

## Icy clues gleaned from Mercury's other half

Few astronomers would expect to find ice on Mercury, the planet that lies closest to the sun's warming rays. But a new radar portrait — the first to image an entire hemisphere of Mercury at radio wavelengths — suggests that a large ice patch may cover the planet's north pole, California astronomers report.

Their radar observations offer an intriguing glimpse of the half of Mercury never photographed by Mariner 10, the only spacecraft ever to fly past the small planet.

"Clearly, we're seeing something that no one has ever seen before," says Raymond Jurgens of the Jet Propulsion Laboratory (JPL) in Pasadena, Calif. Jurgens and his co-workers presented their new findings this week at a meeting of the American Astronomical Society's Division for Planetary Sciences, held in Palo Alto, Calif.

In August, the researchers used a powerful radar beam generated by JPL's 70-meter antenna to bounce radio waves off Mercury. They detected the reflected signals with a group of 26 radio telescopes in the Very Large Array (VLA) near Socorro, N.M. Jurgens and his colleagues expected to get high-resolution images because Mercury was near its closest approach to Earth and the VLA telescopes had been arranged to form a particularly large radio "ear." But they also got an unanticipated bonus: Mercury's north pole was tipped toward Earth, providing a clear view of this rarely seen region.

The resulting images reveal a radar-bright, previously undetected oval structure covering about 640 kilometers by 300 kilometers, they report. Martin Slade of JPL, a member of the research team, notes that both the shape and location of this bright polar region fit with recent calculations by David Paige and Stephen Wood, both with the University of California, Los Angeles. These two astronomers propose that Mercury's north and south poles may get as cold as 125 kelvins (-235°F), even though its equator can reach temperatures as high as 700 kelvins (800°F).

Mercury's high equatorial temperatures can vaporize water and other compounds originating on its surface or released by passing comets and asteroids. While most of those gases escape from the planet's thin atmosphere, Paige and Wood suggest that some may condense out at the chilly north and south poles, forming patches of fractured ice similar to those observed on Mars. Since fractured ice reflects radio waves easily, such patches would appear bright in radar images, Slade explains.

Lower-resolution radio observations made in April and late July at the Arecibo Observatory in Puerto Rico seem to

support the scenario of cold poles. The July data indicate a radar-bright area at Mercury's north pole, notes Slade, while data obtained in April suggest a similar feature at the south pole.

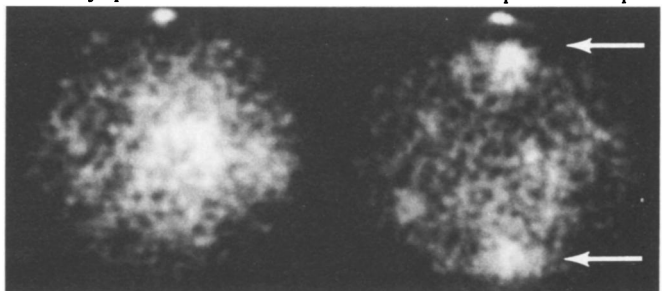
Frozen water isn't the only possible explanation, however. The researchers acknowledge that the bright patches could represent craters or other rugged, radio-reflecting surfaces that just happen to coincide with the north and south poles. Moreover, frozen materials other than water could also appear bright in radar images, they say.

"But we regard these alternatives as farfetched," adds study coauthor Duane O. Muhleman of the California Institute of Technology in Pasadena.

Several astronomers have given the ice theory a frigid welcome, cautioning that it's easy to misinterpret radar maps of the planets. And Merton E. Davies of the Rand Corp. in Santa Monica, Calif., who helped produce Mariner 10's visible-light photographs of Mercury in 1974, notes that the Mariner craft did not detect ice on either pole. On the other hand, says Slade, if the poles are blanketed with "dirty ice" — frozen water topped by dust — such material would go undetected in visible-light photos.

Two other unexpectedly bright structures have come to light in the new radar images. These patches, each about 1,000 kilometers in diameter, lie equidistant north and south of the equator. They coincide with sodium-enhanced regions of Mercury's atmosphere seen in visible-light spectra recorded from Earth.

Slade's team offers one possible explanation



Left: Radar image of Mercury shows hemisphere never photographed by spacecraft. Researchers speculate that the top bright patch represents a polar ice cap. Right: Two weeks later, after Mercury rotated by 100° as seen from Earth, two other bright regions (arrows) appeared.

nation that would tie the sodium abundance to these features: The two radar-reflective regions may represent impact basins — lava-filled craters probably created by meteorite impacts. If crashing meteorites left cracks in Mercury's crust, sodium escaping through the cracks could enrich the atmosphere at the two sites, the California researchers suggest.

For now, all such theories about the surface of Mercury remain speculative, acknowledges Jurgens. Mercury has gone largely ignored since the Mariner 10 mission, he adds, but he hopes the new radar clues will finally put the tiny planet back in the limelight.

— R. Cowen

### Depression gets anxious

Anxiety symptoms often coexist with severe depression, despite the separation of "anxious moods" from depression in the current manual of psychiatric diagnoses, according to a new study.

Clinicians should note that "anxious depression" proves extremely resistant to standard drug and psychotherapy treatments used for depression, psychiatrist Paula J. Clayton of the University of Minnesota in Minneapolis and her colleagues assert in the November *AMERICAN JOURNAL OF PSYCHIATRY*. They also urge researchers to examine more closely the effectiveness of antidepressants and electroshock therapy in individuals suffering from depression colored by anxiety.

Clayton's team prospectively evaluated 327 severely depressed people admitted to psychiatric units or outpatient care programs at five university medical centers involved in a depression study funded by the National Institute of Mental Health. The patients had

experienced no prior psychiatric disturbances.

Several signs of anxiety emerged among the study participants, the researchers report. Moderate to severe worrying over unpleasant thoughts affected three-quarters of the patients. About two-thirds reported moderate to severe fearfulness and apprehension, and one-quarter experienced periodic panic attacks. More than one in three depressed individuals suffered from physical symptoms linked to anxiety, such as headaches and stomach cramps. Phobias, obsessions and compulsions turned up in smaller numbers.

Severely anxious depressed people took an average of 6½ months to recover after treatment started — twice as long as those with moderate, mild or no anxiety — and were more likely to receive a mix of psychotherapy and antidepressants. Study participants with "anxious depression" also were more likely to have parents, siblings and children with severe depression, the researchers note. □