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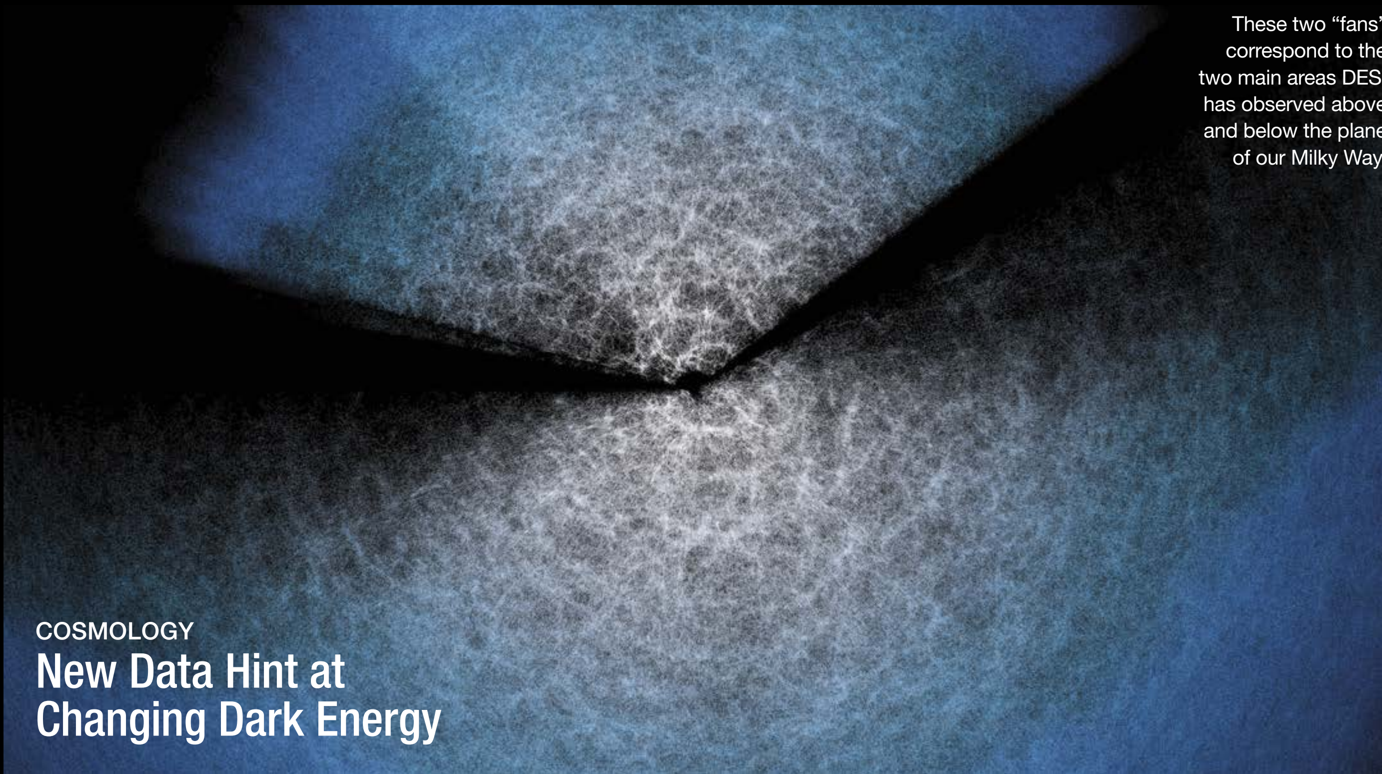

These two "fans" correspond to the two main areas DESI has observed above and below the plane of our Milky Way.

COSMOLOGY

New Data Hint at Changing Dark Energy

THE LARGEST 3D MAP of the universe yet shows hints that dark energy might be weakening over cosmic time. If true, it means that our most trusted cosmological model — in which dark energy is constant — might be wrong.

Dark energy is the reason the universe's expansion rate is currently accelerating. In the early universe, when everything huddled close together, gravity dominated over dark energy. But as space expanded, the gravitational attraction between galaxies (and their halos of dark matter) waned with their growing separation, while a constant dark energy would always have exerted the same repulsive force. Around 5 billion years ago, the pull of gravity dipped below the might of dark energy, and the expansion of the universe began to accelerate away.

Now, new data from the Dark Energy Spectroscopic Instrument (DESI) suggests the acceleration itself may be slowing. Located at the Kitt Peak National Observatory in Arizona, DESI is a powerful instrument capable of observing 5,000 galaxies simultaneously. Astronomers on the DESI team have analyzed three years of observations with more than 14 million galaxies and quasars, posting results on the astronomy arXiv preprint server.

On its own, the new DESI data are consistent with our standard cosmological models. Add in other observations, though, such as of the cosmic microwave background, gravitational lensing, and distant supernovae, and the neatest way to tie it all together is to invoke a weakening dark energy.

"What we are seeing is deeply intriguing," says DESI co-spokesperson Alexie Leauthaud-Harnett (University of California, Santa Cruz). "It is exciting to think that we may be on the cusp of a major discovery about dark energy and the fundamental nature of our universe."

This isn't the first hint from DESI that our leading cosmological model has issues. The project's first results already showed subtle hints of mutable dark energy in 2024. And results presented at the American Physical Society's Global Physics Summit in California from the similarly named but independent Dark Energy Survey (DES) likewise point to a repulsive force that changes over time.

However, it's still far from an open-and-shut case. "The significance of the claim that dark energy is dynamic is still low," says Andy Taylor (University of Edinburgh, UK), who wasn't involved in the research. "It is still possible the disagreement is a statistical fluke, or there may still be some bias in the data causing the results."

That said, if future data firm up these findings, it would be a remarkable breakthrough. "It would be a hugely significant result, worthy of a Nobel prize on its own," Taylor says.

"Whatever the nature of dark energy is, it will shape the future of our universe," says DESI Director Michael Levi (Lawrence Berkeley National Lab). If dark energy were constant, it's possible that runaway expansion would eventually tear all structure in the universe apart in a "Big Rip." But in light of these new results, that fate seems less likely.

"It's pretty remarkable," Levi adds, "that we can look up at the sky with our telescopes and try to answer one of the biggest questions that humanity has ever asked."

■ **COLIN STUART**

DESI COLLABORATION / DOE / KPNO / NOIRLAB / NSF / AURA / R. PROCTOR