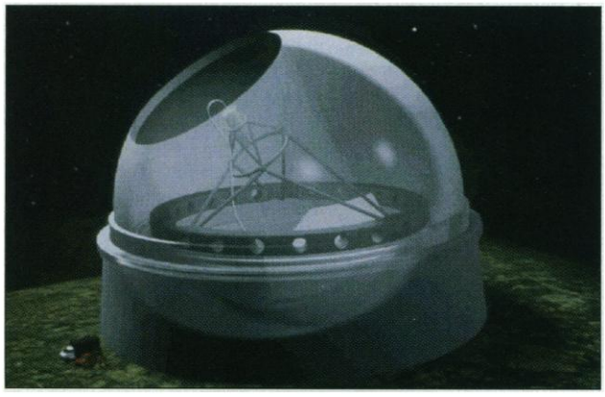
ASTRONOMY

Proposed Scope Takes Mirror Size to the Max

Last week, astronomers peered into their crystal ball and saw a lot of glass: a telescope with a 30- to 50-meter mirror, on which the largest telescopes being built today would fit like so many crackers on a plate. These 8- to 10-meter eyes on the sky will lose much of their sparkle next decade if the proposed Next Generation Space Telescope (NGST) is launched. Combining the distortion-free seeing of space with a powerful 4- to 8-meter mirror, the half-billion-dollar NGST would peer into the universe with unparalleled detail. But the astronomers who met last week* to consider a "maximum-aperture telescope" (MAXAT) aren't ready to cede the future to space.

They hope to persuade their colleagues, especially those who will prepare the next set of spending priorities for U.S. astronomy, that a mammoth ground-based telescope costing up to $1 billion is both feasible and scientifically justified. "It's not quite time to pull up our stakes on the ground," says workshop chair Jay Gallagher of the University of Wisconsin, Madison. "The scientific case for a large aperture is strong, and we see the combination of NGST and MAXAT as particularly powerful."



Wide eye. One design for a future ground-based telescope calls for a segmented mirror at least 30 meters across, tilted at a fixed angle.

Depending on its size, MAXAT could surpass the light-gathering power of NGST by 15- to 150-fold. That would open new vistas, especially in the near-infrared part of the spectrum, where astronomers can best correct for atmospheric blurring. MAXAT could take high-resolution spectra of distant galaxies and "decompose them into their building blocks," says Frank Bash of the University of Texas, Austin. The giant scope might also spot the first supernovae, study the life histories of stars, and peer into the hearts of nascent planetary systems to spy infant and mature Jupiter-sized planets.

If NGST flies, MAXAT could follow up its discoveries just as the twin 10-meter Keck Telescopes in Hawaii work with the Hubble Space Telescope: NGST would capture sharp images, and the huge ground-based instrument would scoop up light to make spectra that reveal what distant objects are made of and how they behave. "Once NGST is flying, this is the next obvious facility," says Matt Mountain, director of the multinational Gemini 8-Meter Telescopes.

The biggest technological challenge would not be MAXAT's gargantuan mirror, which would consist of a mosaic of hundreds of segments, says Roger Angel of the University of Arizona, Tucson. Rather, it's likely to be the adaptive optics controls that would adjust the telescope's optics to compensate for Earth's rippling blanket of air. "We would probably spend the better part of a decade figuring out how to make that affordable," says Angel, who wants to build a 15-meter prototype by putting thin glass into a dish resembling that of a radio telescope.

Gallagher's colleagues plan further meetings before writing a report in time for astronomy's decadal review committee, which will convene next year to set the field's priorities for 2000–10. Alan Dressler of the Carnegie Observatories in Pasadena, California, who hopes to take part in the review, is keeping an open mind until he sees the report. "We're just learning what to do with the 8- to 10-meter telescopes," Dressler says. But because big telescope projects take many years, he notes, "this is an ideal time to consider the next step."

How astronomers would pay for that step is another matter. MAXAT cost estimates range from $250 million to $1 billion depending on the technology adopted. For instance, a dish of segmented mirrors resting on a fixed mount similar to the Arecibo radio telescope in Puerto Rico could cut the costs dramatically and still bring 70% of the sky within view, says Bash. Even so, NASA and the National Science Foundation are unlikely to foot such bills alone—especially with NGST in the pipeline. "Our feeling was that this would have to be a world telescope," Mountain says.

Astronomers in Europe already are thinking along the same lines. Torben Andersen and Arne Ardeberg of Lund Observatory in Lund, Sweden, will hold an international meeting next June to discuss telescopes as large as 50 meters. And Roberto Gilmozzi of the European Southern Observatory (ESO) in Garching, Germany, is pushing his vision of a 100-meter behemoth dubbed OWL, for "overwhelmingly large."

Europe is a rival as well as a potential partner. ESO is pouring $800 million into its Very Large Telescope array of four 8.2-meter mirrors in Chile (*Science*, 1 May, p. 670), and most observers expect ESO to continue pushing the ground-based envelope. "Europe is seizing the leadership in ground-based astronomy, and not even in a subtle way," says Bruce Margon of the University of Washington, Seattle, who did not attend the workshop. "If we are going to concede leadership to them on the ground, we should at least do so by having thought about it."

–ROBERT IRION

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* Maximum-Aperture Telescope workshop, 28–29 August, organized by the Association of Universities for Research in Astronomy, in Madison, Wisconsin.

ASTRONOMY

Galaxy's Oldest Stars Shed Light on Big Bang

FRANK RAY/MCDONALD OBSERVATORY

The early universe, fresh out of the big bang, would have delighted those who hated chemistry at school. The only things around were hydrogen, helium, a bit of lithium, and a few other elements no heavier than boron. All the other elements that fill the periodic table arrived later, forged in the nuclear furnaces of stars and dispersed when the stars exploded as supernovae. Cosmologists studying the element-forming processes in the big bang have been trying to look back through the clutter of more recently formed elements to learn the exact composition of that primordial star stuff. Now they have a rare sample of it: a collection of the very oldest stars in our own galaxy, some of which are more than 13 billion years old, formed just 1 or 2 billion years after the galaxy itself was born.

At an astronomy meeting* in Australia last month, Sean Ryan of the Royal Greenwich Observatory in Cambridge, U.K., Timothy Beers of Michigan State University in East Lansing, and John Norris of Australia's Mount Stromlo and Siding Spring Observatories announced the culmination of a 20-year survey: the identification of a tribe of 1000 stellar Methuselahs. "The ancient stars we are studying formed so early in the life of the galaxy that they contain very little [heavy elements]. That is why they are special," says Ryan. François Spite of Paris Observatory at Meudon notes that these stars

* The Third Stromlo Symposium. The Galactic Halo: Bright Stars and Dark Matter, Canberra, Australia, 17–21 August.