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HEAVENLY DRIFTERS

STARS

By Marcia Bartusiak

The history of astronomy is strewn with the rubble of fallen cosmological models. Copernicus, with his radical doctrine of an Earth revolving about the sun, removed us from the center of the universe. Galileo, the first person to gaze at the heavens with a telescope, introduced humankind to a universe of wondrous intricacy. Now twentieth-century astronomers are challenging another dogma: our portrait of a homogeneous cosmos in which galaxies are evenly distributed.

Extragalactic surveyors have learned that the cosmos doesn't expand in as regular and orderly a fashion as previously thought. The cosmic sea appears to be awash with strong local currents—and no one is sure why. A team of American and British astronomers has discovered that the Milky Way—as well as all the galaxies, clusters of galaxies, and superclusters in a vast region of space surrounding our home galaxy—is racing toward a point in the sky marked by the Southern Cross, a prominent star group in the Southern Hemisphere. Theorists and observers alike are struggling to explain this peculiar and surprising current.

In 1929 the eminent astronomer Edwin Hubble proved that galaxies are carried outward as space-time expands. The spark that ignited this tremendous push is generally assumed to be the Big Bang, the cataclysmic explosion that, as theory has it, gave birth to our universe about 15 billion years ago.

As galaxies move along they also experience more localized, or "peculiar," motions, the result of being pushed or pulled by nearby concentrations of matter. Our Milky Way, for example, hovers at the edge of a large collection of galaxies known as the Local Supercluster and is gradually being drawn toward the Supercluster's center. Further observations had led astronomers to conclude that the Local Supercluster was in turn drawn toward another distant galactic collection, known as the Hydra-Centaurus Supercluster. And according to theories of the distribution of matter in the universe,

these and other galaxies were supposed to be moving at a predictable rate.

New evidence, however, shatters this assumption. While working on an unrelated astronomical project, a team of seven astronomers using six telescopes situated on four continents discovered first of all that Hydra-Centaurus is not drawing closer. It's moving away from us. Second, it is moving at a rate faster than can be attributed to the cosmic expansion astronomers now know occurred. All the galaxies in the Local Supercluster and the Hydra-Centaurus Supercluster are streaming together through space at speeds of more than 1 million miles per hour over and above the rate of cosmic expansion. With everything in motion, it took a while to detect the additional velocities of the galaxies.

"One might think of these galaxies as moving downstream together," says team member Alan Dressler of the Mount Wilson and Las Campanas observatories. "This finding indicates that our long-held belief in a smooth and uniform universe was just an illusion."



Supercluster: racing through space. But why?

In the tradition of so many astronomical findings, the discovery of this large-scale mass flow was serendipitous. Originally the team had set out to study the general properties of elliptical galaxies, those roundish systems of stars. It was the kind of long-term, tedious project rarely heralded in popular-science stories.

"Once we started analyzing our data, we saw the anomalous motion almost right away," Dressler says. "But it took at least a year before we were convinced."

What could be causing this galactic flow? "One simple but speculative interpretation," offers team member David Burstein of Arizona State University, "is that a huge concentration of mass greater than Hydra-Centaurus exists somewhere beyond. This mass could be drawing Hydra-Centaurus, our galaxy, the entire local universe toward it." Lately, survey members think that a vast conglomeration of galaxies beyond Hydra-Centaurus—some 10,000 trillion solar masses in size—is one candidate.

Others wonder if this unusual surge of motion is left over from the universe's primordial beginnings, when the cosmos was generating galaxies and releasing enormous amounts of energy as newborn stars radiated and explosively died. Early last year, in extending their maps of the sky, astronomers at the Harvard-Smithsonian Center for Astrophysics did find that galaxies were arranged as though they formed the surfaces of gigantic cosmic bubbles, forged perhaps from the shock waves of primordial stars, which exploded and pushed the galactic matter into spherical shells. The same explosions are what could have sent the galaxies streaming through space. It will take more sky surveys to do it.

"The more flows and the more bubbles we find, the better," says Dressler, "because it means we are finally going to find out how the universe really works."

"At some time in the future," Dressler adds, "astronomers might look back on our study and the Harvard-Smithsonian survey as turning points in the understanding of the large-scale structure of the universe." 