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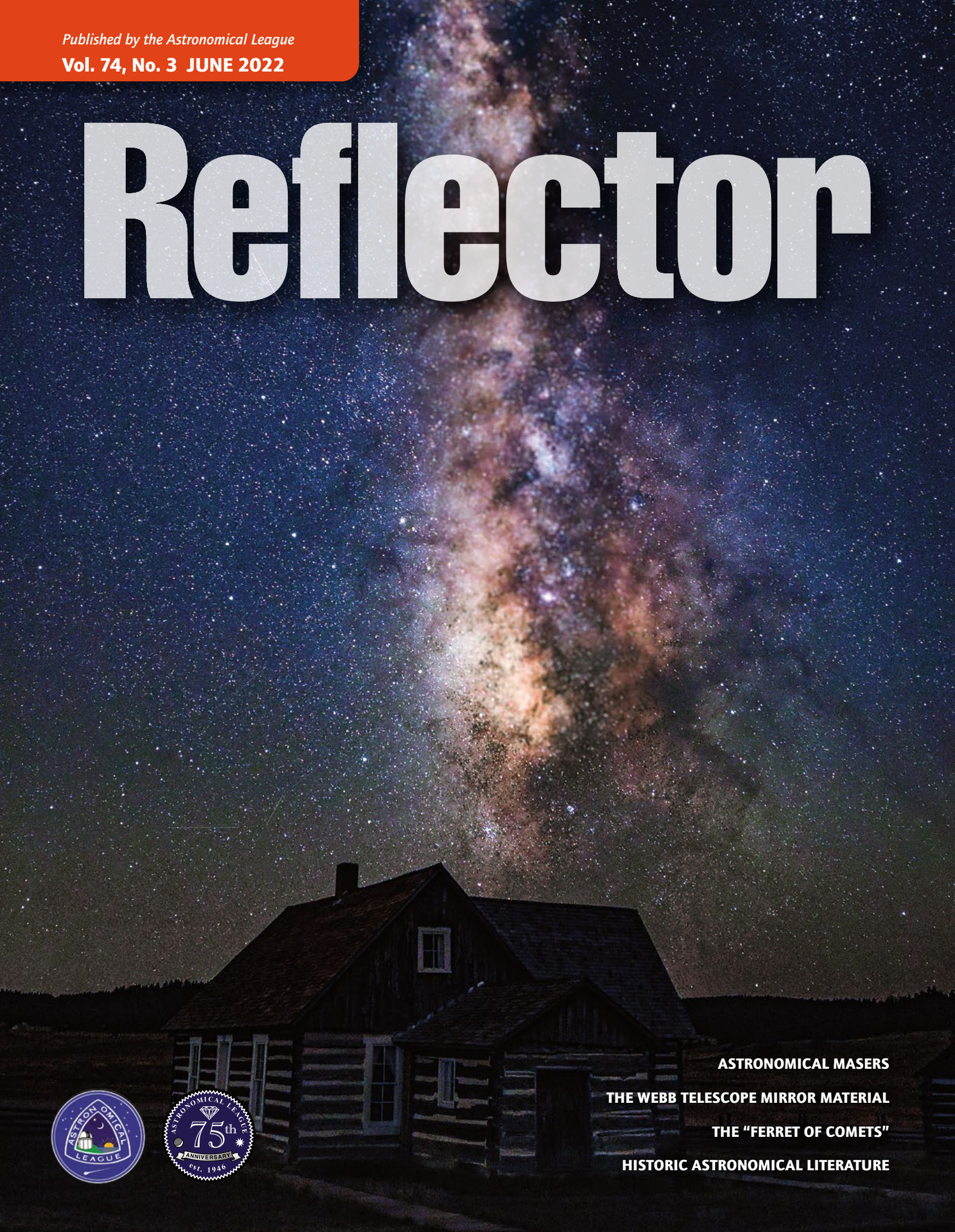
Reflector



ASTRONOMICAL MASERS

THE WEBB TELESCOPE MIRROR MATERIAL

THE "FERRET OF COMETS"

HISTORIC ASTRONOMICAL LITERATURE

The 1960s brought the space program, reigniting interest in the planets as the United States and the Soviet Union launched probes to the other planets in the Solar System. The flood of data allowed scientists to produce more planetary papers, but while a few scientists used Galileo's original definition, most scientists were influenced by the newer notion that moons are not planets. While some moons were as interesting as the planets they orbited, the concept of moon brought forth the image of a cold, dead object like our Moon. Meanwhile, new objects were being discovered in our Solar System at a prodigious rate.

By the time the International Astronomical Union (IAU) voted to demote Pluto to a dwarf planet in 2006, virtually all astronomers wanted to keep the number of planets in the Solar System small (after all, schoolchildren had to memorize them). Satellites were not planets, even though Jupiter's satellite Ganymede is slightly larger than Mercury. To emphasize that point, the IAU passed a separate resolution that there were eight planets and enumerated them.

The definition of a planet that the IAU accepted states that the object must be in orbit around the Sun, in hydrostatic equilibrium (spherical), and have "cleared the neighborhood" around its orbit. The last requirement is somewhat problematic. It eliminated both the (dwarf) planets Ceres and Pluto from the list of planets. But it also depends not only on the physical characteristics of the object, but its location. If Mars orbited farther out, in the Kuiper Belt, it too would be eliminated from the list of planets, since it does not have enough mass to clear an orbit in that region.

Metzger points out, "But if, for instance, a star passes by and disrupts our solar system, then planets are not going have their orbits cleared anymore." Other astronomers have noted that Earth, Mars, Jupiter, and Neptune have not cleared their zones either. Minor planets accompany the first three while Neptune has Pluto in its orbital space.

This definition only applies inside our Solar System. The rapidly expanding number of objects discovered orbiting other stars (exoplanets) are not governed by this definition. The IAU has yet to define an exoplanet or modify the current definition so it applies all across the universe. Metzger says he'd like to see the IAU create a new definition based on the geophysical characteristics of planets, and that the scientific use of the geophysical-focused definition be reflected in textbooks. Perhaps we would then be able to identify an object as a planet when we come out of warp into a new star system.

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Deep-Sky Objects

GLOBULAR STAR CLUSTER M80

Star clusters come in two flavors: open star clusters and globular star clusters. Open star clusters are small and contain anywhere from dozens to thousands of stars. Small groups that are less gravitationally bound are called star associations. Globular star clusters contain many more stars: tens of thousands to a million stars. The one thing common to all star clusters is each was formed out of a giant molecular gas cloud. So all the stars in a cluster share a common chemical origin.

Open star clusters are usually found in the plane of the Milky Way, hence they are also called galactic star clusters. These clusters are young and contain stars of all stellar classes. There are not enough stars for their combined gravity to hold these clusters together indefinitely; their stars will eventually disperse. That is why there are no old open star clusters. Our Sun was formed in an open star cluster that has long-since broken up, leaving our Sun a lone star paving its own path through the Milky Way. Astronomers have identified other stars with very similar composition to the Sun and think they were born in the same star cluster.

Globular star clusters are very old, almost as old as the universe itself. They have enough mass to keep their stars gravitationally bound forever. They contain no large stars of spectral classes O, B, and A. These stars have lifespans much shorter than the age of most globular star clusters. If formed in these clusters, O, B, and A stars have long since died out. The stars in globular clusters are mostly early generation stars in that they do not contain many materials ejected from dying stars. These clusters do not orbit the Milky Way in the galactic plane, but orbit randomly in a fairly uniform spherical halo around the galaxy. Astronomers are not sure how these large clusters formed and ended up in a halo around the galaxy. There are somewhere between 150 and 200 globular clusters in the Milky Way. We find them in other nearly galaxies, that is, galaxies close enough that their globular clusters can be resolved. M31 has thousands of them!

Sagittarius contains the most globular star clusters of any constellation. But Scorpius is not far behind. When gazing at these constellations from our vantage point two-thirds of the way from the center of the Milky Way to the edge, we are looking towards the center of the galaxy, and

beyond it, above and below the galactic plane. That is why so many globular clusters are found in those constellations.

This month I'll focus on globular cluster M80, which is located about halfway between the stars Antares (Alpha Scorpii) and Graffias (Beta Scorpii). M80 is easily seen in binoculars in dark skies. M80 shines at magnitude 7.3 and is 32,600 light-years away. That's 6,600 light-years farther than the center of the Milky Way. It is currently 20,000 light-years north (galactic coordinates) of our galaxy's spiral plane.

M80 has an apparent diameter of 10.0 arcminutes, corresponding to an actual diameter of 95 light-years. It contains several hundred thousand stars, making it one of the most densely packed globular clusters in our galaxy. The cluster is estimated to be 13.5 billion years old.

Charles Messier discovered M80 in 1781. He was unable to resolve the object and distinguish it from a tailless comet, except that M80 did not move with respect to the stars. William Herschel was probably the first astronomer to resolve M80 into stars using his 18.7-inch Newtonian. He described it as "one of the richest and most compressed clusters of small stars I remember to have seen."

M80 is more than four times farther away than M4, a globular cluster located adjacent to Antares. Were M80 as close as M4, it would be slightly bigger and noticeably brighter due to its denser core. At that distance, it would even rival M22, the finest globular cluster visible from mid-northerly latitudes.

An 8-inch telescope at high magnification will provide superb views of M80, resolving it into countless stars and revealing its dense unresolved core. I imaged M80 using an 8-inch f/8 Ritchey–Chrétien with 0.8× focal reducer/field flattener with a SBIG ST-2000XCM CCD camera. The 40-minute exposure was perfect for capturing the cluster.

In the image of M80, the bright star to the upper left of the cluster is SAO 184288 and shines at magnitude 8.44. While the star appears brighter than the cluster, the integrated magnitude of the cluster is brighter. SAO 184288 is a foreground star to the cluster. The second brightest star in the image, below the cluster, is a double star with a magnitude 8.7 yellow primary and a magnitude 10.6 white companion.

There is a nice optical double consisting of a red star and a white star to the lower right of M80 on the image. The red star is magnitude 10.6 while the white star is an easily resolvable double star of magnitude 9.5. Centering the eyepiece on this pair will bring a nice triple star into the view a few arcminutes south of this pair (not captured in this image). The trio has an 8.4 magnitude yellow primary flanked by two 12.8 magnitude white companions.

Because of its location near the ecliptic, occasionally the Moon occults M80. It happened this year on March 22 at 11:20 p.m. CDT. It will not happen again in dark skies for several years.

—Dr. James Dire