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Study puts new spin on Saturn's rotation

Saturn is rotating five minutes faster than previously thought, a
fact that sheds new light on the planet's composition.

Wave patterns in Saturn's clouds show that scientists have been
using the wrong rotation rate for the planet, said Timothy
Dowling, a planetary atmospheres researcher at the University of
Louisville, who helped make the discovery.

The work by Dowling and his colleagues solves a long-standing
puzzle regarding Saturn's winds and also offers clues to the
planet's deep interior. All of the gas giants – Saturn, Jupiter,
Uranus and Neptune – spin on their axes with well-defined
rotation periods, just like the rocky planets. But with no solid
surface features to track, measuring how long they take to make a
complete spin has been a challenge.

"Saturn is the second-largest planet in our solar system, but
we've never known the length of its day," Dowling said. "It's
like trying to listen to recorded music without knowing what
speed to play the tape."

Researchers have successfully measured the rotation of Jupiter,
Uranus and Neptune because all of those planets have tilted
magnetic fields that swivel like a lighthouse beacon. Saturn's
magnetic field, however, is pointed straight up and down, making
it impossible to see its spin.

Until now, scientists have used an imprecise yardstick to measure
Saturn's rotation: weak radio signals.

But even NASA's Cassini probe, a spacecraft launched in 2004 to

study Saturn and its moons that revealed methane lakes on Titan, could not determine exactly how fast Saturn was turning. When scientists compared data gathered by Cassini to data gathered in the early 1980s by the Voyager probe, the numbers showed a significant change in the planet's rotation rate.

"We knew that couldn't be right because planets just don't speed up and slow down in a few years' time," Dowling said.

Dowling previously had tracked large waves on Jupiter in a breakthrough finding that offered new clues to the atmosphere beneath the Jovian clouds. He and his colleagues were scrutinizing Saturn's wind patterns when they noticed similar large waves there.

"The waves were standing still, sort of like a swimmer who heads upstream and just keeps up with the current," he said.

Using detailed temperature data collected by Cassini, the researchers developed a three-dimensional computer model of Saturn's waves. After allowing for wind drift, they found that the planet's day was 10 hours, 34 minutes and 13 seconds long — or five minutes shorter than previously thought. This makes Saturn have both eastward and westward jet streams, making it appear much more like Jupiter than previously thought.

The finding also offers new insight on Saturn's density and interior structure, since the faster a planet spins the more concentrated its center needs to be to maintain its planetary shape.

Peter Read, a University of Oxford physicist and member of the Cassini team, and Gerald Schubert and Ravit Helled, geophysicists from the University of California-Los Angeles and experts on Saturn's interior, joined Dowling on the project.

A report of the findings first appeared in the 30 July 2009 issue of Nature.

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