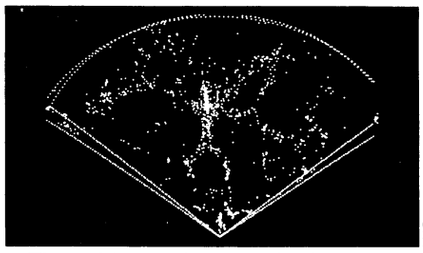
Blown away: Froth of cosmic bubbles

Astronomers used to think the universe was homogeneous. But recent observations of voids in the universe, of clusters of galaxies associated in ultralong superclusters, have seemed to fault the idea. Soon astronomers may have to give it up entirely. The latest, and apparently most extensive, observation, reported at last week's meeting in Houston of the American Astronomical Society, indicates that the universe is a froth of bubbles, large empty volumes with galaxies clustered in their walls.

The distribution of galaxies was observed in what the scientists call a "slice of the universe," a region extending almost halfway around the horizon and 6° thick. In this they have plotted the locations of galaxies according to their velocities of recession from us. The third dimension has to be velocity, says Margaret J. Geller of the Harvard-Smithsonian Center for Astrophysics (CFA) in Cambridge, Mass., because, although astronomers are agreed that a galaxy's recession velocity measures its relative distance, they cannot agree on the value of the Hubble constant, by which they could calculate absolute distance. Along with Geller, the researchers include Valérie de Lapparent (visiting from the Ecole Normale Supérieure de Jeunes Filles and the University of Paris VII in France) and John P. Huchra of the Harvard-Smithsonian CFA.



CFA

The evidence shows up in the pattern in the above illustration: Galaxies appear clustered in long strings with open spaces between them. This is what would appear on a slice taken through a collection of soap bubbles: The lines would be the projections of the walls of the bubbles on the slice. So de Lapparent, Geller and Huchra propose that the universe is structured like soap bubbles. Such a structure could be explained by a theory proposed in 1981 by Jeremiah P. Ostriker of Princeton (N.J.) University and Lennox L. Cowie of the University of Hawaii, which, as Geller says, was generally ignored at the time. According to that theory, a primordial generation of stars, formed before any galaxies, would have exploded. The force of the explosions would have emptied out these bubbles. The formation and expansion of the bubbles is superimposed upon the general (Big Bang) expansion of the universe. Combined observations of both expansions could be one way of pinning down the value of the Hubble constant, Geller says.

The observers plan deeper surveys. "Depth" refers to the faintest galaxies recorded. These may be either the farthest out (and if so their recession velocities will indicate that) or the faintest (intrinsically) that can be recorded at any intermediate distance. A deeper survey should tell whether the bubble pattern extends farther out in the universe. It should also tell whether, as intrinsically fainter galaxies are taken into account, the bubble pattern persists at closer distances. — *D.E. Thomsen*

Was a fifth force felt?

Physicists have divided all the motions in the universe into the domains of four kinds of force: gravity, electromagnetism, the weak subatomic force and the strong subatomic force or color force. Each of these has its source in a different property of material objects — for example, the source of gravity is mass, while that of electromagnetic forces is electric charge. Now, a fifth force is suggested.

Such proposals tend to arise from experimental anomalies that suggest an unknown force may be acting. In the Jan. 6 PHYSICAL REVIEW LETTERS, Ephraim Fischbach (temporarily at the University of Washington in Seattle), Daniel Sudarsky, Aaron Szafer and Carrick Talmadge of Purdue University in West Lafayette, Ind., and S.H. Aronson of Brookhaven National Laboratory in Upton, N.Y., propose that a fifth force was operating in a famous experiment done in Hungary in 1922 by Roland von Eötvös, D. Pekár and E. Fekete. The Eötvös experiment, as it is called, tested the law of gravity by measuring the gravitational attraction between the earth and various materials, including metals, woods and even grease or suet. Fischbach and his co-workers suggest that, unbeknownst to Eötvös and colleagues, slight differences in the responses of different materials indicate that in addition to gravity, a small, *repulsive* force was acting.

Fischbach and his co-workers relate this suggested force to a quality of matter called hypercharge or baryon number. The baryon number is related to the number of neutrons and protons, and therefore to the chemical composition of a material — thus explaining the difference in force for different materials. The researchers propose a formal similarity between this hypercharge force and electromagnetism. Just as electromagnetic forces are carried from object to object by intermediary particles called photons, so this hypercharge force would be carried by "hyperphotons." A number of experiments could test for the existence of the hypercharge force, including a direct search for the hyperphotons themselves.

— *D.E. Thomsen*

Herbal medicine: R_x for chimps?

Dawn breaks on Tanzania's Gombe National Park, and several chimpanzees depart their tree-borne nests in search of an unusual breakfast. They pass up nearby fruit trees and take a 20-minute trek to a patch of grassland where they swallow — without chewing — the leaves of a shrub known as *Aspilia*.

Are the leaves a tasty addition to ape diets on the African savanna? Probably not. It appears that the chimps seek out a recently identified substance on the leaves that kills disease-causing bacteria, fungi and parasites, reports anthropologist Richard Wrangham in the latest ANTHROQUEST, the newsletter of the L.S.B. Leakey Foundation. Last year, Wrangham, of the University of Michigan in Ann Arbor, and two colleagues visited botanical research centers in East Africa and found that several African tribes similarly use the leaves, often swallowing them to ease stomachaches or rubbing them on surface wounds or cuts.

If the chimps are aping humans by intentionally medicating themselves to fight disease or reduce pain, says Wrangham, "we can envision a slowly growing use of [herbal medicines] by human ancestors over millions of years."

Wrangham has observed more than 100 instances of *Aspilia* swallowing at Gombe and at another nearby site, Mahale Mountains National Park. Upon locating the 6- to 10-foot-tall shrubs, a chimp typically puts its lips around a single unplucked leaf, perhaps touching it lightly with its tongue. Several leaves are tried in this way before one is pulled off the stem. The animal rolls the leaf around in its mouth rather than chewing it. Within 15 seconds the leaf is swallowed, occasionally with a grimace. No more than 30 leaves are consumed over the next 10 minutes.

Chimps of all ages engage in this behavior, says Wrangham, but for some reason females use *Aspilia* about once every 10 days, while males use it an average of once a month. There are other mysteries: It is not known, for instance, why Gombe chimps swallow the leaves at dawn while Mahale chimps consume them at any time of day. Also, humans and chimps use the same three species of *Aspilia* and neglect a fourth species. The distinguishing