

questions are favorite themes in the Japanese astronomy community.” Through Gemini, Japanese astronomers would gain access to the southern sky. And the WFMOS project would announce Japan as a major player in astronomy. “It is a good opportunity for Subaru to have a big international collaboration,” says Naoshi Sugiyama, an astronomer at Subaru’s parent body, the National Astronomical Observatory of Japan.

At this point, says Karoji, “I have not one yen [to pay for WFMOS]. We need two things, approval in the community and approval from the NAOJ headquarters for funding.” Gemini and Subaru are moving forward with design plans and seeking money. The plan is to have a conceptual design by spring 2007 and a decision on going ahead later that year.

Another project in the making for a bit further in the future would use optical fibers to link a half dozen Mauna Kea telescopes into an optical interferometer. “The classic way to have done that with multiple telescopes would be to build great big tunnels between them and have optical rays in vacuum pipes,” says Keck director Fred Chaffee. With fibers, he adds, “The technical challenge is inversely proportional to the wavelength, so with optical wavelengths a million times shorter than radio, everything becomes literally a million times more difficult. It’s a completely different ball game.” The two Keck telescopes were linked last year, demonstrating the proof of principle. The project is called OHANA (Optical Hawaii Array for Nanoradian Astronomy), the Hawaiian word for “family.”

Toni Feder

Probing Dark Energy Through Baryon Acoustic Oscillations

Dark energy makes up more than 70% of the universe, but no one knows what it is. Its existence was inferred in the 1990s to explain why the expansion of the universe is accelerating, which was determined from observations of supernovae of known luminosity, or “standard candles.” Now scientists want to learn more about how dark energy behaves by using a “standard ruler.”

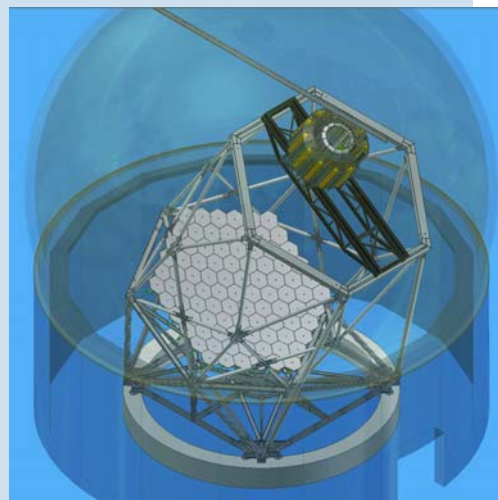
The standard-ruler approach involves measuring the traces of the primordial baryon acoustic oscillations in the large-scale structure of the universe at different times in history. The oscillations are remnants of sound waves in the first 300 000 or so years after the Big Bang, and are imprinted in the distribution of galaxies.

The Wide-Field Multi-Object Spectrograph (WFMOS), a proposed collaboration between the Gemini and Subaru telescopes (see the story on page 30), will use baryon acoustic oscillations and spectroscopic redshifts to probe dark energy. The most serious scientific competition so far probably comes from the proposed Hobby-Eberly Telescope Dark Energy Experiment (HETDEX). Both are surveys that involve “cartography of galaxies through space and time,” says the University of Texas at Austin’s Gary Hill, a principal investigator of HETDEX. “We will measure the distances between galaxies, Fourier transform that distribution, and for every galaxy, look where others are relative to it.” WFMOS will consider two time epochs, around redshifts 1 and 3, while HETDEX will look at a continuum of redshifts in the range 1.8 to 3.7.

WFMOS will use preselected galaxies, whereas HETDEX will take spectra of every point in its smaller field of view, and then use the spectra to select galaxies for analysis. “There is no a priori advantage to either approach,” says the University of Pennsylvania’s Gary Bernstein, a member of a dark-energy task force set up by NASA, NSF, and the US Department of Energy.

Neither experiment has full funding yet, but if both proceed on the time scales they’ve sketched out for themselves, HETDEX will start in 2009 and WFMOS around 2012.

Toni Feder



VIRUS (Visible Integral-field Replicable Unit Spectrograph), the instrument that would carry out a proposed dark-energy survey using the Hobby-Eberly Telescope, would consist of 145 copies of a unit spectrograph. (Artist’s rendering courtesy of the HETDEX Team, McDonald Observatory, Texas.)

Evolution Wins in Pennsylvania, Loses in Kansas

A few years ago, registered nurse Bernadette Reinking, weary after three decades of working with physicians and the medical system, retreated into her house in central Pennsylvania to, as she puts it, “raise my grandbabies”—all seven of them. Then, after two years of full-time grandmothering, she said, “I opened my door and found all of this mess.”

The mess was the Dover Area School Board, where, according to Reinking, the school board members “were not very kind to people who were offering other opinions.” Reinking, whose four children had gone through the Dover school system, decided to run for a seat on the board.

A slate of “real-world” candidates swept the intelligent design majority off the Dover, Pennsylvania, school board, while in Kansas antievolutionists not only weakened science standards, but redefined science itself.

So did Bryan Rehm, a high-school physics teacher who was angered by school board members “calling people names and spouting Bible scripture at people who disagreed with them.” Rehm said the school board also stopped funding school field trips, ended student participation in a national robotics competition, and was cutting back on other activities he thought were important.

Although many parents in the school district were concerned about

those actions, the issue that crystallized the opposition was a requirement enacted by the board that biology teachers in the school district read a statement to students saying evolution is “not a fact” and that students can learn about other theories, including intelligent design, by reading antievolution material in the school library.

The nine-member board approved the statement over objections from its own scientific standards committee. Rehm and 10 other parents sued,

claiming that the requirement was unconstitutional and that intelligent design was actually religious creationism being brought into the classroom. The trial ended on 4 November 2005, and four days later, eight of the nine intelligent design advocates on the school board were defeated by Reinking, Rehm, and six others running as the Dover Cares slate. (Rehm's election by less than 100 votes has since been challenged and a special runoff election was set for 3 January.) The court decision, which turns in part on whether intelligent design is religiously based, was expected in late December or early January.

The defeat of the intelligent design majority on the board was widely reported in the national media as a victory for evolution. The National Center for Science Education, the California-based organization that defends the teaching of evolution in public schools, issued a statement under the headline, "Dover voters choose good science at polls."

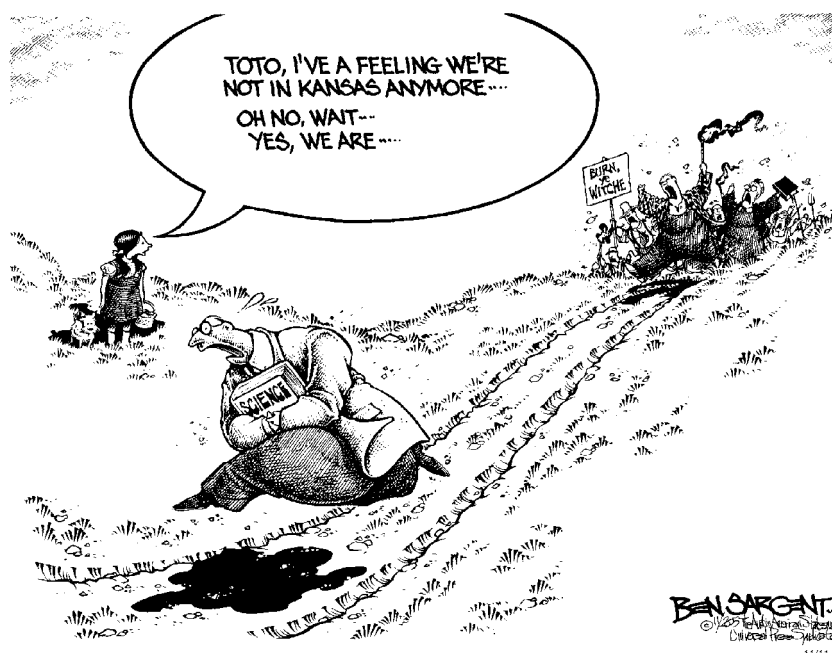
Religious conservatives weren't happy. Pat Robertson, founder of the Christian Broadcasting Network, reacted to the election by telling the "good citizens of Dover" that "if there is a disaster in your area, don't turn to God. You just rejected him from your city."

The new board took office on 5 December with, Reinking said, "the focus of improving the education of our children. We want them to be able to go out and get good jobs with health insurance. Real-world kinds of things."

While things were good for science advocates in Pennsylvania, they were bad in Kansas. There, the Kansas State Board of Education not only approved a revision of the state's science standards to include criticism of Darwinian evolution, but went a step further and redefined science itself.

The old definition termed science the "human activity of seeking natural explanations for what we observe in the world around us." The new definition describes science as "a systematic method of continuing investigation that uses observation, hypothesis testing, measurement, experimentation, logical argument and theory building to lead to more adequate explanations of natural phenomena."

University of Kansas physicist Adrian Melott, a veteran of the long battle between evolution and creationism in Kansas, said the new definition allows for the possibility of a supernatural explanation in science. Melott said he is dismayed by the resurgence of the creationists on the school board, but not surprised.



"We had the same thing happen six years ago," he said, when creationists organized and won the majority of seats on the state board (see PHYSICS TODAY, November 1999, page 59). They rewrote the science standards, but before they could go into effect, "people woke up and voted them out. Then they promptly went to sleep again and these people took over the board again in 2004."

University of Kansas cosmologist Hume Feldman said he was particularly troubled by "the idea that science can be redefined by this group, most of whom aren't even educators. Their idea, the way they do this, is that they don't insist that intelligent design be taught in the class, but that it be implied. Their focus is on saying evolution is not a fact."

The board is currently rewriting the science standards to reflect the new definition of science, but that task is being made difficult by the refusal of the National Academy of Sciences (NAS) to allow the use of its copyrighted National Science Education Standards. The American Association for the Advancement of Science

and the National Science Teachers Association have also refused to allow the Kansas board to use their material in writing the new standards.

In an October letter to the Kansas department of education, NAS president Ralph Cicerone wrote, "The revised [Kansas science standard] attempts to portray evolution as a theory in crisis and raises 'controversies' (e.g. the Cambrian explosion) that evolutionary scientists have refuted many times using the available evidence."

Keith Miller, a Kansas State University geologist, said only a couple of the antievolutionist members of the 10-member board have to be defeated in the 2006 election to give the pro-science side a majority, "but it is hard to get people passionate about a school board election." That's made more difficult when creationist advocates equate endorsing science with endorsing atheism, he said. "And we also have to recognize that this is a much longer-term problem. We can't say that if we win the next election, then we don't have to worry any more."

Jim Dawson

Building for Pakistan's Quake Zone

Pervez Hoodbhoy's mission is to erect buildings that can withstand a major earthquake, like the one that killed more than 70 000 people, injured 200 000 more, and made 2.8 million homeless in Afghanistan, Pakistan, and Northern India last October. Working with other physicists from Quaid-e-Azam University in Islamabad, Pakistan, 220 kilome-

ters southwest of the earthquake's epicenter, Hoodbhoy has so far raised \$400 000, largely from US physicists and arms-control analysts. The relief-team physicists are using the money to build private homes, shelters, and schools.

In the urban areas rocked by the 7.6-magnitude quake, 60% of the buildings were made of un-reinforced concrete,