biotech melting pot to exploit its own genome center, it would consider a site near a different research powerhouse.

Ironically, Wellcome's tribulations at Hinxton come at a time when the U.K. government is promoting the biosciences as critical for the country's economic well-being and employment prospects. The Department of Trade and Industry, for example, is encouraging companies to gather together into biotech "clusters" similar to those in Maryland, North Carolina, and around the Massachusetts Institute of Technology. Urban geographer Alan Wilson of the University of Leeds says updating Britain's dusty planning regulations is crucial for biotech's development. Wilson is part of a team working with Science Minister David Sainsbury to identify ways in which government can help the biotech sector. "It is a shame that these issues are polarized as single planning questions, such as can the village stand an extra thousand houses," he says.

Dexter says he is still trying to arrange a meeting with the council. In the meantime, several cities—both in the United Kingdom and overseas—are eager to attract the prestige and money of the Wellcome Trust and have submitted proposals that the trust is evaluating. "Think about the major genome sequencing centers around the world," says Dexter. "There are some attractive overseas options."

–HELEN GAVAGHAN

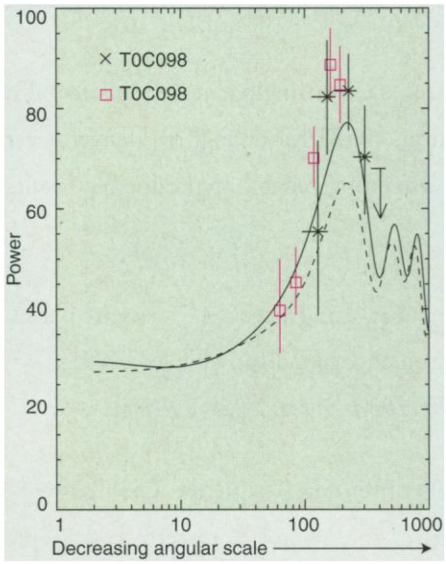
Helen Gavaghan writes from Hebden Bridge, U.K.

COSMOLOGY

Firming Up the Case For a Flat Cosmos

Doing research in modern cosmology is a bit like watching the game show *Wheel of Fortune*. At the beginning, the hidden phrase is impossible to guess, but as Vanna White turns over each letter the answer suddenly becomes blindingly obvious. A long-sought hump in measurements of the universe's faint background radiation, for example, was no more than a hint in earlier observations, but now a telescope high in the Chilean Andes has opened a clear view of it. The discovery, which will be reported in the 10 October *Astrophysical Journal Letters*, confirms a long-standing prediction about the universe's total mass and energy density and hints that a major part of the total may be a mysterious form of energy in empty space.

The "hump" actually measures the coarseness of the ripples imprinted on the cosmic microwave background (CMB) shortly after the big bang. In its first 100,000 years or so, the baby universe was so dense and hot that matter and light behaved like a single fluid, so that fluctuations in the density of the ionized gas created corresponding hot and cold spots in the radiation. But as the universe expanded and the gas cooled, light broke free, or decoupled, from matter. A fossil record of the fluctuations at the time of the decoupling can be seen even today, imprinted on the CMB.



Peak of interest. New measurements from Cerro Toco in Chile reveal the angular size at which cosmic-background fluctuations are most common.

SOURCE: MILLER *ET AL.*

Because cosmologists can calculate the actual size of the most common ripples, their apparent size in the sky reflects the overall shape of space, just as the apparent size of objects seen through a lens depends on the shape of the glass. By measuring the angle at which the fluctuations are most common—the "hump"—cosmologists can trace the geometry of the universe, which is determined by the total amount of energy and matter it contains. Theorists' favorite picture of the big bang implies that the universe contains just enough matter and energy to retain a flat geometry, in which parallel lines always remain parallel, rather than diverging or converging, as they would in "open" or "closed" universes. In a flat universe the hump would fall at an angular size of about 1 degree.

Finding the hump has proved difficult, however, because it requires extremely precise comparisons of the CMB's temperature at different points in the sky. A first glimpse came from two experiments done last year at the South Pole, Viper and Python. Viper showed that the abundance of ripples seemed to increase from 1/6 of a degree up to 1 degree; Python showed it falling on scales larger than 1 degree (*Science*, 1 January, p. 21). But no single experiment covered the entire hump, and cosmologists were concerned that they might be forcing mismatched pieces of the puzzle together. "There are always calibration issues" when the results of different experiments are combined, says Princeton University astrophysicist Amber Miller.

The new measurements by the Microwave Anisotropy Telescope (MAT) team, a collaboration led by Lyman Page of Princeton and Michael Devlin of the University of Pennsylvania, seem to have put that concern to rest. Observing from a dedicated 85-centimeter telescope perched high on the southern slopes of Cerro Toco in northern Chile, the MAT team compared the CMB at different spots in the sky for almost 1200 hours. They found that the abundance of ripples clearly "rises and then falls" near 1 degree, says Miller.

"All by itself it shows the existence" of the 1-degree hump, says University of Chicago cosmologist Michael Turner. He says it will take the Microwave Anisotropy Probe satellite, to be launched in fall 2000, to reveal the precise shape and position of the hump. But already, Turner says, "we can claim to have a complete accounting of the matter and energy in the universe."

If so, the universe that astronomers can see is seriously underweight. Simply counting up all of its stars, gas, and hidden "dark matter," astronomers have found only 30% of the critical density needed to flatten it. Theorists speculate that the rest takes the form of a cosmological constant first proposed by Einstein, an energy in empty space that pushes on the fabric of space-time. Its effects may already have been spotted in observations of distant exploding stars, or supernovae, which appear to show that the expansion of the universe is accelerating (*Science*, 18 December 1998, p. 2156), says Saul Perlmutter of Lawrence Berkeley National Laboratory in California.

Happily, the supernova observations point to a cosmological constant that accounts for nearly 70% of the critical density, just enough to make up the deficit. The consistency of the two results is "nudging us from having to believe [in the cosmological constant] to being able to measure it," says Harvard University astrophysicist Robert Kirshner.

–MARK SINCELL

Mark Sincell is a science writer in Houston.

LASER FUSION

A Less Powerful NIF Will Still Cost More

The managers of a giant laser project have proposed drastically shrinking the National Ignition Facility (NIF) to curb rising costs, a step that could reduce its chances of achieving an important scientific goal in fusion research. But the downsizing will not elimi-