Our Milky Way: Spirals in space

On one of these cool, clear spring evenings, go outside and look toward the south. Depending on your latitude, the bright stars of Orion, Taurus, Auriga, Gemini, and the two dogs, Canis Major and Canis Minor, will be visible. This area of the sky is especially familiar to stargazers because of the bright stars. It is also a region of space where part of the galaxy in which we live is visible. We traditionally call this the Milky Way—somewhat of a misnomer, as the entire galaxy in which we live is the Milky Way galaxy. This is an area, however, that glows more brightly than the background sky and under good conditions (dark skies away from light pollution) appears as a faintly glowing band that stretches across the sky, from the southern to the northern horizons.

The Milky Way galaxy is a very large collection of stars, dust, and gases spread out in what is believed to be a flattened, disk shape some 100,000 light years in diameter. The central region of the galaxy is more spherical and is referred to as the galactic bulge. In many texts and illustrations, our solar system is depicted as part of one of the galaxy's spiral arms, located approximately 20,000 to 30,000 light years from the galaxy's center. These spiral arms gracefully arc outward from the galactic bulge in long curving assemblages of relatively young, hot stars; open star clusters; and intergalactic dust and gases. In some galaxies the spiral arms are clearly defined while other galaxies contain spiral arms that appear ragged or irregular in comparison.

A curiosity of modern astronomy is that spiral arms should eventually merge into circular patterns of stars wrapped around the central region of a galaxy. This is because the spiral arms (and the galaxy as a whole) are not solid. As a result, our galaxy, like other galaxies, rotates differentially. In other words, as the distance outward from the center of the galaxy increases, the orbital speed of galactic objects also increases. Galaxies, while composed of gravitationally linked objects, are composed of a great many individual objects—all of which have their own orbital speed around the galactic center that is dependent on their distance from the center. Eventually, as a galaxy turns about its rotation center, the spiral arms should wrap around the center forming circles rather than spirals.

So, why does a galaxy have spiral arms?

Not all galaxies are spiral shaped, and not all spiral-shaped galaxies have spiral arms. Galaxies are typically classified as one of four general types based on their appearance. They are referred to as either spiral, barred spiral, irregular, or elliptical shaped. In the case of spiral-shaped galaxies, they are further subdivided into three classifications based on the extent of the galactic bulge. There appears to be a correlation between the size of the galactic bulge and the shape of the spiral arms. Type Sa have a large galactic bulge with circular spiral arms, while type Sc spiral galaxies have the smallest galactic bulge with diffuse, poorly defined spiral arms. The Milky Way galaxy is type Sb, intermediate in galactic bulge size with fairly well-defined spiral arms.

Because spiral arms rotate differentially, there has to be an explanation for the structure of a spiral arm. One theory suggests the presence and motion of density waves moving around the galactic center at a slower rate than the surrounding galactic material (stars, dust, and gases). These density waves, possibly created by supernova deaths of high-mass stars, move slowly through the intergalactic medium somewhat like a wave moving across a body of water. There are alternating crests and troughs in a wave, and the spiral arms may represent the crests of the density wave. In this area, the pressure becomes great enough to generate the temperature required for nuclear fusion of hydrogen, which is why this region is the birthplace of new stars.

So, the next time you are able to see the Milky Way, consider that you may be gazing across intergalactic space from the crest of one density wave (the spiral arm we live within) toward the crest of another density wave. Surf's up!

HUBBLE HERITAGE TEAM (AURA/STSCI/NASA)

The outer spiral arms of the majestic spiral galaxy NGC 4414, some 60 million light years away, are considerably bluer than the rest of the galaxy because of the ongoing formation of young, blue stars.

Special celestial events

Spring forward—Remember to set your clocks forward one hour on Sunday, April 2, as daylight saving time begins.

Visible planets

Take a good look over the southwestern horizon at sunset during April and early May for a glimpse of Mars, Jupiter, and Saturn. This will be the only opportunity for planet viewing until July.

Next issue

In the May issue we'll preview the celestial events you'll want to be on the lookout for this summer, including two solar and one lunar eclipse.

Moon phases	April	May
New Moon	4/04	5/04
First Quarter Moon	4/11	5/10
Full Moon	4/18	5/18
Last Quarter Moon	4/26	5/26

Internet resources

The Galaxies That Fill Our Universe—
hoku.ifa.hawaii.edu/astrokid/files/galaxies.htm
Astronomy Picture of the Day—
antwrp.gsfc.nasa.gov/apod/lib/spirals.html

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