MESSIER 44, THE BEEHIVE CLUSTER, AND 67

The Beehive Cluster is an open cluster in Cancer just visible to the naked eye. It is one of the nearest open clusters to Earth, containing a larger population of stars than other nearby bright open clusters. Under dark skies, the Beehive Cluster looks like a small nebulous object to the naked eye; It has been known since ancient times. Classical astronomer **Ptolemy** described it as "nebulous mass in the breast of Cancer," and it was among the first objects that **Galileo** studied with his telescope.

Age and proper motion coincide with those of the Hyades, suggesting they may share similar origins. Both clusters also contain red giants and white dwarfs, which represent later stages of stellar evolution, along with many main sequence stars.

OBSERVATION DATA (J2000.0 EPOCH)
Constellation Cancer
Right ascension 08h 40.4m
Declination 19° 59'
Distance 577 ly (177 pc)
Apparent magnitude (V) 3.7
Apparent dimensions (V) 95'
PHYSICAL CHARACTERISTICS
Mass ~500-600 M$_\odot$
Estimated age ~600-700 million years
OTHER DESIGNATIONS
The Beehive Cluster is also known as Praesepe (Latin for "manger"), M44, NGC 2632, or Cr 189), Distance to M44 is often cited to be between 160 and 187 parsecs (520-610 light years), but the revised Hipparcos parallaxes (2009) for Praesepe members and the latest infrared color-magnitude diagram favours an analogous distance of 182 pc. There is better age estimates of around 600 million years old, equivalent to about 625 million years for the Hyades. The bright inner cluster core's diameter is about 7.0 parsecs (23 light years).]

Observationally, the Beehive is easily visible to the naked-eye as a small nebulous cloud when Cancer culminates in the early evening each year from February to May. At 1.5° across, the cluster easily fits within the field of view of binoculars or low powered small telescopes.

HISTORY

In 1609, Galileo first telescopically observed the Beehive and was able to resolve it into 40 stars. **Charles Messier** added it to his famous catalogue in 1769 after precisely measuring its position in the sky. Along with the Orion Nebula and the Pleiades cluster, Messier's inclusion of the Beehive has been noted as curious, as most of Messier's objects were much fainter and more easily confused with comets. Another possibility is that Messier simply wanted to have a larger catalog than his scientific rival **Lacaille**, whose 1755 catalog contained 42 objects, and so he added some bright, well-known objects to boost his list.

Ancient Greeks and Romans saw this object as a manger from which two donkeys, the adjacent stars Asellus Borealis and Asellus Australis, are eating; these are the donkeys that **Dionysos** and **Silenus** rode into battle against the Titans.

Hipparchus (c.130 BC) refers to the cluster as Nephelion ("Little Cloud") in his star catalogue. **Claudius Ptolemy's** Almagest includes the Beehive Cluster as one of seven "nebulae" (four of which are real, describing it as "The Nebulous Mass in the Breast of Cancer". **Aratus** (c.260-270 BC) calls the cluster Achlus or "Little Mist" in his poem Phainomaina.

Like many star clusters of all kinds, Praesepe has experienced mass segregation. This means that
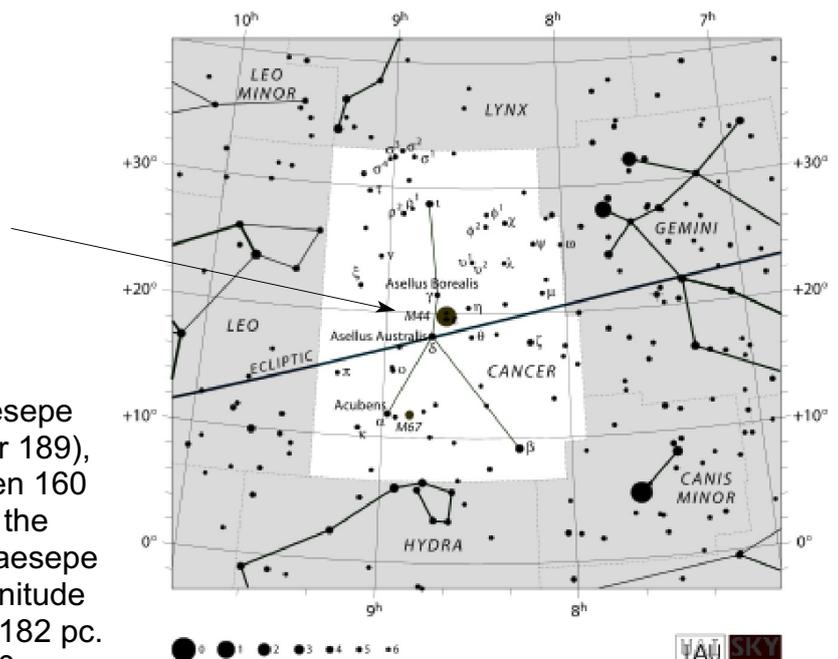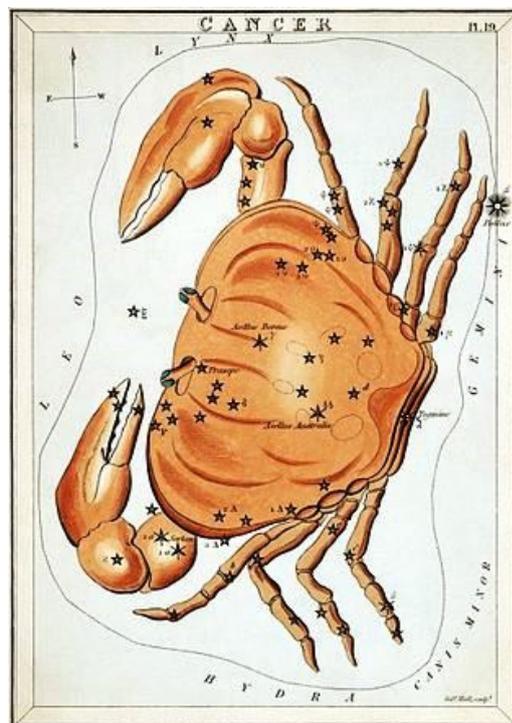
bright, massive stars are concentrated in the cluster's core, while dimmer, less massive stars populate its halo (sometimes called the corona). The cluster's core radius is estimated at 3.5 parsecs (11.4 light years); its half-mass radius is about 3.9 parsecs (12.7 light years); and its tidal radius is about 12 parsecs (39 light years). However, the tidal radius also includes many stars that are merely "passing through" and not bona fide cluster members.

Altogether, the cluster contains at least 1000 gravitationally bound stars, for a total mass of about 500-600 Solar masses. A recent survey counts 1010 high-probability members, of which 68% are M dwarfs, 30% are Sun-like stars of spectral classes F, G, and K, and about 2% are bright stars of spectral class A. Also present are five giant stars, four of which have spectral class K0 III and the fifth G0 III.

So far, eleven white dwarfs have been identified, representing the final evolutionary phase of the cluster's most massive stars, which originally belonged to spectral type B. Brown dwarfs, however, are extremely rare in this cluster, probably because they have been lost by tidal stripping from the halo.

In September, 2012 two planets which orbit separate stars were discovered in the Beehive Cluster. The finding was significant

Cancer as depicted in Urania's Mirror, a set of constellation cards published in London c.1825

for being the first planets detected orbiting stars like Earth's Sun that were situated in stellar clusters. Planets had previously been detected in such clusters, but not orbiting stars like the Sun.

Cancer is one of the twelve constellations of the zodiac. Its name is Latin for crab and it is commonly represented as one. It is a medium-size constellation with an area of 506 square degrees and its stars are rather faint, its brightest star *Beta Cancri* having an apparent magnitude of 3.5. It contains two stars with known planets, including *55 Cancri*, which has five: one super-earth and four gas giants, one of which is in the habitable zone and as such has expected temperatures similar to Earth. Located at the centre of the constellation is Praesepe (Messier 44), one of the closest open clusters to Earth and a popular target for amateur astronomers.

The smaller, denser open cluster Messier 67 can also be found in Cancer, 2600 light-years from Earth. It has an area of approximately 0.5 square degrees, the size of the full Moon. It contains approximately 200 stars, the brightest of which are of the tenth magnitude.

OBSERVATION DATA (J2000.0 EPOCH)
Constellation Cancer
Right ascension 08h 51.3m
Declination +11° 49'
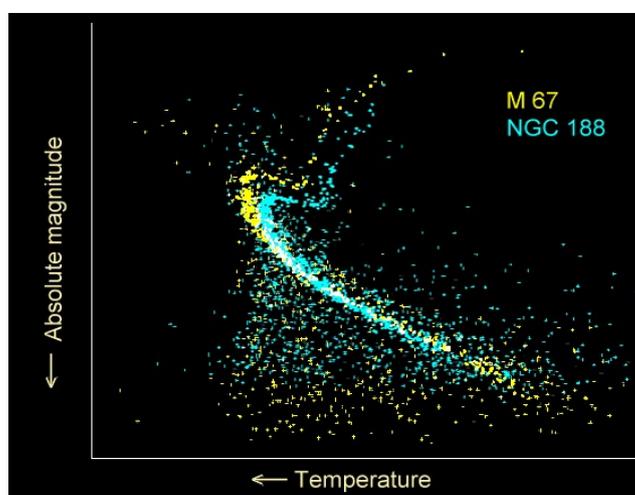Distance ~2.61-2.93 kly (800-900 pc
Apparent magnitude (V) 6.1
Apparent dimensions (V) 30.0'

Messier 67 (also known as M67 or NGC 2682) is an open cluster in the constellation of Cancer. It was discovered by **Johann Gottfried Koehler** in 1779. Age estimates for the cluster range between 3.2 and 5 billion years, with the most recent estimate (4 Gyr) implying stars in M67 are younger than the Sun. Distance estimates are likewise varied and typically range between 800–900 pc.

Hertzsprung-Russell diagram for two open clusters, M67 and NGC 188, showing color-magnitude data for two of the best-studied old open clusters.

M67 is not the oldest known open cluster, but Galactic clusters known to be older are few, and none of those is closer than M67. The latter is an important laboratory for studying stellar evolution, since the cluster is well populated, negligible amounts of dust obscuration, and all its stars are at the same distance and age, except for approximately 30 anomalous blue stragglers, whose origins are not fully understood yet. M67 is probably the second best observed open cluster after the Hyades cluster.

AK, with EarthSky and Wikipedia Notes