Atom & Cosmos

For longer versions of these and other Atom & Cosmos stories, visit **www.sciencenews.org**

Big Bang's glow maps early mass

Cosmic radiation confirms existence of dark energy

By Alexandra Witze

In a cosmic feat of observation, astronomers have used the distortions of ancient light left over from the Big Bang to explore how clumps of matter were distributed in the early universe.

The work also independently confirms the existence of dark energy, an enigmatic force that appears to be pushing the cosmos apart faster and faster.

Researchers using the Atacama Cosmology Telescope in the Chilean Andes reported the discoveries July 5 in two papers in *Physical Review Letters*. The new work "will be a really powerful probe for figuring out dark energy and a lot of other interesting things," says team member Blake Sherwin of Princeton University.

Several scientists have won Nobel Prizes for studying the cosmic microwave background radiation, the afterglow left from the fireball that accompanied the creation of the universe 13.7 billion years ago. In the 2000s, a satellite called the Wilkinson Microwave Anisotropy Probe mapped how that radiation is spread across the entire sky. But seeing the distortions now being studied required a telescope with more precise vision.

Using the 6-meter Atacama telescope, astronomers analyzed the temperature of the afterglow in a narrow strip of sky along the celestial equator. They used complex statistical analyses to tease out how temperature fluctuations — essentially, hot and cold spots on the ancient sky map — had been distorted by intervening matter.

Astronomers regularly see such "gravitational lensing" with individual galaxies or galaxy clusters, when another massive clump of matter gets in the way. Just as a piece of broken glass distorts light passing through it, gravity from the foreground clump distorts the light coming from the more distant one, making it appear as a smeared-out arc.

Scientists first reported seeing gravitational lensing in the cosmic microwave background in 2007. Now the Atacama scientists have taken that work further. Their high-resolution data on gravitational distortions provided more statistical information about how mass, including invisible "dark matter," was distributed in the early universe. The new work is also the first to discern the lensing without using other sources of data.

"What's nice about being able to detect lensing using just the cosmic microwave background is that you don't have to make an assumption about knowing where the dark matter already is," says team member Sudeep Das of the University of California, Berkeley.

The team also verified that dark energy exists, as previous studies of distant exploded stars have suggested. "It's arguably the most important measurement in physics in the last couple of decades, so it's definitely worth confirming," says Sherwin.

Together, the new studies open a window to studying where matter lies in the distant universe, says Wayne Hu, a cosmologist at the University of Chicago.

Other experiments will soon start hunting for lensing in polarized light coming from the Big Bang afterglow.

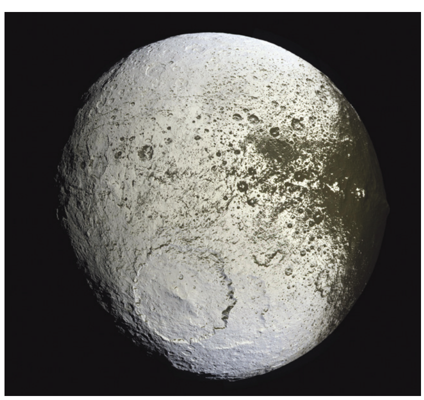
Iapetus splattered in orbital dustup

Black layer is from another Saturn moon's wrong-way motion

By Nadia Drake

Imagine a powdered-sugar doughnut hole plowing through a cloud of dark-chocolate dust. The resulting two-colored treat would resemble one of Saturn's weirder moons, Iapetus — an icy world with a coal black face and a bright white backside.

For centuries astronomers have puzzled over the source of this yin-yang color pattern. Now a team led by Daniel Tamayo of Cornell University offers an explanation: Dust flung from another of Saturn's moons is coating one side of Iapetus. Because Iapetus doesn't rotate relative to Saturn, the same face continually catches the dark moon flakes.



Dust from another Saturn moon blackens Iapetus, seen in this false-color image taken by NASA's Cassini spacecraft.

NASA, JPL-CALTECH, SPACE SCIENCE INSTITUTE

In a study posted online July 7 in *Icarus*, Tamayo and colleagues mathematically describe the movement of dust particles in the outer Saturnian system. The team focuses on dust coming from Phoebe, a dark and distant moon that circles Saturn in the opposite direction as Iapetus.

Collisions between Phoebe and smaller outer moons produce an enormous, invisible ring of dust lying far beyond Saturn's well-known photogenic ones. Nearly every particle in that ring larger than 10 micrometers across ends up on Iapetus, the team concludes. Smaller particles that miss Iapetus land on the Saturn moons Titan and Hyperion.

"This is a very significant paper," says astronomer Bonnie Buratti of the Jet Propulsion Laboratory in Pasadena, Calif. "It does the math."