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# Reflector

REMEMBERING BILL BOGARDUS

PHOTOGRAPHING THE MOON

TREASURES OF THE LINDA HALL LIBRARY

THE COSMIC WEB



required. Fifth, the color quality of the lighting has to be considered, with lower correlated color temperature (less than 2400 K) preferred in most cases.

All in all, this *Science* article summarizes the known and potential environmental harm from artificial light at night. It states the case and recommends societal changes that have long been advocated by those dedicated to fighting light pollution. It is gratifying to see such work prominently displayed in one of the world's foremost scientific publications.

—Tim Hunter  
Co-founder, IDA

## Deep-Sky Objects

### VIRGO'S BEST BARRED SPIRAL GALAXY

Virgo is the second largest constellation by size. It follows Hydra and is slightly larger than third-place Ursa Major. The constellation contains three percent of the celestial sphere. One might think such a large constellation would contain myriad galactic star clusters, wondrous nebulae, a plethora of globular star clusters, and scores of galaxies. But alas, none of the above is true!



When we look at the constellation Virgo, we are looking towards high northerly galactic declinations, almost as far away from the plane of the Milky Way as possible. So there are virtually no galactic star clusters. Of the 677 NGC objects cataloged in Virgo, not one is an open cluster. Virgo has no NGC nebulae and only one globular star cluster (NGC 5634).

Even my above statement of Virgo possibly containing scores of galaxies is off: the constel-

lation does not just contain scores of galaxies; it contains hundreds of galaxies. Almost every one of the 677 NGC objects in Virgo is a galaxy.

Virgo is known for some pretty impressive galaxies. It contains great elliptical galaxies like M84, M86, and M87. It also holds impressive spiral galaxies like the Sombrero Galaxy (M104). Overall there are 11 Messier galaxies in this bountiful constellation.

Two less-mentioned Messier galaxies in Virgo are M58 and M90. These galaxies are the only Messier objects in Virgo classified as barred spiral galaxies. I find M58 to be the more interesting of the two since it appears face-on. This orientation allows for better views of the central bar and spiral arms.

Most spiral galaxies contain a dense core of stars surrounded by spiral arms. Barred spiral galaxies contain a bar of stars with the spiral arms originating from the ends of the bar. Spiral arms typically contain gas and dust as well as numerous nebulae and star clusters. Bars contain just stars and appear to lack gas and dust. Few spiral galaxies more than seven billion years old contain bars, and some astronomers think bars may be a transient, recurring phase in spiral galaxy evolution. Up to two-thirds of modern galaxies may contain bars. Even our home galaxy, the Milky Way, is a barred spiral galaxy.

Charles Messier discovered M58 in 1779. It was one of 14 spiral “nebulae” known to exist before 1850. The galaxy is located near the northern edge of Virgo. It lies about one-third of the way along a line from the star Vindemiatrix (Epsilon Virginis) to the star

Denebola (Beta Leonis). The galaxy lies near and in between several other brighter galaxies: M60, M87, M89, and M90.

Brightness estimates for M58 average around 9.7. The galaxy is 5.5 by 4.5 arcminutes in size. In small telescopes, the galaxy may look similar to its elliptical companions. Eight-inch telescopes will begin to reveal its central bar as well as brighter areas of its spiral arms. The galaxy lies 75 million light-years away, about 50 percent farther

than the other Messier objects surrounding it on the celestial sphere. Were it located at the same distance, it would rival those galaxies in apparent brightness.

My image of M58 was taken with a 10-inch f/6.9 Newtonian using an SBIG ST-2000XCM CCD camera. The exposure was 180 minutes. North is up and east is to the left. To the right of the galaxy lies the brightest star in the image, eighth-magnitude SAO 100179. The faintest stars in the image are dimmer than magnitude 18. The fuzzy “star” located near the lower left corner is spiral galaxy IC 3604, magnitude 15.3.

Note how tightly wound M58's spiral arms are. The spiral arms are not uniform in brightness, resulting in bright arcs rather than complete spiral arms visible to the eye in larger amateur telescopes. The bar appears to have a central bulge, perhaps indicating the galaxy is in transition to or from an ordinary spiral galaxy.

The constellation Virgo offers a smorgasbord of galaxies to view each spring. No menu is complete without spying the constellation's best barred spiral galaxy, M58.

—Dr. James R. Dire  
Kauai Educational Association for  
Science and Astronomy

## Night Sky Network

### ASTRONOMY TOOLKITS FOR OUTREACH EVENTS

Sidewalk astronomy is one of many types of outreach that clubs perform. Astronomy clubs receive invitations year-round to visit schools, libraries, scout camps, and take part in various community events. Telescopes are usually requested, but often volunteers are also asked to give a talk, share a science demonstration, or otherwise engage with kids in hands-on activities. Events may be scheduled for the middle of the day, inside, or both. Some events, like school STEM fairs, happen rain or shine. The resources provided by the Night Sky Network's outreach toolkits are perfect fits for outreach situations such as these where telescopes might not work out so well, and can even help enrich regular club meetings and stargazing activities right alongside volunteers with telescopes.

Outreach kits are one of the cornerstones of the NSN program. These collections of hands-on activities, handouts, ready-to-use presentations, models, posters, and other demonstrations focus