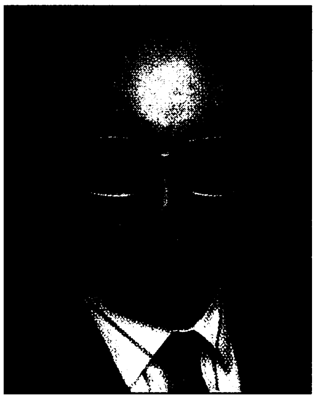
structure in the end. "The ultimate goal is crystals in, structures out," he says. He expects that it will be another 2 years before the full process is complete.

—ROBERT F. SERVICE

STRUCTURAL BIOLOGY

A Plan to Release Data Within Six Months

AIRLIE HOUSE, VIRGINIA—In the 1990s, gene sequencers were under the gun to make their raw data public as rapidly as possible. Now, it's the turn of the gem-cutters of biology—the people who decipher the shape of protein molecules—and some are not too comfortable with the notion. Last week, international leaders of the field rejected a proposal that labs now gearing up to roboticize the study of proteins give away structural coordinates immediately, or within 3 weeks of completion. Instead, at a meeting at an estate here in Virginia's horse country, they agreed to speed up data release, but on a timetable that will allow for the filing of patent applications.



Raising the pace. NIH's Marvin Cassman plans for accelerated data release from U.S. labs.

The plan for immediate data release was drafted at a meeting a year ago in Hinxton, U.K., home of the Wellcome Trust's genome center.* Many said it reflected the ideals of British scientists, who were among the leaders in pushing for rapid release of genome data. But several members of the Airlie group said the proposed short deadlines wouldn't allow enough time to refine and validate structural information. Others, noting that structural data may be valuable for drug design, argued frankly that too-rapid data release would impede patenting. In the end, the group endorsed the release of "most" protein structures from high-throughput labs "as rapidly as possible," with a maximum delay of 6 months for proteins of "special interest." Today, the rule is that investigators release coordinates when they publish a structure.

The strongest opposition to the Hinxton plan came from Japanese delegates, who said it can take many months to process proteins and prepare U.S. patent filings. Toichi Sakata, representing the agency that funds Japanese structural biology—the Ministry of Education, Culture, Sports, Science, and Technology—indicated that Japanese taxpayers want a return on investments in protein analysis in the form of intellectual property. The Japanese group proposed the 6-month limit.

Once the Japanese had spoken, senior European and U.S. scientists said they liked the 6-month delay, too. Udo Heinemann of the Max Delbrück Center for Molecular Medicine in Berlin saw a "fundamental difference" in the way structural genomics is carried out in Europe and the United States. He said his funding agency views his work as being closer to drug development than basic biology. Joel Janin of the Laboratory of Structural Enzymology and Biochemistry in Gif-sur-Yvette, France, felt that "the average European group's view is probably closer to the Japanese position" than the Hinxton model. And biophysicist Stephen Burley of the Rockefeller University in New York City said, "I'm not sure that there's agreement within U.S. groups" that protein structure data are commercially "precompetitive."

A minority objected to the 6-month rule but didn't dissent. "This is a complete reversal" of earlier goals, said Cyrus Chothia, a theoretician of structural biology at the Medical Research Council Laboratory of Molecular Biology in Cambridge, U.K. He chided his colleagues for what he saw as a retreat from data sharing. One meeting organizer detected signs of gambler's fever in the patent discussion: "It reminds me of the lottery," he said. "Very few people will win, but everyone dreams they will."

Participants did agree, however, to increase data sharing and avoid duplication by exchanging lists of "target" proteins in advance. And they outlined a new system of fast peer review and electronic publication, bypassing paper journals to get results out quickly. But they declined to adopt a plan advanced by the U.S. National Institute of General Medical Sciences (NIGMS), part of the National Institutes of Health (NIH), to create a central, public Web site at NIH listing targets claimed by each lab. NIH will do this for its own grantees. One group that specifically opposed listing its own targets is a private consortium led by the Wellcome Trust, which is recruiting about 10 company sponsors for a program to solve and publish 200 protein structures per year (*Science*, 30 March, p. 2531). A trust attorney explained that the companies do not want to tip competitors to potential research plans, but are willing to give away structures once they've been completed.

NIGMS director Marvin Cassman ascribes the difference between the Hinxton and Airlie meetings to the fact that "last year, structural genomics was pie in the sky; this year, the pie is on the plate," and everyone is looking for a slice. NIGMS is leading the effort to speed up protein analysis, having awarded $150 million in structural genomics grants to seven centers last year (*Science*, 29 September 2000, p. 2254). The centers funded under this program are likely to be held to more rigorous data-release standards than the rules adopted at Airlie, Cassman said. NIGMS official John Norvell explained that relatively few families of proteins are represented in the public databases at present, and NIGMS is pushing its centers to identify new proteins at the rate of about 200 per year by 2006.

—ELIOT MARSHALL

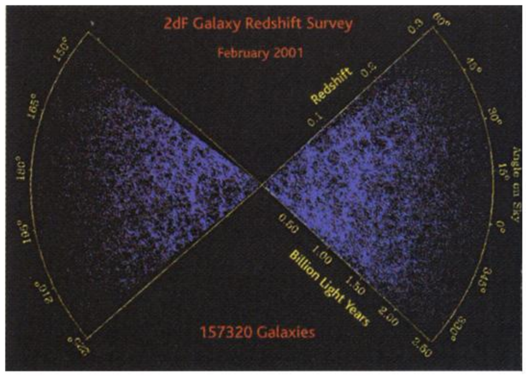
* The First International Structural Genomics Meeting took place in Hinxton, U.K., in April 2000; the second, at Airlie House near Warrenton, Virginia, 4 to 6 April, 2001. The third will be in Berlin.

ASTROPHYSICS

Galaxy Mappers Detect Wiggly Cosmic Order

BALTIMORE, MARYLAND—A wiggly pattern in the way galaxies are arrayed has yielded a new recipe for the early universe. Last week, at meetings on both sides of the Atlantic Ocean,* astronomers working on the ambitious Two Degree Field (2dF) galaxy survey announced that they had seen subtle variations in the distribution of matter at different scales. The discovery provides a new method of calculating the amounts of different types of matter in the cosmos shortly after the big bang.

"That would be extremely exciting if they've seen it," says Max Tegmark, a physicist at the University of Pennsylvania in Philadelphia. Knowing the ratio of ordinary "baryonic" matter to unseen dark matter in the universe is key to deciding among competing cosmological models, Tegmark says.



Deep space. Galactic voids and clusters mapped by the Two Degree Field survey trace ripples from the big bang.

The 2dF survey, which uses the 4-meter

* "The Dark Universe," Baltimore, Maryland, 2–5 April; Royal Astronomical Society National Astronomy Meeting, Cambridge, United Kingdom, 2–6 April.

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Anglo-Australian Telescope in Coonabarabran, Australia, is halfway through its attempt to map 250,000 galaxies. The distribution of those galaxies depends crucially on events in the very early universe. For a few hundred thousand years after the big bang, matter and energy were a seething plasma, ringing with the concussion of the cataclysmic explosion. Pressure waves rattled through the plasma, compressing matter, letting it expand, and compressing it again. As the universe grew and cooled, the compressed regions gave rise to massive clusters of galaxies, while the rarefied ones stayed relatively free of matter. So by looking at the distribution of galaxies and voids, astronomers can figure out what the acoustic waves in the early universe were like, just as they can with the distribution of peaks and dips in the strength of the cosmic background radiation (*Science*, 28 April 2000, p. 595; 19 January 2001, p. 414).

Different types of matter, however, transmitted those pressure waves in different ways. Ordinary baryonic matter would have compressed and expanded very strongly, as it was constantly being slammed about by the radiation pressure. "Exotic" dark matter—the kind believed to consist of so-far-undetected particles—would have oscillated more weakly, as it barely interacts with radiation. (That's what makes it invisible to telescopes.) Thus, wiggles in the distribution of galaxies—bumpy features in the graph that describes clumps of matter and voids on various scales—can reveal how much of the primordial matter was baryonic.

"When you make plots, you do see bumps, hills, and valleys," says Cambridge University astrophysicist Ofer Lahav, a member of the 2dF team. "When we all first saw the pictures, we were very excited." Although Lahav advises caution in interpreting such preliminary results, he says the measurements indicate that baryonic matter in the early universe weighed in at 5% of the mass needed to give space the shape that cosmologists prefer. That's smack-dab between the 4% based on theories of how atomic nuclei were generated in the early universe and the 6% implied by measurements of cosmic background radiation.

The 2dF data collected so far aren't strong enough to settle any cosmological arguments. University of Chicago astrophysicist Michael Turner thinks the results are intriguing but reserves judgment for the moment. "What's great about cosmology now is that the results are just going to get better," he says. "We don't have to debate each other until we're blue in the face. There's more data coming." Further observations by the survey and the rival Sloan Digital Sky Survey could provide a more definitive answer within the year. —**Charles Seife**

COSMOLOGY

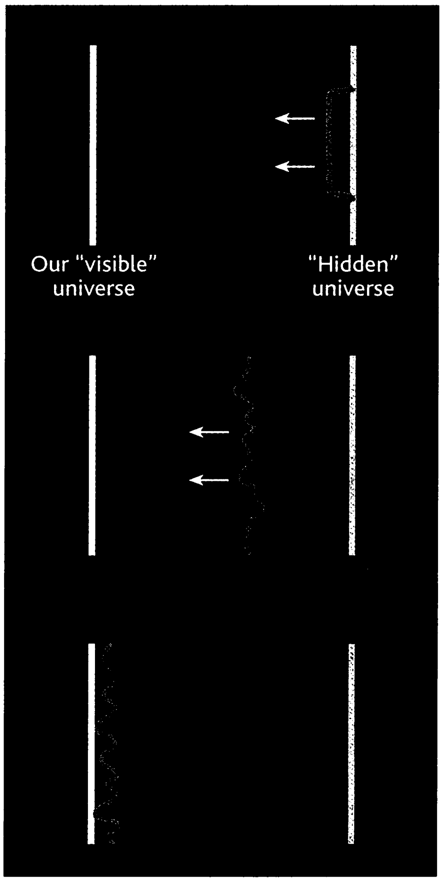
Big Bang's New Rival Debuts With a Splash

Baltimore, Maryland—Will the big bang make way for a big splat? It might, if a new idea by four cosmologists catches on. Their theory, posted online* and unveiled here last week in a surprise talk at the Space Telescope Science Institute, provides what other scientists are calling the first credible alternative to the reigning big bang model and its long-standing add-on, inflation.

"It's a neat idea. In a way, we didn't have any competitors to inflation until now," says David Spergel, an astrophysicist at Princeton University. "I'm more comfortable at the moment with inflation, but that's probably because I've lived with it longer."

Inflation theory has been cock of the walk since the early 1980s, when physicist Alan Guth concocted it to solve several problems that had been plaguing big bang theorists. For instance, the universe appears to be "flat" (a technical term describing the large-scale curvature of space) and has roughly the same properties everywhere—features that a simple big bang model can't easily explain. Inflationary theory proposes that the very early universe went through an amazingly violent and rapid expansion for less than 10^{-32} second, which gave the universe precisely the flatness and isotropy that we see today. Almost every cosmologist accepts inflation, and for 20 years no one has come up with a new scenario that so well matches scientists' observations.

"This is a fairly ambitious project," admits Princeton physicist Paul Steinhardt. Along with his student Justin Khoury and physicists Neil Turok of Cambridge University and Burt Ovrut of the University of Pennsylvania in Philadelphia, Steinhardt has created what they call the "ekpyrotic model": a version of the early universe that explains flatness and isotropy without invoking inflation.



Splatter film. In the ekpyrotic model, a four-dimensional scrap of another universe wrinkles as it floats through 5D space, then stamps our universe with a mix of long-range regularity and small-scale disorder.

At first glance, the new model—based on an extension of string theory known as M-theory—seems surreal. It takes place in 11 dimensions, six of which are rolled up and can safely be ignored. In that effectively five-dimensional space float two perfectly flat four-dimensional membranes, like sheets drying on parallel clotheslines. One of the sheets is our universe; the other, a "hidden" parallel universe. Provoked by random fluctuations, our unseen companion spontaneously sheds a membrane that slowly floats toward our universe. As it moves, it flattens out—although quantum fluctuations wrinkle its surface somewhat—and gently accelerates toward our membrane. The floater speeds up and splats into our universe, whereupon some of the energy of the collision becomes the energy and matter that make up our cosmos. Because both the moving membrane and our own membrane start out roughly flat, our postcollision universe remains flat as well. "Flat plus flat equals flat," says Steinhardt.

Because the membrane floats so slowly, it has a chance to equilibrate, giving it more or less the same properties over its entire surface, although the quantum fluctuations cause some irregularities. That explains our universe's roughly (but not exactly) isotropic nature. But whereas inflation solves the problems of flatness and isotropy by a quick, violent process, Steinhardt points out, "this model works in the opposite sense: slowly, but over a long period of time." Another attractive feature is that it gets rid of the singularity at the beginning of the universe: Instead of a pointlike big bang, the universe is formed in a platelike splash.

* arXiv.org/abs/hep-th/0103239

ILLUSTRATION: A. STONEBRAKER