MESSIER 5 GLOBULAR CLUSTER

Messier 5 by Hubble Space Telescope

Messier 5 or M5 (also designated NGC 5904) is a globular cluster in the constellation Serpens. It was discovered by **Gottfried Kirch** in 1702 when looking for comets. It should not be confused with the much fainter and more distant globular cluster Palomar 5, which is situated nearby in the sky.

DISCOVERY AND VISIBILITY

M5 is, under extremely good conditions, just visible to the naked eye as a faint "star" near the star 5 Serpentis. Binoculars or small telescopes will identify the object as non-stellar while larger telescopes will show some individual stars, of which the brightest are of apparent magnitude 12.2. **Charles Messier** also noted it in 1764, but thought it a nebula without any stars associated with it. **William Herschel** was the first to resolve individual stars in the cluster in 1791, counting roughly 200. (see below for details on William Herschel).

CHARACTERISTICS

Spanning 165 light-years in diameter, M5 is one of the largest known globular clusters. The gravitational sphere of influence of M5, (i.e. the volume of space in which stars are gravitationally bound to it rather than being torn away by the Milky Way's gravitational pull) has a radius of some 200 light-years. At 13 billion years old, M5 is also one of the oldest globular clusters in the Milky Way Galaxy. Its distance is about 24,500 light-years from Earth, and it contains more than 100,000 stars.

NOTABLE STARS

105 stars in M5 are known to be variable in brightness, 97 of them belonging to the *RR Lyrae* type. RR Lyrae stars, sometimes referred to as "Cluster Variables", are somewhat similar to Cepheid type variables and as such can be used as a tool to measure distances in outer space since the relation between their luminosities and periods are well known. The brightest and most easily observed variable in M5 varies from magnitude 10.6 to 12.1 in a period of just over 26 days.

A dwarf nova has also been observed in this cluster. Dwarf novae are distinct from classical novae in other ways; their luminosity is lower, and they are typically recurrent on a scale from days to decades. The luminosity of the outburst increases with the recurrence interval as well as the orbital period; recent research with the Hubble space telescope suggests that the latter relationship could make dwarf novae useful standard candles for measuring cosmic distances. A dwarf nova (pl. novae) is a type of cataclysmic variable star consisting of a close binary star system in which one of the components is a white dwarf that accretes matter from its companion. The first one to be observed was *U Geminorum* in 1855; however, the mechanism was not known till 1974, when **Brian Warner** showed that the nova is due to the increase of the luminosity of the accretion disk.

They are similar to classical novae in that the white dwarf is involved in periodic outbursts, but the mechanisms are different. **Classical novae result from the fusion and detonation of accreted hydrogen on the primary's surface. Current theory suggests that dwarf novae result from instability in the accretion disk, when gas in the disk reaches a critical temperature that causes a change in viscosity, resulting in a temporary increase in mass flow through the disc, which heats the whole disc and hence increases its luminosity**. The mass transfer from the donor star is less than this increased flow through the disc, so the disc will eventually drop back below the critical temperature and revert to a cooler, duller mode.

There are three subtypes of the *U Geminorum* stars:

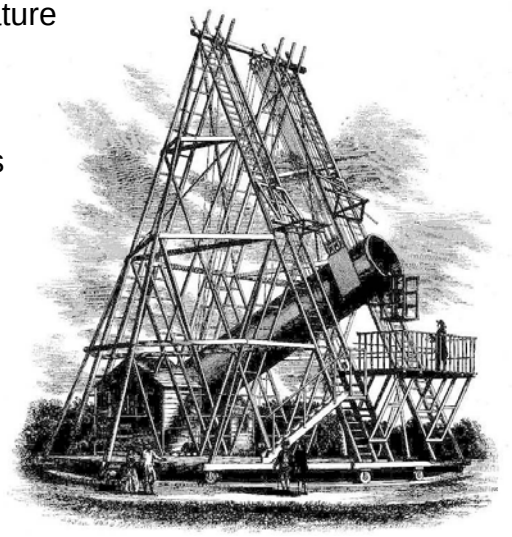
1. *SS Cygni* stars, which increase in brightness by 2-6 mag in 1–2 days, and return to their original brightnesses in several subsequent days.
2. *SU Ursae Majoris* stars, which have brighter and longer "supermaxima" outbursts, or "super-outbursts," in addition to normal outbursts.
3. *Z Camelopardalis* stars, which temporarily "halt" at a particular brightness below their peak.

In May 31, 1783 William Herschel wrote about M5: "With a magnifying power of 250, it is all resolved into stars: they are very close, and the appearance is beautiful. With 600, perfectly resolved. There is a considerable star not far from the middle; another not far from one side, but out of the cluster; another pretty bright one; a great number of small ones."

Friedrich Wilhelm Herschel born 15 November 1738 in Hanover Germany, died 25 August 1822 (aged 83) in Slough, England, UK

Frederick William Herschel was a British astronomer and composer of German origin, and brother of fellow astronomer Caroline Herschel, with whom he worked. Herschel was born in the Electorate of Hanover in Germany, part of the Holy Roman Empire, one of ten children of **Isaac Herschel** by his marriage to **Anna Ilse Moritzen**. His family were Lutheran Christians. His father was an oboist in the Hanover Military Band and Herschel followed him into the Band. As the threat of war with France loomed under King George II, the Hanoverian Guards were recalled from England to defend Hanover. After they were defeated at the Battle of Hastenbeck, Isaak sent his two sons to seek refuge in England in late 1757.

Herschel constructed his first large telescope in 1774, after which he spent nine years carrying out sky surveys to investigate double stars. The resolving power of the Herschel telescopes revealed that the nebulae in the Messier catalogue were clusters of stars. Herschel published a catalogue of 2,500 nebulae objects in 1802 and a revised version in 1820 of 5,000 objects. **In the course of an observation on 13 March 1781 he realized that one celestial body he had observed was not a star, but a planet, Uranus. This was the first planet to be discovered since antiquity and Herschel became famous overnight. He called the new planet *Georgium sidus*, after King George III, who then appointed him Court Astronomer and he was elected as a Fellow of the Royal Society. But the name did not stick. In France, where reference to a British king was frowned upon, the planet was known as 'Herschel' until the name 'Uranus' was universally adopted.** Herschel pioneered the use of astronomical spectrophotometry as a diagnostic tool, using prisms and temperature measuring equipment to measure the wavelength distribution of stellar spectra. Other work included an improved determination of the rotation period of Mars, the discovery that the Martian polar caps vary seasonally, the discovery of Titania and Oberon (moons of Uranus) and Enceladus and Mimas (moons of Saturn). In addition, Herschel discovered infrared radiation. Herschel was made a Knight of the Royal Guelphic Order in 1816. He was the first President of the Royal Astronomical Society when it was founded in 1820. He died in August 1822, and his work was continued by his only son, **John Herschel.**



Herschel's 40 foot telescope
In May, 1791, Sir William Herschel directed this grand 40-foot reflector to M5 and counted about 200 individual stars.

After completing his 40 feet telescope William commented that it should only be used for examining objects that other instruments will not reach. To look through one larger than required is a loss of time, which, in a fine night, an astronomer has not to spare. Also it ought to be known that the opportunities of using the 40 feet reflector are rendered very scarce by two material circumstances. The first is the changeable temperature of the atmosphere, by which the mirror is often covered with condensation of vapour upon its surface, which renders it useless for many hours; and in cold weather by freezing upon it for the whole night, and even for weeks together; for the ice cannot be safely taken off untill a general thaw removes it. The next is that, with all imaginable care, the polish of a mirror exposed like that of the 40 feet telescope, though well covered up, will only preserve its required lustre and delicacy about two years. The three observations given above must consequently be looked upon as having been made by three different mirrors. AK, with Wikipedia Notes.