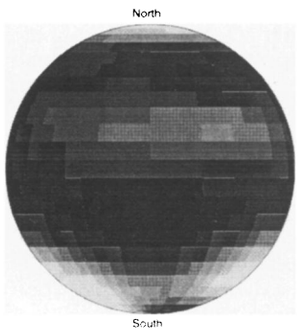
Astronomy

Out of the shadows: A new map of Pluto

Taking advantage of several eclipses of Pluto by its moon Charon during the past several years, astronomers have constructed a new map of the surface brightness of the distant, frozen planet. The map depicts an unusually bright patch at Pluto's south pole and indicates that the planet may undergo seasonal changes in surface brightness as it moves closer to and farther away from the sun during its 248-year orbit.



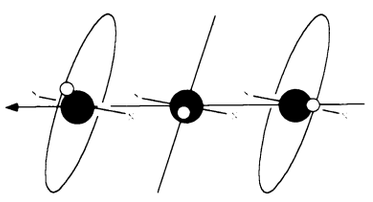
Binzel, Young

Map shows brightness of the hemisphere of Pluto that Charon periodically eclipses. Lightest regions reflect more than 95 percent of sunlight, darkest regions less than 15 percent.

Richard P. Binzel of the Massachusetts Institute of Technology in Cambridge began the study in 1985, when he became the first to detect eclipses of Pluto by its recently discovered moon. Taking advantage of an alignment of Earth, Pluto and Charon that occurs for a few years each century, Binzel viewed several eclipses from 1985 through 1990, using telescopes at McDonald Observatory near Fort Davis, Texas.

Each four-hour partial eclipse always dims the same face of Pluto. During Binzel's years of observations, Charon blocked different banana-shaped swatches of the planet. The first several eclipses dimmed Pluto's north polar region; later events blocked the planet's equatorial and south polar regions.

The changing eclipse pattern enabled Binzel and a graduate student, Eliot F. Young, to create a luminosity map of one entire face of the planet – even though neither the Hubble Space Telescope nor ground-based instruments can resolve Pluto's tiny surface. Measuring the overall drop in Pluto's luminosity during each eclipse, and keeping precise track of what portion of the planet Charon had blocked during each encounter, the researchers calculated the contribution of each banana-shaped section to the planet's overall surface brightness. They presented their map last month at a meeting of the American Geophysical Union in Montreal.



Binzel, Young

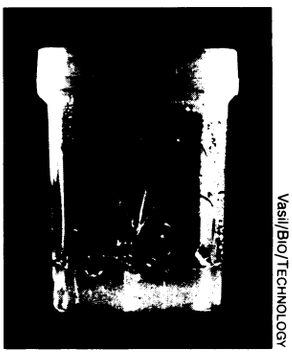
During recently observed partial eclipses of Pluto, Charon (white circle) first passed in front of the planet's north pole (left), then its south pole (right).

Pluto's south polar cap is extremely bright, while the north polar cap appears dim. Young attributes this asymmetry to seasonal variations during the planet's elliptical orbit, which takes Pluto as close to the sun as 30 times the distance between Earth and the sun, and as far away as 50 times that distance.

During years when Pluto recedes from the sun, the planet's south pole lies in darkness, which could enable highly reflective methane frost to settle there and account for the region's brightness. When Pluto approaches the sun, its south pole receives constant sunlight, but the region's reflective methane coat – akin to wearing white in summer – might allow the pole to maintain a cool temperature and retain a frost layer, the researchers speculate.

Biology

First gene-spliced wheat



Vasil/Bio/Technology

Young herbicide-resistant wheat plant.

In a feat that could boost wheat production worldwide, plant biologists have for the first time permanently transferred a foreign gene into wheat.

The gene makes wheat resistant to the herbicide phosphinothricin – sold under the trade name Basta – which normally kills any plant it touches, weed or crop. Plant breeders say the Basta-resistant wheat should enable farmers to spray their fields with the powerful chemical to eradicate weeds without harming their harvest.

Indra K. Vasil at the University of Florida in Gainesville and his colleagues have worked for years to genetically engineer wheat, one of the world's most important food crops. Several times, they inserted a foreign gene into a young wheat plant, but the plant failed to pass the gene on to successive generations, indicating the gene's instability.

Now, in the June Bio/Technology, Vasil and his co-workers report they have engineered a wheat plant that can reliably hand down a new gene to its offspring. The researchers used a .22-caliber "gene gun" to blast the gene for an enzyme that breaks down Basta directly into a clump of wheat cells grown in the laboratory. The immature cells grew into fully developed wheat plants that proved resistant to the herbicide, Vasil's group found. Moreover, when bred with normal wheat plants, the genetically engineered wheat yielded two successive generations of Basta-resistant plants.

The development is a "significant achievement," says Donald N. Duvick, a semiretired plant breeder affiliated with Iowa State University in Ames and formerly vice president for research at Pioneer Hi-Bred in Johnston, Iowa. But Duvick cautions against widespread use of Basta and Basta-resistant wheat. "They shouldn't be used too extensively," he asserts, "because weeds could evolve resistance to the herbicide, too."

Vasil says his group is now attempting to insert genes that would allow wheat plants to fend off devastating viral and fungal infections. Next, he says, they hope to use genetic engineering to boost the nutritive value of the grain.

Glow little stressed plant, glow

Two years ago, researchers at Stanford University found that plants can react to touch by "turning on" a specific set of genes. These genes direct the production of proteins that bind to calcium and that may play a role in changing a plant's growth pattern (SN: 2/24/90, p.117).

Now, a team at the University of Edinburgh in Scotland has detected marked increases in calcium levels within plant shoots exposed to wind. Anthony J. Trewavas and his group inserted a jellyfish gene into tobacco plants, causing them to glow blue as their calcium levels rose. In the June 1 Proceedings of the National Academy of Sciences, the researchers report that the shoots glowed a brighter blue after being squirted with puffs of air from a syringe.

"This establishes quite clearly that wind has an immediate effect on calcium," says Trewavas. He speculates that calcium serves as a signal that prompts wind-buffeted plant cells to shore up their cell walls and brace the plant in place.

Trewavas says the finding may have commercial spin-offs. Some companies have inquired whether the technique could create glow-in-the-dark flowers or luminous grass for airports.