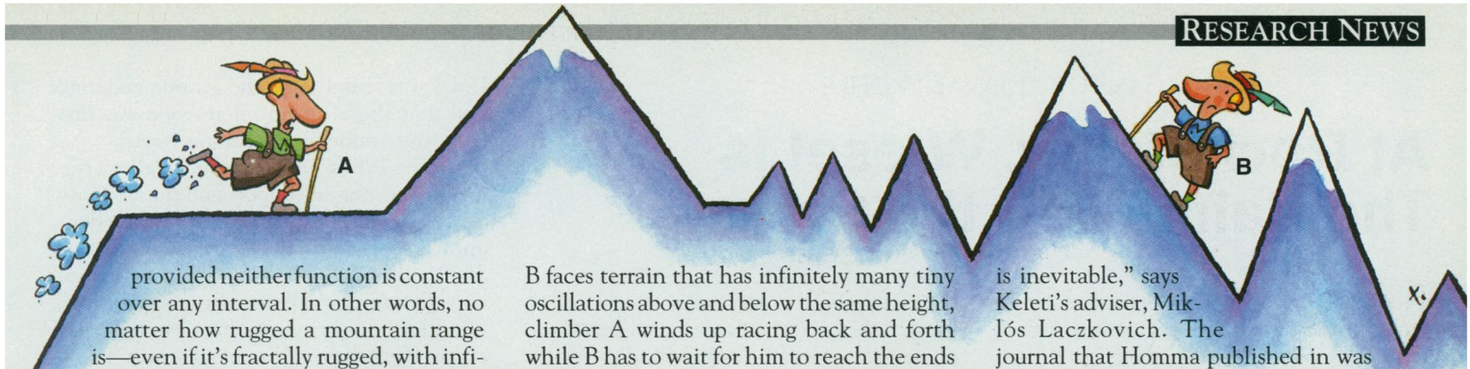


TERRY E. SMITH

provided neither function is constant over any interval. In other words, no matter how rugged a mountain range is—even if it's fractally rugged, with infinitely many tiny ups and downs—the converging climbers can execute their simultaneous ascent. It can require a lot of backtracking: If climber A reaches a 700-foot peak while climber B is going up to an 800-foot peak, climber B has to stop at 700 feet and back track down as climber A descends from the 700-foot peak. Climber B can only continue to the 800-foot level when climber A encounters a peak of that altitude (or higher).

This works as long as there are no plateaus where simultaneous ascent may not be possible (see illustration). If climber A has a level stretch at a certain altitude while climber B faces terrain that has infinitely many tiny oscillations above and below the same height, climber A winds up racing back and forth while B has to wait for him to reach the ends of the plateau. Then, as B's oscillations get infinitely smaller, A must run infinitely faster, trying to be at both ends of the plateau at once, which is impossible.

Keleti's paper, reviewers felt, took a well-known result for finite mountain ranges and elegantly generalized it to apply to infinitely rugged ranges. But then came what Keleti calls "the unhappy end." Following a trail of references pointed out by a reader, Keleti came across a paper by Tatsuo Homma that appeared in 1952. Not only did Homma's paper have Keleti's theorem, but the proof was even similar. "This kind of rediscovery is inevitable," says Keleti's adviser, Miklós Laczkovich. The journal that Homma published in was relatively obscure, and the paper's title—"A Theorem About Continuous Functions"—was unspecific.

While dismayed at finding his result to be nearly twice his age, Keleti has ideas for pushing the theory further. In particular, he wonders if the climbers can, on any mountain range, find a way to make their simultaneous ascent with a minimal amount of backtracking. However, whatever he proves next, you can be sure he'll be combing the literature with the care of an Everest climber placing his pitons.

–Barry Cipra

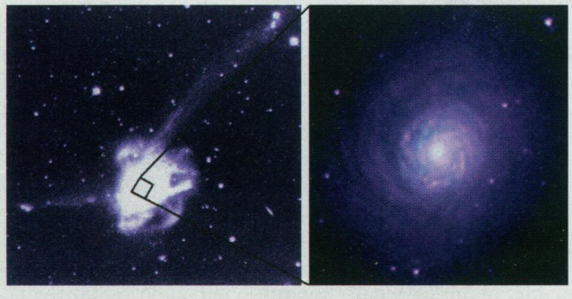
ASTRONOMY

Galaxies in Collision–Up Close

Out in the constellation Aquarius lies an island of stars that, from the ground, is just a ragged, egg-shaped cloud from which wispy filaments stream. But a recent close-up look with the Hubble Space Telescope opened up this galaxy like a treasure chest, revealing 42 spherical star clusters and a strange, starry pinwheel. Scientists who announced the discovery last week say they are guessing these oddities were produced as two galaxies merged a billion years ago. If they are right, it indicates that collisions play a major role in shaping the arrangements of stars and galaxies.

When he first sighted this galactic treasure trove last October, astronomer Brad Whitmore of the Space Telescope Science Institute says he thought he had caught the wrong galaxy—a spiral like our own Milky Way instead of the egg-shaped elliptical galaxy he was supposed to be observing—NGC 7252. He says he "was astounded" when he realized he had the right object and was seeing a tiny spiral embedded in the much larger mass of gas and stars. The little spiral spanned only $\frac{1}{20}$ the distance of a full spiral galaxy. He notes that the pinwheel rotates in the opposite direction from the stars and gas in the rest of the structure. The counter-rotation seen here shows that something catastrophic—like a collision—stirred up the smooth rotation that characterizes most ordinary galaxies. And astronomers have other clues, including the trailing streams and irregular shape—that seem to show this galaxy merged from two.

Astronomers say they are catching the ideal window of time for seeing into a probable merger galaxy. Catch a galaxy too soon after a collision and you can't see much, says co-observer François Schweizer of the Carnegie Institution of Washington. "At first there is a smog," he says, from stirred-up gas and dust. "We are catching it at a point just where the smog has lifted."



When galaxies collide. This galaxy, NGC 7252 *(left)*, may have formed from two merging galaxies. The counter-rotating minispiral *(right)* in the galaxy's center signals a merge.

In a galactic crash like this, Schweizer says, stars would rarely collide, but gas and dust in the galaxy would intermingle, heat up, and give rise to new stars and new structures. One likely product is the mini-spiral, where a burst of star formation is taking place, says Whitmore. He admits that the pinwheel is probably just a temporary pattern, soon to fade away, but it bears a remarkable resemblance to the form of a spiral galaxy, and, indeed, he thinks that the violent collision process that gave rise to it, "may be similar to formation of all galaxies."

Astronomers are also interested in NGC 7252's 40 spherical "globular" clusters, each holding up to a million tightly packed stars. Similar clusters in our Milky Way hold the oldest known stars in the universe. So for years astronomers assumed all clusters were made from ancient stars, but recent observations are turning up clusters that shine with the blue light of newborn stars. The clusters in NGC 7252 are only about 50 million to 500 million years old, says Whitmore: "To an astronomer, that's just yesterday."

A speculation that such clusters originate in collisions was put forward several years ago by Keith Ashman of the University of Toronto. Discovering these new clusters in a candidate merger galaxy supports that idea. The finding also adds support to a controversial idea that all ellipticals are formed by collisions. Previously, this premise foundered on some basic addition: Elliptical galaxies have more globular clusters than would by produced by adding the clusters in one spiral galaxy to the clusters in another. But if the collision process actually creates new clusters, in addition to the pre-existing ones, the notion is more tenable.

"This is trying to tell us something fundamental about the whole galaxy formation process," says Whitmore. "Maybe it was a lot more violent than we thought."

–Faye Flam