Milky Way Galaxy Encircled by Stars

Finding May Be Clue to Formation

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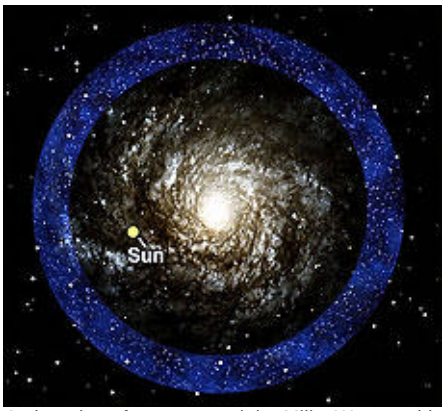
With its black hole nursing an eating disorder, its magnetic lines tangled like spaghetti and a ring of clutter left from a collision with a dwarf, Earth's home galaxy looks more and more like a mess that not even Martha Stewart could pretty up.

Astronomers have long known that the glittering firmament of the Milky Way wheeling overhead on a clear night is a peaceful illusion that masks cosmic violence and chaos. But some recent observations have revealed new variations on the theme.

Scientists said yesterday that they have discovered a previously unsuspected belt of stars encircling the galaxy like a giant undulating hula hoop 120,000 light-years in diameter. Astronomers believe the star belt is the tell-tale remnant of a collision between the Milky Way and a smaller "dwarf" galaxy and could help explain how the galaxy formed about 10 billion years ago.

Other teams of observers looking inward to the heart of the galaxy reported fresh insights into the lean and hungry lifestyle of a huge black hole believed to lurk there, and they described a shocking hodgepodge in the magnetic field at the galactic core. The scientists discussed these findings at the winter meeting of the American Astronomical Society in Seattle.

The Milky Way system is a spiral disk, or pinwheel, of about 400 billion visible stars. Its flat, starry disk is enveloped in a vast spherical shell, or halo. Although the halo contains most of the mass of the galaxy, it is largely invisible and its composition is unknown. Scientists know it is there mainly because of its gravitational influence.



A giant ring of stars around the Milky Way, could be evidence of our galaxy's violent birth. (Rensselear Polytechnic Institute - Sloan Digital Sky Survey)

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By studying the star belt, astronomers hope to obtain better measurements of this mysterious dark matter.

"What's new is the position of the star belt on the outskirts of the Milky Way, an ideal position to study the distribution and amount of dark and light mass," said Brian Yanny of the Fermi National Accelerator Laboratory's Experimental Astrophysics Group, a co-leader of the observing team.

The sun and its planets are situated on one of the galaxy's spiral arms, about two-thirds of the way out, or about 25,000 light-years from the center of the disk. (A light-year is 5.9 trillion miles, the distance light travels in a year in a vacuum.) Astronomers find it frustratingly difficult to observe their home galaxy because they are inside it and because vast lanes of gas and dust (more mess) block their view. To try to penetrate these obstructions, they observe in various wavelengths of light.

Smaller galaxies get stretched and pulled apart by gravity as they fall into big galaxies, researchers believe, and the remnants form into streams of stars orbiting the dominant galaxies.

"When we find large groups of stars formed into rings, it's an indication that at least part of our galaxy was formed by a lot of smaller or dwarf galaxies mixing together," said Heidi Jo Newberg of Rensselaer Polytechnic Institute, a co-leader of the research team.

Newberg's team discovered the star belt by using one of the most complex camera systems ever designed, part of the Sloan Digital Sky Survey. This unprecedented project to map one-quarter of the sky in 3-D is based at the Apache Point Observatory in New Mexico.

At the galaxy's crowded core, the scientists said, there is new evidence that the black hole, which weighs about three million times the mass of the sun, is starved and cantankerous.

The team used NASA's Chandra X-ray Observatory -- with its unprecedented focus, sensitivity and ability to see fine detail -- to take the longest X-ray observation ever of the monster.

The results from the 164-hour exposure showed that the black hole flared up several times at irregular intervals, presumably as it sucked in material such as gas or dust, which got squeezed and heated, twisted and accelerated as it neared the hole's "event horizon" -- the point at which matter and information effectively leave the known universe. (A black hole is a collapsed object so dense that nothing, not even light, can escape its gravity after crossing that point of no return. Astronomers study the objects through the fireworks they trigger around themselves.)

"We are getting a look at the everyday life of a super-massive black hole like never before," said Frederick K. Baganoff of the Massachusetts Institute of Technology, who presented the results on behalf of an international team. "We see it flaring on an almost daily basis."

The rapidity of the X-ray flares indicates they are occurring near the event horizon, but their weak intensity suggests that the black hole is starved for food.

"Although it appears to snack often, this black hole is definitely on a severe diet," Baganoff said. "This could be because explosive events in the past blew away much of the gas from the neighborhood of the black hole."

Another team of scientists yesterday challenged the conventional view of the magnetic field at the Milky Way's center, which held that strange filament-like structures in the field were all aligned in similar directions, as orderly as iron filings near a bar magnet.

On the contrary, said astronomers using the National Science Foundation's Very Large Array radio telescope reported. They found three times as many filaments as past observers and found the structures to be arrayed every which way -- tangled "like a bowl of spaghetti."

"The Milky Way's center is an exciting, mysterious region that, once again, has given us a surprise," said Namir Kassim of the Naval Research Laboratory, one of the team leaders.

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