Starring Role for the Space Telescope

Astronomers have always wanted a telescope located outside the earth's atmosphere. Now they are about to get one. The Space Telescope is expected to be put up by the space shuttle in the next few years.

According to Jack Brandt of the NASA Goddard Space Flight Center, the Space Telescope was sold to the United States Congress as an instrument for seeing the edges of the universe. Later, people saw that it would be able to do excellent planetary imaging. What almost got lost in the shuttle was the instrument's capability of observing the stars. Speaking in Seattle at last week's meeting of the Astronomical Society of the Pacific, Brandt tried to redress the balance of publicity a little and to tell stellar astronomers (a very numerous group even when compared to planetary or galactic astronomers) what the Space Telescope could do for them.

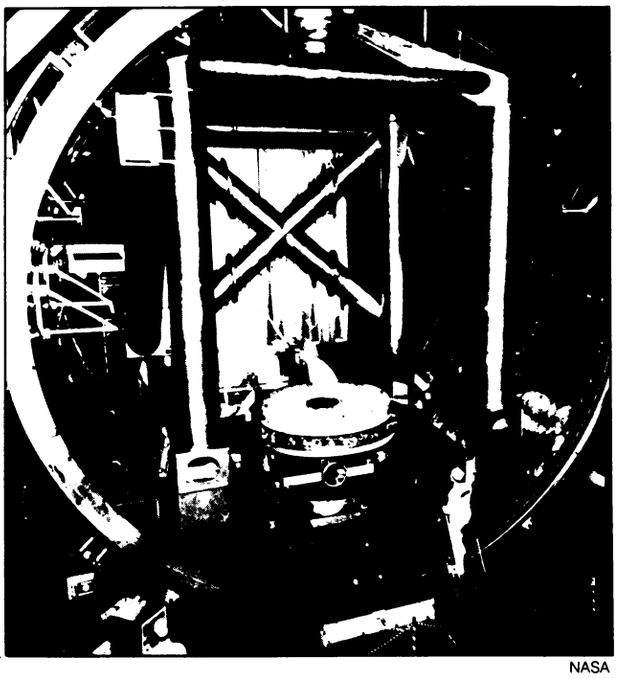
It means first of all "orders of magnitude more stars of any kind in any class." Stellar astronomy goes by statistics. More examples generally lead to better understanding and more precise theories. They may also open up new aspects of the problem entirely. Brandt gave some examples: Binary systems involving K supergiants and B main sequence stars show great losses of matter over time, contributing to strong stellar winds. A high rate of stellar wind flow means fast evolution for both the star and the interstellar medium in the neighborhood. The Space Telescope should be able to study the atmospheres of these stars as they go in and out of eclipse. Five such systems can be studied by the International Ultraviolet Explorer satellite. One hundred will be available with the ST. Comparisons are with the International Ultraviolet Explorer because the ST is basically an instrument for ultraviolet observing.

In principle, the Space Telescope could do all of the peculiar class A stars that are known and discover more, most if not all of the bright OB stars, white dwarfs, symbiotic stars, etc., etc. For most star classes the ST will be able to study stars 6 to 8 magnitudes fainter than now available. "You can calculate the spectra you would see," Brandt says, and then degrade them to IUE levels. "The information vanishes before your eyes with IUE resolution." The ST could do good spectra down to 26th magnitude. This will mean a real beginning for stellar astronomy of other galaxies. Many more stars will be available for study in the Magellanic Clouds than now are, and some can be studied in the galaxies M31 and M33.

The oldest way of measuring the distances of stars is by trigonometric parallax. Observations made when the earth is at different positions in its orbit are compared. If there is a difference in the apparent positions of the star, the angle between them can be used to triangulate the distance of the star. Only a few stars are near enough to display parallax, but for them it gives a distance that is not assailable on the grounds that the star's astrophysics may affect the measurement (as is the case with the redshifts of quasars). Parallactic distances are also the foundation of all astronomical distance measurements. The system of measurement of galactic distance using the periods of cepheid variable stars is anchored on a sample of cepheids whose distances are known by parallax. The system of measuring the greatest galactic distances by redshift is founded more or less on galaxies measured through cepheids. Brandt estimates that parallaxes will be observable to 10 times the distance now possible. That means (by simply taking the cube) 1,000 times as many stars. Maybe some of the peculiar stellar objects now of interest to astrophysicists will come into the range.

The Space Telescope will have a faint object camera capable of getting an image of a 28th magnitude star — albeit with an expensive 10-hour exposure. The same instrument could do profiles of the intensity of the light over the image of a single star or a close binary. It might also do photometry in globular clusters of stars, where the light of many stars tends to smear together for ground-based telescopes.

Over-all there are "order-of-magnitude leaps in many of its capabilities," says Brandt, and the prospect of "a large number of unexpected discoveries." □



NASA

The Space Telescope's 2.5 meter primary mirror was fabricated by Perkin-Elmer. It is shown here undergoing tests.

Reagan unveils new energy policy plan

The Reagan administration presented its "reformulated energy-policy guidelines" to Congress on July 17. So as not to be pinned down by something "static and unresponsive," its strategy consists of a philosophy rather than an actual blueprint or action plan. And that strategy represents a clear shift from the last federal energy plan, one developed by Jimmy Carter (SN: 7/21/79, p. 38).

Whereas Carter's plan proposed major new federal initiatives — such as development of a synthetic-fuels corporation and solar-development bank — Reagan instead proposes pulling the government out of the energy development scene to the full extent possible. Rather than setting specific objectives and guidelines — such as the Carter goal to develop a domestic capacity to produce 2.5 million barrels of "alternative fuels" per day within the next decade — Reagan would for the most part let market forces determine both national fuel-use patterns and which technologies deserve development support.

Even the goal to reduce oil imports — once Carter's highest energy priority — has undergone significant moderation. "Achieving a low level of U.S. oil imports *at any cost* is not a major criterion for the nation's energy security and economic health," the new Reagan plan says, because "even at its current high price, imported oil in some cases is substantially less expensive than available alternatives." Therefore, federal policies will

strive to avoid "distorting" market forces "through indiscriminate subsidies for alternatives that cost more than imported oil now and offer no short-term to mid-term likelihood of being economically competitive."

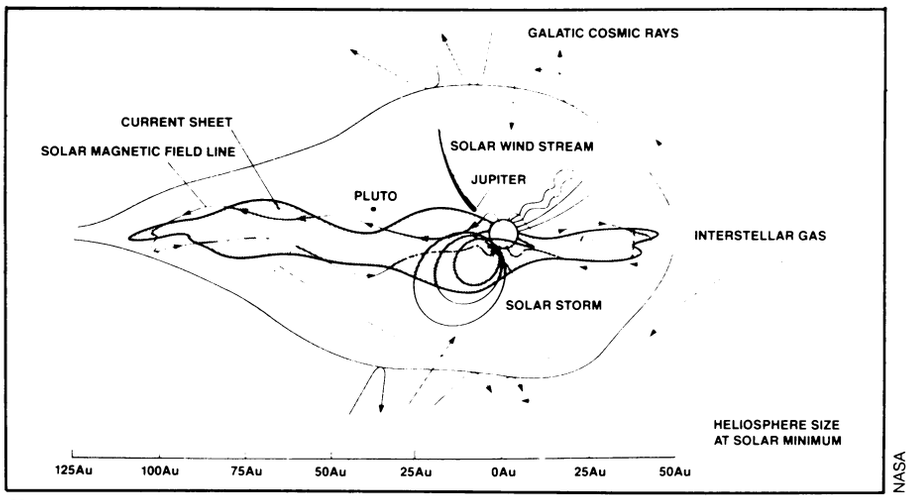
The Reagan plan seems coy about discussing specifics, though actions by the new administration offer strong clues as to how this philosophy is being interpreted. Reagan proposals would cut direct federal support for solar technologies, alcohol fuels, biomass and urban-waste systems $2.2 billion over the next five years. The plan says steadily increasing oil prices, precipitated by the complete decontrol of oil and oil-product prices on January 28, can be counted on to encourage private investors to finish developing the more viable of these technologies. The same goes for five major synthetic-fuels development projects—including the SRC-I and SRC-II plants.

Energy conservation programs will also see retrenchments. Over the six-year period ending in 1979, household energy consumption fell 14 percent, commercial energy consumption (per square foot) dropped 18 percent, and industrial efficiency (measured in output per unit of energy consumed) rose 12 percent. As a result, there is little need for the government to continue most energy-conservation demonstration programs, the administration says. Private investors have been given sufficient incentives to step in and take over. At least, that's the justification given for withdrawing federal support for programs such as those to develop high-efficiency consumer products, advanced automotive engines, efficient industrial processes and electric and hybrid vehicles.

Regulatory reform is one of Reagan's highest priorities. This administration has already revoked regulations involved with oil pricing. The energy-policy statement adds that another 75 of the remaining 150 individual rulemaking activities pertaining to energy have been targeted for modification, recision or withdrawal. Details are to be spelled out later.

Finally, "efforts to step up domestic energy production are too important," the plan says, "to be frustrated by inadequate access to the mineral wealth of our own land." Therefore, leasing policies will be changed to "guarantee" that energy resources on federal lands — an estimated 60 percent of all U.S. energy resources — will be explored and produced at a pace consistent with national needs, environmental concerns and the public interest. Environmental and economic impacts of these changes could prove substantial. For example, those announced last month increase the pace and acreage of lease offerings for oil and gas drilling on the outer continental shelf. They also permit all tracts in a given region to be covered, for the first time, by a single environmental-impact assessment. □

Pioneer 10: Where no probe has gone before



Heliosphere at solar maximum, inferred from Pioneer 10 and other spacecraft data.

Nothing else made on earth has come even close to traveling as far from home as a little probe named Pioneer 10. Launched on March 2, 1972, it took the first close-up look at Jupiter 21 months later, and has since been on its way out of the solar system. Last Sunday, July 26, the craft passed its "silver AU" — a point 25 Astronomical Units or 3.75 billion kilometers from the sun, 25 times as far away as earth.

Three other spacecraft are also outward bound, but all are still relatively close to their home star. Pioneer 11 was launched barely a year after its predecessor, but after passing Jupiter it headed back across the solar system to an encounter with Saturn, so that it is only 10.5 AU from the sun. The more recent Voyager 1 and 2 probes are at 10.2 and 9.4 AU respectively.

Pioneer 10 thus finds itself in the least-explored reaches of space, where virtually everything it measures is a new discovery. The solar wind, for example, was expected by some researchers to slow down far from the sun, yet it apparently does not. Also, the lines of the interplanetary magnetic field, rather than lying in smooth spirals, turn out to be tied in knots, possibly by variations in the charged particles pouring forth from the sun. Still a mystery is the location of the heliopause, the boundary between the sun's gigantic magnetosphere and the interstellar wind —a vastly enlarged version of the interaction between the solar wind and the magnetic field of Jupiter. Some researchers now guesstimate it to lie perhaps 50 to 100 AU out, but clues are essentially nonexistent. One such would be a major increase in the number of charged particles, such as one might find just inside the sun's magnetic "bow shock," but any signs of such a possible long-distance build-up are now masked by the present high level of solar activity.

For the four outward-bound spacecraft, the great exodus from the solar system (as defined by the orbit of the outermost known planet) will occur in a two-year rush at the end of the decade. The Voyagers, traveling faster, will have caught up, opening the way when Voyager 1 crosses Neptune's orbit (part of which is outside of Pluto's elliptical path) in November of 1988. For the rest, Pluto's orbit is the "edge": Pioneer 10 in June of 1989, Voyager 2 in September 1990 and Pioneer 11 the following month. By that time the data bank on *outer* outer space will have grown considerably, though the heliopause may be an elusive goal. The thermonuclear batteries powering the Pioneer transmitters may become too weak a year or two later, but even the more powerful signals from the Voyagers may depend on continual improvements in NASA's deep-space tracking network if they are to relay the word from the real magnetospheric boundary between the sun's domain and interstellar space. □

Mexican panda pup: Second time around

More calm than last year, Ying-ying, the 7-year-old female panda at the Chapultepec Zoo in Mexico City, gave birth to her second pup and the second panda ever born outside of China. The gestation period was 126 days and labor took half an hour. A year ago the anxious new mother accidentally crushed her first-born when it was 8 days old. Now zoo officials are taking care that mother and pup are not disturbed; the animals are being viewed only over closed circuit television. The zoo reports that Ying-ying holds the pup to her chest and feeds it when it cries. Ying-ying weighs 275 pounds and the officials estimate the newborn is 9 inches long and weighs 3.2 ounces. The pup appears smaller than last year's short-lived female, so zoo officials guess it is male but will not be certain for six months. □