

## The Whirlpool Galaxy (M51) and Companion Galaxy

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## Out of This Whirl

The graceful, winding arms of the majestic spiral galaxy M51 appear like a grand spiral staircase sweeping through space. They are actually long lanes of stars and gas laced with dust.

This sharpest-ever image, taken with NASA's Hubble Space Telescope, illustrates a spiral galaxy's grand design, from its curving spiral arms, where young stars reside, to its yellowish central core, a home of older stars. The galaxy is nicknamed the Whirlpool because of its swirling structure.

The Whirlpool's most striking feature is its two curving arms, a hallmark of so-called grand-design spiral galaxies. Many spiral galaxies possess numerous, loosely shaped arms which make their spiral structure less pronounced. These arms serve an important purpose in spiral galaxies. They are star-formation factories, compressing hydrogen gas and creating clusters of new stars. In the Whirlpool, the assembly line begins with the dark clouds of gas on the inner edge, then moves to bright pink star-forming regions, and ends with the brilliant blue star clusters along the outer edge.

Some astronomers believe that the Whirlpool's arms are so prominent because of the effects of a close encounter with NGC 5195, the small, yellowish galaxy at the outermost tip of one of the Whirlpool's arms. At first glance, the compact galaxy appears to be tugging on the arm. Hubble's clear view, however, shows that NGC 5195 is passing behind the Whirlpool. The small galaxy has been gliding past the Whirlpool for hundreds of millions of years.

As NGC 5195 drifts by, its gravitational muscle pumps up waves within the Whirlpool's pancake-shaped disk. The waves are like ripples in a pond generated when a rock is thrown in the water. When the waves pass through orbiting gas clouds within the disk, they squeeze the gaseous material along each arm's inner edge. The dark dusty material looks like gathering storm clouds. These dense clouds collapse, creating a wake of star birth, as seen in the bright pink star-forming regions. The largest stars eventually sweep away the dusty cocoons with a torrent of radiation, hurricane-like stellar winds, and shock waves from supernova blasts. Bright blue star clusters emerge from the mayhem, illuminating the Whirlpool's arms like city streetlights.

The Whirlpool is one of astronomy's galactic darlings. Its beautiful face-on view and closeness to Earth allow astronomers to study a classic spiral galaxy's structure and star-forming processes.

## VOCABULARY

**Galaxy:** A collection of stars, gas, and dust bound together by gravity.

**Stellar wind:** Streams of charged particles flowing from the star at millions of kilometers per hour.

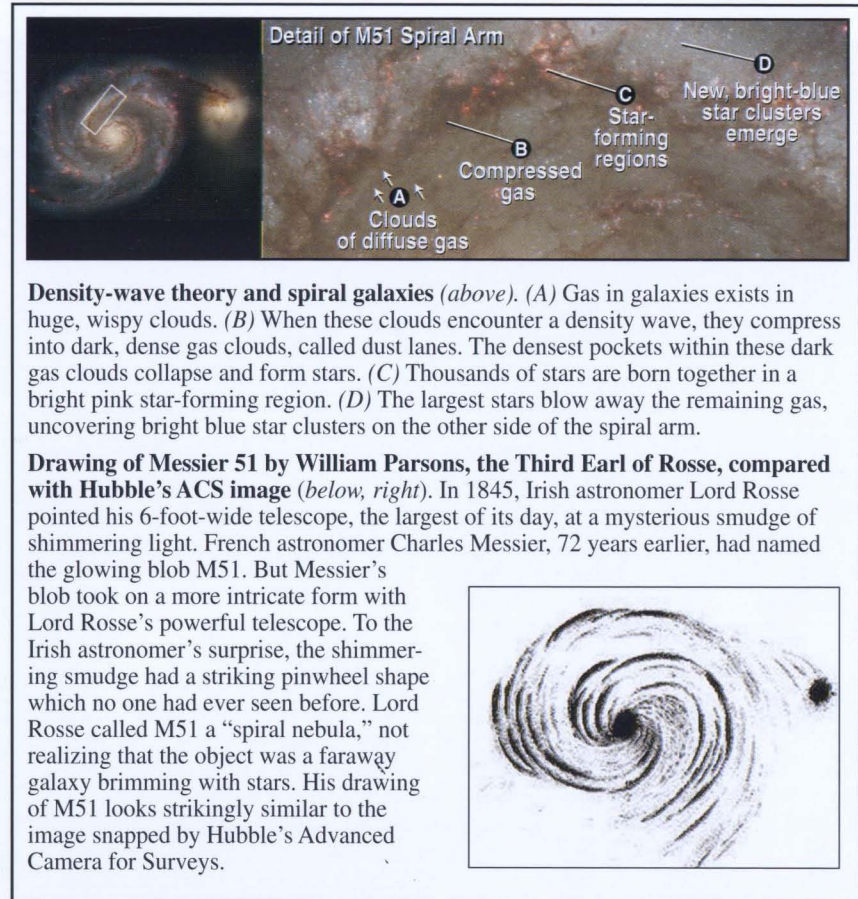
## FAST FACTS

**Location:** Constellation Canes Venatici (the Hunting Dogs)

**Distance from Earth:** 31 million light-years

**Width (of entire ACS image):** 90,000 light-years

*Credits: NASA, ESA, S. Beckwith (STScI), and the Hubble Heritage Team (STScI/AURA)*



**Density-wave theory and spiral galaxies** (above). (A) Gas in galaxies exists in huge, wispy clouds. (B) When these clouds encounter a density wave, they compress into dark, dense gas clouds, called dust lanes. The densest pockets within these dark gas clouds collapse and form stars. (C) Thousands of stars are born together in a bright pink star-forming region. (D) The largest stars blow away the remaining gas, uncovering bright blue star clusters on the other side of the spiral arm.

**Drawing of Messier 51 by William Parsons, the Third Earl of Rosse, compared with Hubble's ACS image** (below, right). In 1845, Irish astronomer Lord Rosse pointed his 6-foot-wide telescope, the largest of its day, at a mysterious smudge of shimmering light. French astronomer Charles Messier, 72 years earlier, had named the glowing blob M51. But Messier's blob took on a more intricate form with Lord Rosse's powerful telescope. To the Irish astronomer's surprise, the shimmering smudge had a striking pinwheel shape which no one had ever seen before. Lord Rosse called M51 a "spiral nebula," not realizing that the object was a faraway galaxy brimming with stars. His drawing of M51 looks strikingly similar to the image snapped by Hubble's Advanced Camera for Surveys.

You can get images and other information about the Hubble Space Telescope on the World Wide Web. Visit <http://www.stsci.edu/outreach> and follow the links.

The corresponding Classroom Activity for this lithograph can be found at:

<http://amazing-space.stsci.edu/> or may be obtained by contacting the Office of Public Outreach at the Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218.