ing resources and found that the number of species could not exceed the number of scarce resources—two. Only a single species survived if each species was not a specialist at exploiting one of the two resources.

Huisman and Weissing investigated what happened when more than two resources were in short supply. Right at the count of three, they observed a surprising result: Species competing for three or more resources never reach a stable equilibrium. This instability dispels the strict limit of *n* species for *n* resources, the researchers report.

With three scarce nutrients, they found that species populations oscillated, and that even nine species could prosper cheek by jowl. With four or five nutrients in short supply, the fluctuations were chaotic, and still more species could coexist.

These findings didn't apply to species that are extremely specialized. Mediocre competitors that don't focus narrowly on any one nutrient are the ones that permit a highly diverse ecosystem, Huisman and Weissing observed.

Hubbell says this finding contradicts ecologists' intuitions that being different is crucial to a species' success.

In modeling primary producers such as phytoplankton and plants, which turn inorganic resources into biomass, other theorists have pointed to oscillations as a way to break the diversity barrier. To generate such oscillations, however, they had appealed to an external driving force, such as temperature variations.

"No one would have guessed that if you put three limiting resources together with many species [in a spatially featureless model environment] that they would be able to coexist" without influences from outside, says ecologist G. David Tilman of the University of Minnesota in St. Paul. "This is a major advance."

The fluctuations arise, explains Huisman, because when a species that excels at garnering one resource gains an upper hand, its burgeoning population drives down availability of another nutrient that it needs. A second species better at scavenging that nutrient then comes into its own and supplants the first.

As the balance of nutrients shifts, different sets of skills can each momentarily be advantageous. Every species gets a recurring chance to be the fittest.

Tilman characterizes Huisman and Weissing's finding as just a proof of principle, however. Many eminently reasonable justifications for diversity have emerged in recent years, he says. Only intensive field studies will reveal the extent to which each one figures in particular ecosystems.

In the meantime, the finding is a bit of nourishment for thoughtful ecologists. "I know I will think about whether this applies in the grasslands in which I work," says Tilman. —*O. Baker*

New supernova goes the cosmic distance

Astronomers have discovered a supernova more distant than any previously known. This exploded star lies about 9.5 billion light-years from Earth. Dubbed Dudley Doright by its discoverers, the supernova could be one of the shining lights that will test the astounding finding, reported last year, that the expansion of the universe is accelerating.

A team including John L. Tonry of the University of Hawaii in Honolulu and Nicholas B. Suntzeff of the Cerro Tololo Inter-American Observatory in La Serena, Chile, announced the discovery of the supernova—officially designated SN 1999fv—in a Nov.19 circular of the International Astronomical Union.

The discovery team, as well as another group, has used this type of supernova to probe the fundamental nature of the universe. Members of this supernova group, classified as 1a by their composition, are known as standard candles because they have the same intrinsic brightness in both nearby and distant galaxies.

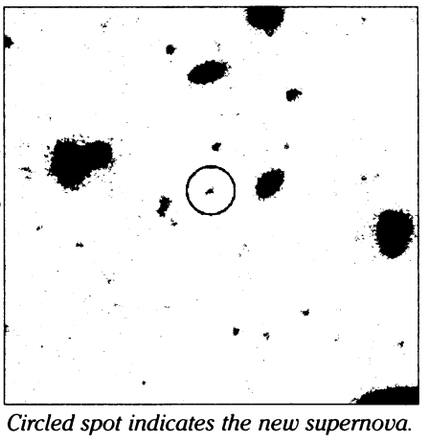
Because light from a faraway galaxy takes several billion years to reach Earth, astronomers observe such a galaxy as it appeared when the universe was younger. If cosmic expansion had recently slowed, there would be less distance between Earth and a remote galaxy than if the expansion had proceeded at a constant speed. A supernova in such a galaxy would therefore look brighter than if the expansion had been constant.

Early last year, the two teams announced that they had found exactly the opposite. Distant supernovas looked about 20 percent dimmer than expected, indicating that the universe has over the past few billion years revved up its rate of expansion (SN: 12/19&26/98, p. 392).

It's possible, though, that the two teams were fooled. Intervening dust could have made the supernovas look dimmer, or the more distant ones might have a slightly different composition than nearby supernovas, causing them to appear fainter.

Extremely distant supernovas provide a means to settle these conundrums, Suntzeff notes. That's because these supernovas can reveal whether the expansion of the universe had decelerated when it was very young. The youthful cosmos was so dense that the gravitational tug of matter would have dwarfed any antigravity term that astronomers have invoked to explain why cosmic expansion later sped up.

Dust or compositional differences could not mimic both deceleration at early times in the universe and acceleration at more recent times, astronomers say. By finding a large sample of supernovas that lie more than 10 billion light-years from Earth—no small feat—researchers in as few as 2 years might test whether cosmic acceleration is genuine, Suntzeff notes.



Circled spot indicates the new supernova.

Studying extremely distant supernovas "is one of our best near-term bets," agrees Philip A. Pinto of the University of Arizona in Tucson. —*R. Cowen*

Hubble goes blind, for now

NASA's flagship observatory, the Hubble Space Telescope, has shut down for what astronomers hope will be just a short intermission. However, delays in scheduling a repair mission combined with a looming Y2K problem, could turn a brief break into a lengthy interlude.

Since January, Hubble has operated with only three of its original six gyroscopes active, the minimum to accurately point the observatory. That precarious situation prompted NASA last March to propose a repair mission scheduled for October. Several delays, due to wiring problems on the space shuttle, have now forced the 9-day mission to be rescheduled for Dec. 9. On Nov. 13, however, a fourth gyroscope failed, leaving the telescope unable to make observations.

To avoid any Y2K computer glitches, NASA won't fly the mission this year if electrical problems or bad weather postpones liftoff past Dec. 18, says Denny Holt, manager for the repair mission at NASA's Johnson Space Center in Houston.

The team plans to rely on the same flight software that guided the Hubble servicing mission in 1997 (SN: 11/6/99, p. 294). Although ongoing tests of the software haven't found any showstoppers so far, it has not yet been certified as Y2K compliant, Holt notes.

If the software needs only minor adjustments to make it Y2K compatible, the mission could fly as early as Jan. 13, he adds. But if the software has to be replaced, the launch could be delayed by an additional 4 months, which would waste more than $80 million. —*R. Cowen*