Astronomy

Living with lambda

It's totally repulsive, and no one can make it go away.

The immovable beast on the minds of astronomers these days is known as lambda, the cosmological constant. It's the simplest form of an antigravity force pervading the universe, according to a controversial hypothesis. To the surprise of many researchers, recent studies suggest that the expansion of the universe is speeding up rather than slowing down. The existence of a force that would oppose the pull of gravity could explain the startling observations (SN: 3/21/98, p. 185).

The new studies measure brightness to gauge the distance between Earth and supernovas in remote galaxies. Combined with new data on the cosmic microwave background—the faint echo of radiation left over from the Big Bang—the case for a cosmological constant becomes even stronger, says Max Tegmark of the Institute for Advanced Study in Princeton, N.J. He presented the analysis earlier this month at a meeting on missing energy in the universe at the Fermi National Accelerator Laboratory in Batavia, Ill. "This thing—which most of my colleagues despise and feel very uncomfortable about and will make any excuse to not have to deal with—keeps fitting the data so nicely," says Tegmark. "One day I think I'm going to have to write a paper called 'living with lambda.'"

The new studies, he explains, compare the distance of supernovas from Earth and the speed at which they are receding. This information enables astronomers to deduce the difference between the cosmic density of matter and the density of energy associated with the cosmological constant. In contrast, observations of the cosmic microwave background in effect measure the sum of these two quantities.

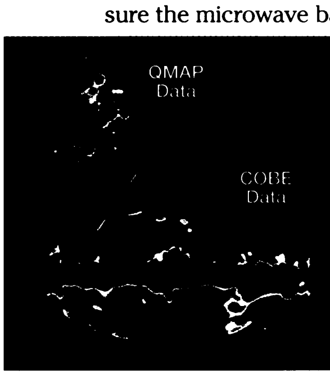
Recent measurements of fluctuations in the intensity of the microwave background over a small area of the sky are beginning to point to two conclusions, says Tegmark. An analysis of these experiments, which include a set of balloon-borne detectors called QMAP, hints that the total density of matter and energy is just enough to keep the universe flat. In other words, the large-scale curvature of the cosmos may be zero, as predicted by a popular model of how the universe evolved (SN: 2/28/98, p. 139).

Moreover, combining these data with the supernova observations suggests that the density associated with the cosmological constant is about twice that associated with matter.

Acknowledging that both the supernova and microwave background measurements contain large uncertainties, Tegmark cautions that the conclusions are far from firm. "The main thing to take away is that the two sets of observations are clearly consistent" with a cosmological constant, he says.

David N. Spergel of Princeton University strikes a more skeptical note. "I must confess to being one of many people . . . who are not convinced by either the current cosmic microwave background data or the supernova data."

With a slew of supernova observations awaiting analysis and several new balloon and ground-based experiments set to measure the microwave background, the case for or against an antigravity force may be settled by 2000, says Michael S. Turner of Fermilab and the University of Chicago. —*R.C.*



QMAP team/NASA

In two recent flights over North America, QMAP measured variations in the intensity of the cosmic microwave background over a relatively small patch of sky. In contrast, the cosmic background explorer (COBE) satellite mapped the entire sky. Red denotes the highest intensity, blue the lowest.

Biology

What good can nectar do a fern?

Scientists have wondered for years why ferns make nectar. Ferns don't have flowers, so they don't need this sweet fluid to lure pollen-spreading creatures. In studies of other kinds of plants, botanists have found that the steady traffic of nectar-sipping ants reduces damage to leaves by leaf-eating insects, so they proposed that fern nectar also attracts ants. Until now, however, ferns have baffled all attempts to determine whether the ants actually afford them significant protection.

Researchers have observed for the first time that a species of *Polypodium* fern in Mexico indeed suffers less damage when ants feed on its nectar, report Suzanne Koptur of Florida International University in Miami and her colleagues. Their analysis appears in the May American Journal of Botany.

Koptur's team blocked ant traffic to some of the young fronds of *P. plebeium* in a wet mountain forest in Veracruz. After a month, the fronds without ants were significantly more battered by other insects than control fronds on the same plant.

The team also looked at—and dismissed—another proposed explanation: that nectaries lure creatures which somehow disperse fern spores. The fern that Koptur studied makes nectar only when the fronds are young and particularly vulnerable, stopping before spore production. —*S. M.*

Monk seal killer may be misidentified

Scientists may have missed a major collaborator, or even fingered the wrong suspect, when investigating the deaths of more than 100 endangered Mediterranean monk seals off the Atlantic coast of the Sahara Desert in May and June last year.

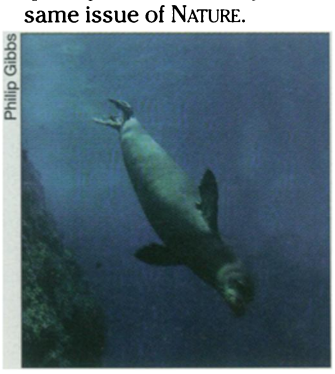
Earlier reports blamed the die-off in two caves of seals on a previously unidentified morbillivirus (SN: 8/30/97, p.134). However, a Spanish research team has looked into the possibility that the seals died from eating fish that had been contaminated with deadly phycotoxins produced by a bloom of dinoflagellate algae.

"We here suggest intoxication by algal toxins is a more likely cause of the deaths," Mauro Hernández of the Vida Silvestre Forensic Laboratory in Madrid and his colleagues report in the May 7 Nature.

The researchers examined 117 seal carcasses and analyzed tissues from 8 of them in detail. Several phycotoxins turned up in the seals, and water samples contained three toxic dinoflagellates, including high concentrations of *Alexandrium minutum*. No one knows how much of these toxins healthy seals can sustain, the researchers note.

Questions remain about both the algal and the viral theories, says John Harwood of the University of Saint Andrews in Scotland. He has little doubt that a morbillivirus was circulating at the time, but he notes that the seals' deaths did not resemble those in other virus outbreaks. "[T]he animals died quickly, with few, if any, overt signs of disease," he notes in the same issue of Nature.

Philip Gibbs



Fewer than 500 monk seals survive worldwide.

Harwood would have expected even higher algal concentrations if there had been a full-scale bloom where the seals died. If the bloom, with its fast-acting toxins, were farther out in the ocean, it is puzzling that the seals died so close to home, he adds.

Both algae and a virus may have been responsible, Harwood says. He adds that the controversy highlights the need for more information about the seals. —*S. M.*