

Astronomers Describe New Evidence of 'Inconvenient' Galaxy

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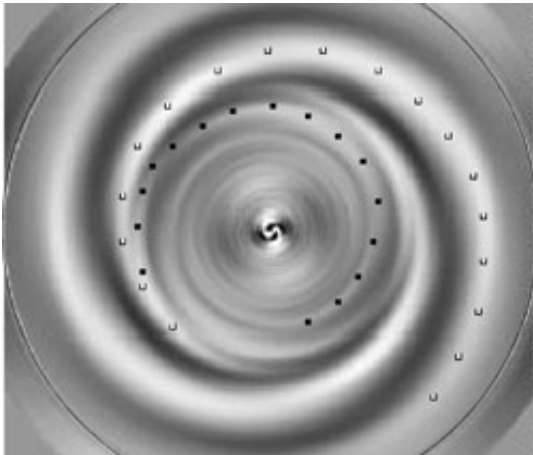
In this color image of NGC4622, note the strong inner counter-clockwise outward winding single arm and the strong outer clockwise outward winding pair of arms. Fourier analysis of the image reveals a hidden inner counter-clockwise pair. No matter which way the disk turns, one of the pairs must wind outward in the direction of turning.

Discovery of two new components within a puzzling spiral galaxy confirm it must have a pair of arms winding in the opposite direction from most galaxies, according to results being presented today to the American Astronomical Society meeting in Austin, Texas. Presenting the results are Drs. Gene Byrd and Ron Buta, from The University of

Alabama; Tarsh Freeman, Bevill Community College; and Dr. Sethanne Howard, retired from the U.S. Naval Observatory.

“While the existence of a galaxy with a pair of ‘backward’ arms may seem like an inconvenient truth to many, our latest analysis indicates it is, nonetheless, a reality,” says Byrd, professor of astronomy at The University of Alabama.

The galaxy, known as NGC4622, lies 200 million light years away in the constellation Centaurus.



In this Fourier component image of NGC4622’s arm pairs, one of the previously known strong pair of outer clockwise arms is marked with white dots. Interior to this, one of the newly discovered pair of counter-clockwise arms is marked with black dots. Either the newly discovered inner pair or the previously known outer pair must lead, winding outward in the direction the disk turns. Analysis of Fourier images in different colors indicates that the outer pair leads.

Spiral arm pairs seen in galaxies are thought to trail, meaning they wind outward, opposite the direction of rotation of the disk material. Leading arms, such as the pair reported by the astronomers for NGC4622, do the

opposite, opening outward in the same direction as the rotation of the galaxy's disk.

Using a Fourier component image method to further analyze a 2001 Hubble Space Telescope image, the team discovered a previously hidden inner counter clockwise pair of spiral arms.

“Contrary to conventional wisdom, with both an inner counter-clockwise pair and an outer clockwise pair of spiral arms, NGC4622 must have a pair of leading arms,” Byrd said. “With two pairs of arms winding in opposite directions, one pair must lead and one pair must trail. Which way is which depends on the disk's rotation. The outer clockwise pair must be the leading pair if the disk turns clockwise. Alternatively, the inner counter clockwise pair must be the leading pair if the disk turns counter clockwise.”

The team also discovered an outer clockwise single arm, previously hidden by the stronger outer clockwise arm pair. The galaxy also has a previously identified inner single counterclockwise arm. This confirms the galaxy must have a single leading arm. The outer clockwise arm must be the leading arm if the disk turns clockwise. The inner counter clockwise arm must be the leading single arm if the disk turns counter clockwise.

The researchers also performed a more complicated analysis of different color Fourier image components. This revealed the stronger outer clockwise pair of arms as the leading pair.

Results are also scheduled for January publication in *Astronomical Journal*.

In 2002, team members first published, to great skepticism, results from a previous method that indicated the galaxy had a leading pair of spiral

arms.

Other astronomers were skeptical of the 2002 announcement, in part, because the galaxy disk is only tilted about 19 degrees from face-on and because clumpy dust clouds might be concentrated on one side of the disk, creating misleading results. In response, the team's new Fourier component method is actually assisted by the small tilt, and the effects of dust are not used in the latest analysis.

“Two independent methods now indicate that NGC4622's arms do indeed behave in a very unusual fashion, with the outer arms winding outward in the same direction the galaxy turns,” said Byrd, a faculty member within UA's College of Arts and Sciences.

Further studies of the origin of this behavior are needed, the researchers said. The Hubble Space Telescope image reveals a dark dust lane in the center which suggests the galaxy may have consumed a smaller companion galaxy, the researchers said.

Source: University of Alabama

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