ASTRONOMY

# Do Galaxies Fly Through the Universe in Formation?

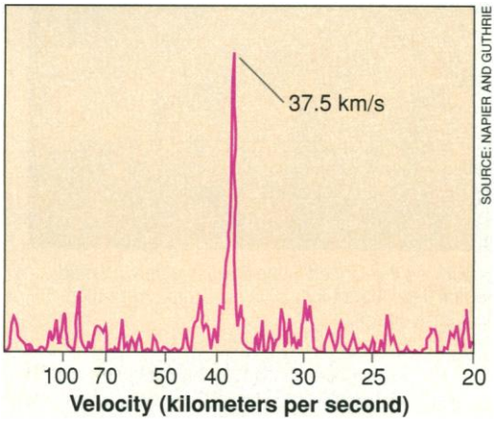
OXFORD, U.K.—Imagine if engineers claimed to have found an effect that prevented aircraft from flying at any old speed, but instead restricted them to fixed multiples of, say, 100 kilometers an hour: 500 kph, 600 kph—but never 550. That may sound ludicrous, but it's just the kind of effect that two British astronomers say they've discovered among galaxies moving through the universe. In a study of redshifts—a measure of velocity away from the Earth—for more than 200 galaxies, Bill Napier of Oxford University and Bruce Guthrie, a retired astronomer from the Royal Observatory in Edinburgh, claim to have the best evidence yet for a 20-year-old claim: that redshifts fall into packets, clustered around specific values.

Few astronomers have taken the notion of "quantized redshifts" seriously in the past, but some galaxy specialists who have seen the new results—slated to appear in the journal *Astronomy and Astrophysics*—are no longer dismissing them out of hand. Says galaxy specialist Mike Disney of the University of Wales at Cardiff, one of the many who have been skeptical in the past, "This paper suggests to me that there is a pretty strong case for getting more of the right kind of data to settle this extremely important debate." Harvard galaxy expert John Huchra, another longtime skeptic, goes further: "My curiosity is now sufficiently whetted that I'm thinking of writing an observing proposal for checking to see if [the effect] holds up with other galaxies." If it does, standard cosmology might be turned on its ear: "It would mean abandoning a great deal of present research," says Disney.

In the standard picture of the cosmos, there is no reason why redshifts should be restricted to any particular values. Astronomers assume that redshifts result from the general expansion of the universe that began with the big bang. The expansion stretches the light of distant galaxies, shifting the spectral lines it contains toward longer—and thus redder—wavelengths. And according to current models of the expansion of the universe, galaxy speed, and hence redshift, should increase steadily with distance, rather than bunching around particular values.

In 1976, however, William Tifft of the Steward Observatory at the University of Arizona claimed that visible-light redshift measurements suggested that galaxies in a cluster in the constellation Coma have redshifts that fall into distinct velocity packets. The velocities, he said, always came out at some multiple of about 72 kilometers per second (km/s). A year later, Tifft claimed to have found a similar "quantization" in the velocities of galaxies closer to our own.

The claim met with widespread indifference, but Tifft and his colleague W. John Cocke continued to amass more evidence for the effect throughout the 1980s. To get a more accurate fix on redshifts, they studied a radio wavelength emitted by neutral hydrogen gas in galaxies across the sky. These new observations led them to revise the figure for the fundamental velocity to 36 km/s—exactly half the figure for the galaxies in clusters. To most astronomers, such revisions only weakened the claim, and the skepticism grew when Tifft and Cocke reported detecting still other "fundamental" velocities, or no quantization at all, depending on where they looked. "When things start to get complicated like this, it usually gives people all the excuse they need to ignore the whole phenomenon," says Napier.




**Inexplicable signal.** A frequency analysis of galaxy redshifts indicates that they are multiples of 37.5 km/s.

Napier and Guthrie's new results, however, have none of this complexity. They focused on the velocities of spiral galaxies spread right across the sky to the edge of the Local Supercluster, at a distance of about 100 million light-years—making their study the most extensive test yet of quantized redshifts. To minimize the chances that the effect is simply an instrumental quirk, Napier and Guthrie gathered redshift measurements from eight different, widely spread radio observatories, from Effelsberg in Germany to Arecibo in Puerto Rico. In all, they studied 97 spirals, each with redshift measurements from several of the observatories.

To each set of redshifts, Napier and Guthrie applied a correction to cancel out the effect of the solar system's motion around our own galaxy. They then examined the results using a mathematical process called power spectrum analysis to reveal any quantization. The analysis revealed a quantization consistent with a fundamental velocity of 37.5 km/s. According to the astronomers, the probability of getting so strong an effect by random chance alone is around 1 in 10,000. At the request of a referee appointed by *Astronomy and Astrophysics*, Napier and Guthrie went on to repeat the whole process with a further set of 117 galaxies, and the same quantization showed up, this time with a probability of 5 in 10,000 that the effect was a fluke. The fact that both these independent data sets yield the same quantization, says Napier, implies "an overall probability of getting so strong an effect by chance alone of around 5 in 100 million."

But if the effect is so strong, why has no one spotted it before? Napier says that's because galaxy velocities are not usually measured accurately enough to pick up the periodicity. Harvard's Huchra plans to test that notion by making very high-precision measurements at optical wavelengths. If the effect is genuine, it should show up clearly. If not, Huchra's research may reveal where the problem lies: "Perhaps there's some funny selection bias that might have caused it to happen," he suggests.

If quantized redshift does survive another round of tests, theorists will have a sticky problem trying to explain it. "I don't have any ideas myself," says Guthrie. He says some theorists have proposed so-called "oscillating scalar fields" as one possible answer. Such fields, which are an outgrowth of proposed quantum theories linking the fundamental forces of nature, could permeate the whole universe like a form of antigravity, affecting the dynamics of galaxies. Suitably tuned, they might be able to explain quantized velocity effects.

That's highly unorthodox, and other explanations are even more so. To Princeton University cosmologist James Peebles, the conflict between quantized redshift and existing cosmology is a reason to treat the claims with extreme caution. "I demand a very high level of proof which I haven't seen yet," he says, adding that he has yet to study Napier and Guthrie's data. "I'm not being dogmatic and saying it cannot happen, but if it does, it's a real shocker."

Responds Napier, "If there's a way out of this conclusion, we haven't seen it. And it's not for lack of trying."

**–Robert Matthews**

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