille) produced a tabulation of forty-two objects in the southern sky in 1755, and John Bode published seventy-five objects in 1777.²

Perhaps no one was in a better position to compile such a catalog than comet hunter Charles Messier. He had both the means and a motive. Countless nights under the sky sharpened his knowledge of the location and appearance of the objects. This was augmented by his mapping skills.

Messier’s main motive for assembling his Catalogue seems to be best summed up in his memoir in the journal *Connaissance des Temps* for 1801. In it he wrote:³

What caused me to undertake the catalogue was the nebula I discovered above the southern horn of Taurus on September 12, 1758, whilst observing the comet of that year. This nebula had such a resemblance to a comet in its form and brightness that I endeavored to find others so that astronomers would not confuse these same nebulae with comets just beginning to appear. I observed further with suitable refractors for the discovery of comets and this is the purpose I had in mind in forming the catalogue.