Little Red Dots Discovered by JWST

What do we know? — Overview as of September 2026

Little Red Dots (LRDs) are one of the more surprising things JWST has turned up, and 2026 has been a big year for understanding them. Here's where things stand.

What They Are

LRDs are compact, extremely red point-source-like objects found in JWST deep-field images, mostly at redshifts corresponding to roughly 600 million to 1.6 billion years after the Big Bang. Over 300 have been found so far, and a systematic sample study mapped 341 LRDs across several major JWST surveys, tracking their abundance from redshift 2 to 11 and strengthening the link between these compact red sources and a widespread population of faint early active galactic nuclei.

They earned an early reputation for “breaking cosmology” — some scientists noted that they appear in large numbers around 600 million years after the Big Bang but seem to disappear before the universe reaches 2 billion years old, and their apparent numbers and masses initially seemed too large for standard galaxy-formation models to explain.

The Leading Explanation: Black Holes in Gas Cocoons

A major turning point came from a Nature study analyzing the highest-quality JWST spectra available. It found that little red dots are young supermassive black holes shrouded in dense cocoons of ionized gas, where electron scattering rather than Doppler motion broadens their spectral lines. This mattered for the “broken cosmology” worry: it showed the black holes inside little red dots are likely about 100 times less massive than earlier estimates suggested, because the dense gas cocoons around them were artificially broadening spectral lines in a way that mimicked a heavier object — bringing masses back in line with what models predicted.

The “Black Hole Star” Idea

Building on that, a striking new twist appeared in August 2026: researchers proposed a genuinely new class of object, a **black hole star** — roughly the scale of a solar system, with a star-like envelope powered not by fusion but by a feeding black hole at its core. In this picture, matter spirals into the black hole, heats up, and converts infall energy into radiation, with a young galaxy's light added on top making the whole thing look like a typical LRD. A follow-up search found 241 candidate black-hole-star-dominated sources in Webb data, though that's described as a testable population-level hypothesis rather than 241 confirmed cases.

Deep single-object spectroscopy has backed this up too: a June 2026 team led by Vasily Kokorev at UT Austin published the deepest spectrum ever taken of a single little red dot (a lensed object called GLIMPSE-17775), finding more than 40 independent spectral lines — containing multiple lines of evidence pointing to a black hole star, with researchers noting that no previous LRD had all the pieces

of evidence in the same place.

A Competing Model: Pulsating Supermassive Stars

Not everyone agrees it's a black hole. A pair of Harvard-led papers proposed a very different mechanism: living stars roughly 100,000 times the Sun's mass, pulsating violently and shedding gas shells shortly before collapsing into the universe's first supermassive black holes. Notably, this was the first model to simultaneously explain all three of LRDs' defining oddities — their V-shaped spectra, compact appearance, and unusual nitrogen chemistry — where earlier proposals typically nailed one or two features but stumbled on the rest. The authors' next step is translating the model into detailed spectral predictions JWST can directly test.

Other Findings on Environments and Fate

- Direct dynamical mass measurements are starting to happen: one study used gravitational lensing and deep spectroscopy to directly measure a roughly 50-million-solar-mass black hole in an LRD at redshift 7.04.
- LRDs aren't necessarily isolated — one was found surrounded by eight nearby galaxies, direct evidence that at least some LRDs sit in strongly overdense environments where interactions and mergers may be more likely.
- Very recently, researchers reported evidence of Little Red Dots caught in the act of merging, supporting the idea that LRDs are early black holes and that their mergers help build up supermassive black holes.
- There's also a related oddball object — an unusual LRD-like source with strong X-ray emission that may be a transitional stage between deeply buried little red dots and more conventional AGN.

Bottom Line

The field has moved from “these might break cosmology” to a much more settled (though still contested) picture where LRDs are largely young, gas-shrouded accreting black holes — with a serious rival theory that some may instead be exotic pulsating supermassive stars on the verge of collapsing into black holes. Both camps agree these objects are a missing link in how the universe's first supermassive black holes formed; they disagree on exactly what's glowing inside the red dot.

Compiled from JWST research reported through September 2026, including studies published in Nature, The Astrophysical Journal, and Publications of the Astronomical Society of Japan.