'Pancake' Hints at How Cosmos Grew Lumpy

It's a puzzle that has left astrophysicists in the dark for more than two decades: How did the universe, which apparently began as a generally smooth broth of matter and energy, evolve into the current, lumpy collection of stars, galaxies and galaxy clusters?

Since the early 1970s, researchers have proposed two main theories to explain the enigma. One model, the bottom-up scenario, assumes that small lumps in the generally smooth texture of the early universe acted as seeds for groups of galaxies that formed later in time. A rival, top-down theory takes a contrasting view: Random lumps quickly led to the creation of giant, pancake-shaped gas clusters, which eventually fragmented into galaxies or clusters of galaxies.

The absence of direct evidence for giant pancake clusters in the very early universe left researchers to debate the two models. But now the discovery of a distant cloud of atomic hydrogen, made during a radio survey of vast regions of the heavens, might tip the balance in favor of the top-down model.

Using the Very Large Array radio telescope near Socorro, N.M., a trio of astronomers has found the most massive blob of atomic hydrogen gas ever detected. More than 100 trillion times the mass of the sun, this clump resides some 3 billion light-years from Earth. From their radio measurements, the astronomers infer that the blob has the pancake shape predicted by Soviet physicist Yakov B. Zel'dovich and his colleagues, who first proposed the top-down theory in the early 1970s.

After searching a volume of sky greater than 10^{25} cubic light-years during a four-year hunt for cosmic pancakes, Juan M. Uson, Durgadas S. Bagri and Timothy J. Cornwell of the National Radio Astronomy Observatory in Socorro found telltale radio emissions of a massive clump of atomic hydrogen last spring. The diffuse source, which stretches across a span of about 5 million light-years, likely represents a giant pancake cluster about to break into galaxies, Uson says. He and his colleagues report their results in the Dec. 9 Physical Review Letters.

The competing, bottom-up theory could also account for a few massive clusters, Uson says, but a discovery of several more of these blobs could spell trouble for bottom-up supporters.

Uson says his team has now found a second candidate pancake. Detecting more will prove challenging, he adds, because although the universe may have formed many such objects, each might last only a few hundred million years before splitting into galaxies.

Though he calls the new finding important, P. J. E. Peebles of Princeton University, who helped develop the bottom-up theory, says "it's not likely that one new observation is going to finally reveal the [correct theory]."

Peebles acknowledges that the newly discovered gas cloud "certainly looks like the predicted Zel'dovich pancake." However, he expressed skepticism "about accepting this [as conclusive] evidence" for the top-down theory because "there are arguments against the pancake picture that seem to me to be strong."

Peebles points to a young, developing cluster comprising several ancient galaxies – including the Milky Way – as one of several indications that the universe evolves from little to big, not the other way around.

However, he observes, the new finding may help further refute a particular version of the bottom-up theory, which invokes a hypothetical, hidden type of material known as cold dark matter. Such matter would interact weakly with photons, allowing primordial lumps in the cosmos to grow relatively rapidly. The cold dark matter scenario has come under increasing attack because it still cannot explain a variety of recent observations about the structure of the universe (SN: 1/26/91, p.52).

Concludes Peebles, "This [new result] could be one more nail in a coffin [for cold dark matter] that's already studded with nails." – *R. Cowen*

Depression therapy gets interpersonal

A year ago, psychologists reported that three-quarters of severely depressed individuals who received high doses of an antidepressant drug for three years – after initially responding well to a combination of the medication and a form of short-term psychotherapy – suffered no return bouts of the psychiatric disorder (SN: 1/26/91, p.56). But another finding from the same study intrigued the investigators: Half of those whose depression cleared with the drug-psychotherapy approach, and who then received only one hour of psychotherapy per month with no medication, also remained depression-free for three years.

A closer analysis of these participants and their therapists now indicates that most of the long-term improvement was sparked by a consistent focus on improving social skills and relations with others, rather than by other techniques or "nonspecific" influences such as the mere presence of an understanding therapist, report Ellen Frank and her colleagues at the University of Pittsburgh School of Medicine.

If confirmed in a larger sample of volunteers, the new finding would herald a powerful and cost-effective way to quell severe depression over the long haul, especially among the many people who cannot or will not take antidepressants for years at a time, the researchers conclude in the December Archives of General Psychiatry. Various studies have indicated that one-third to one-half of all severely depressed individuals prescribed antidepressants either reduce or halt use of the drugs because of side effects, which may include blurred vision, weight gain, drowsiness, lowered blood pressure and impotence.

The Pittsburgh scientists studied 36 depressed adults treated by one of six therapists trained in interpersonal therapy, which examines how conflicts with others and disturbed relationships contribute to depression. Trained raters evaluated audiotapes of the monthly sessions to establish the extent to which each therapist focused on interpersonal issues, as opposed to other factors, such as depressed mood, distorted thinking about the self, or unconscious conflicts.

The 11 patients who received therapy rated as "highly specific" for interpersonal concerns stayed depression-free for a median of nearly two years; the remainder suffered a relapse after a median of just under five months.

No overall differences in technique or success turned up among the individual therapists. However, each therapist applied interpersonal therapy better with some patients than with others. This underscores the importance of learning what aspects of a therapist-patient match will best enhance a psychotherapy's effectiveness, the Pittsburgh researchers assert.

The data do not show that only interpersonal therapy prevents recurrences of depression, they add. But whatever the therapeutic approach, a focus on the patient's social world appears critical. For instance, cognitive-behavioral therapists – who try to correct distorted thinking, attitudes and behavior – may often focus on a depressed person's unrealistic expectations about social relations and on his or her pessimism concerning intimacy with others, the scientists note. – *B. Bower*