



The Universe's INVISIBLE HAND

Dark energy does more than hurry along the expansion of the universe. It also has a stranglehold on the shape and spacing of galaxies

BY CHRISTOPHER J. CONSELICE

WHAT TOOK US SO LONG? Only in 1998 did astronomers discover we had been missing nearly three quarters of the contents of the universe, the so-called dark energy—an unknown form of energy that surrounds each of us, tugging at us ever so slightly, holding the fate of the cosmos in its grip, but to which we are almost totally blind. Some researchers, to be sure, had anticipated that such energy existed, but even they will tell you that its detection ranks among the most revolutionary discoveries in 20th-century cosmology. Not only does dark energy appear to make up the bulk of the universe, but its existence, if it stands the test of time, will probably require the development of new theories of physics.

Scientists are just starting the long process of figuring out what dark energy is and what its implications are. One realization has already sunk in: although dark energy betrayed its existence through its effect on the universe as a whole, it may also shape the evolution of the universe's inhabitants—stars, galaxies, galaxy clusters. Astronomers may have been staring at its handiwork for decades without realizing it.

Ironically, the very pervasiveness of dark energy is what made it so hard to recognize. Dark energy, unlike matter, does not clump in some places more than others; by its very nature, it is spread smoothly everywhere. Whatever the location—be it in your kitchen or in intergalactic space—it has the same density, about 10^{-26} kilogram per cubic meter, equivalent to a handful of hydrogen atoms. All the dark energy in our solar system amounts to the mass of a small asteroid, making it an utterly inconsequential player in the dance of the planets. Its effects stand out only when viewed over vast distances and spans of time.

Since the days of American astronomer Edwin Hubble, observers have known that all but the nearest galaxies are moving away from us at a rapid rate. This rate is proportional to distance: the more distant a galaxy is, the faster its recession. Such a pattern implied that galaxies are not moving through space in the conventional sense but are being carried along as the fabric of space itself stretches [see “Misconceptions about the Big Bang,” by Charles H. Lineweaver and Tamara M. Davis; SCI-