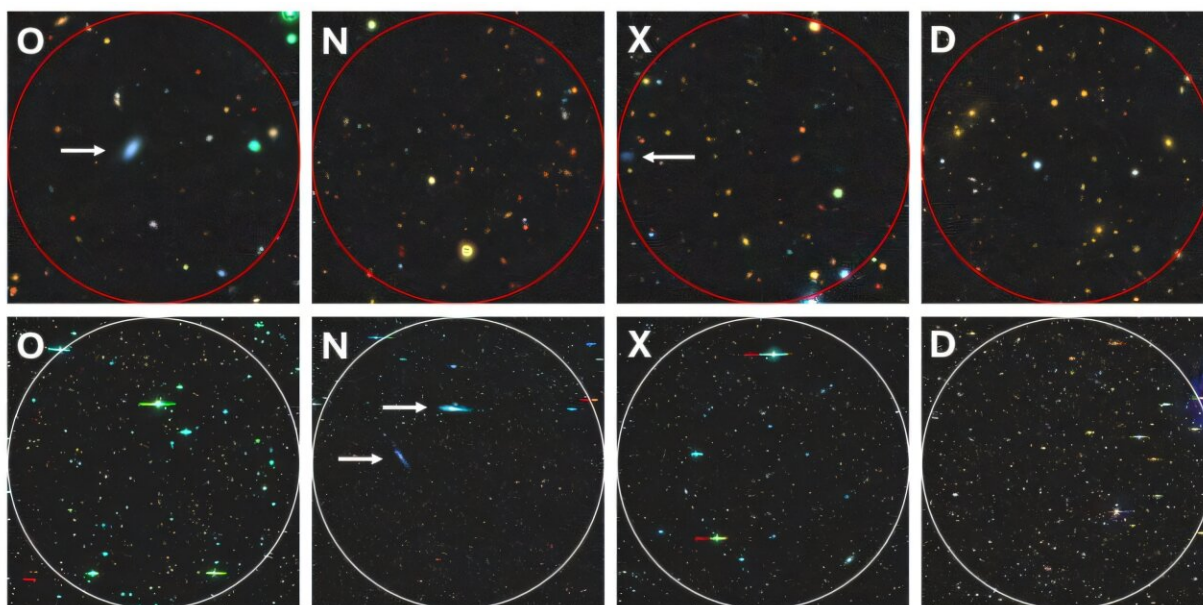


What are dark galaxies? Astronomers expose 70 hidden candidates with no visible stars

April 27 2026, by Shreejaya Karantha



Examples of the four categories used to classify HI sources: optical counterpart (O), nearby galaxy (N), unsure (X), and dark galaxy candidate (D). The red circle shows the FAST beam size (3') and the white circle marks a 150 kpc radius around the source. O–Optical Counterpart: The blue galaxy, identified by a white arrow, represents the optical counterpart of the FASHI source J165132.43+581535.3. N–Nearby Galaxy: The FASHI source is J124154.31+320735.2, which is located near two galaxies indicated by white arrows. X–Unsure Source: The FASHI source J160441.93+414207.2 presents an unclear optical counterpart. D–Dark Galaxy Candidate: A true dark galaxy candidate shows no visible optical counterpart at either scale, except for background galaxies. Credit: *arXiv* (2026). DOI: 10.48550/arxiv.2604.14699

Galaxies are not always teeming with vibrant, hot young stars. Sometimes, they are rich in gas and dark matter but have very few or no stars, making them extremely difficult to detect. They are called "dark galaxies" and recently astronomers have identified 70 potential dark galaxies using early data from the Five-hundred-meter Aperture Spherical Telescope (FAST). A paper outlining this research work was submitted to the [arXiv](#) preprint server on April 16.

Ghost structures

The existence of dark galaxies has long been predicted by theory. The currently accepted model of the universe—the [Lambda Cold Dark matter model](#)—describes how dark matter clumps into halos across a wide range of masses to form galaxies but also predicts far more low-mass halos than we actually observe as galaxies.

For decades, astronomers suspected that many of these "missing" halos never formed stars due to processes such as [UV background radiation](#) (from quasars and early galaxies) heating their gas, or simply too small to gravitationally hold onto the cold gas needed to create stars. What remained were dark matter halos with no or very few stars to shine back at us—dark galaxies.

To find more dark galaxy candidates, a team of astronomers led by Marco Monaci of the Center for Astrophysics and Supercomputing at Swinburne University of Technology scanned the sky for [neutral hydrogen gas](#) (HI) emission. It is a reliable tracer of galaxies with a reservoir of neutral hydrogen that emits a very specific radio signal at a wavelength of 21 cm (the "21 cm line").

This line is produced when the electron in a hydrogen atom flips its spin. To avoid mistaking stripped gas clouds from galaxy interactions for true dark galaxies, the team required candidates to have no optical

counterpart and to be isolated, located at least 150 kiloparsecs away from any bright galaxy.

Clues from hydrogen

Astronomers started with 41,741 HI sources from the [FAST All Sky HI](#) (FASHI) catalog, which is a survey of neutral hydrogen detected by FAST. They then narrowed it down to 3,436 sources within roughly 50 million parsecs of Earth.

The team then cross-checked these against major optical galaxy catalogs to filter out already-known galaxies, leaving 1,278 sources with no known optical counterpart. After further examination, 1,091 sources remained unidentified.

These were then visually inspected using deep optical images, sorting them into four classes: those with a likely optical counterpart, those near bright galaxies (possible gas clouds or tails), uncertain cases, and the cleanest 85 candidates with no identifiable optical counterpart at all.

After a final round of quality checks that removed 15 problematic sources, they arrived at a final catalog of 70 dark galaxy candidates (DGCs). Astronomers also found that the sample may contain two populations: [truly dark galaxies](#) with no stars, and "almost dark" galaxies with stars too faint to detect with current optical surveys.

The researchers are careful to mention that these 70 sources are the best candidates, not confirmed dark galaxies. To verify them, follow-up observations are needed: high-resolution HI imaging to confirm the gas structure, and extremely deep optical imaging to rule out faint stellar bodies below current detection limits.

"Consequently, once the full FASHI catalog is completed, we expect

roughly 200 DGCs over the area observable by the FAST telescope," the team wrote in the paper. For now, this study presents a potential catalog of these elusive structures that could serve as a foundation for upcoming dark galaxy studies.

More information: Marco Monaci et al, FAST and Dark: A catalogue of Dark Galaxy Candidates within 50 Mpc, *arXiv* (2026). [DOI: 10.48550/arxiv.2604.14699](https://doi.org/10.48550/arxiv.2604.14699)

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