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Intense Bursts of Star Formation Drive Fierce Galactic Winds



Gas out of the starburst galaxy M82 in this composite image from three observatories. Credit: Smithsonian Chandra X-ray Observatory

Fierce galactic winds powered by an intense burst of star formation may blow gas right out of massive galaxies, shutting down their ability to make new stars.

Sifting through images and data from three telescopes, a team of astronomers found 29 objects with outflowing winds measuring up to 2,500 kilometers per second, an order of magnitude faster than most observed galactic winds.

“They’re nearly blowing themselves apart,” said Aleksandar Diamond-Stanic, a fellow at the University of California’s Southern California Center for Galaxy Evolution, who led the study. “Most galactic winds are more like fountains; the outflowing gas will fall back onto

the galaxies. With the high-velocity winds we’ve observed the outflowing gas will escape the galaxy and never return.” Diamond-Stanic and colleagues published their findings in *Astrophysical Journal Letters*.

The galaxies they observed are a few billion light years away with outflowing winds of 500 to 2,500 kilometers per second. Initially they thought the winds might be coming from quasars, but a closer look revealed these winds emanate from entire galaxies.

Young, bright and compact, these massive galaxies are in the midst of or just completing a period of star formation as intense as anyone has ever observed.

“These galactic-scale crazy-fast winds are probably driven by the really massive stars exploding and pushing out the gas around them,” said Alison Coil, professor in UC San Diego’s Center for Astrophysics and Space Sciences and a co-author of the paper. “There’s just such a

high density of those stars it's like all these bombs went off near each other at the same time. Each bomb evacuates the area around it, then the next can push gas out further until they're evacuating gas on the scale of the whole galaxy.”

Galaxies with winds this fast are also quite rare, opening up the question of whether these are unusual events or part of a common phase in the evolution of massive galaxies that is seldom observed because it is so brief.

Astrophysicists still lack an explanation for how and why starmaking ends. Theorists who model the evolution of galaxies often invoke supermassive black holes called active galactic nuclei, which can also generate savage winds, to explain how gas needed to form stars can be depleted.

These new observations demonstrate that black holes may not be necessary to account for how these kinds galaxies run out of gas. “The winds seem to be powered by the starburst,” Diamond-Stanic said. “The central supermassive black hole is apparently just a spectator for these massive stellar fireworks.”

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