Alternating flows and a high-latitude eastward jet explain Saturn's polar hexagon, researchers report

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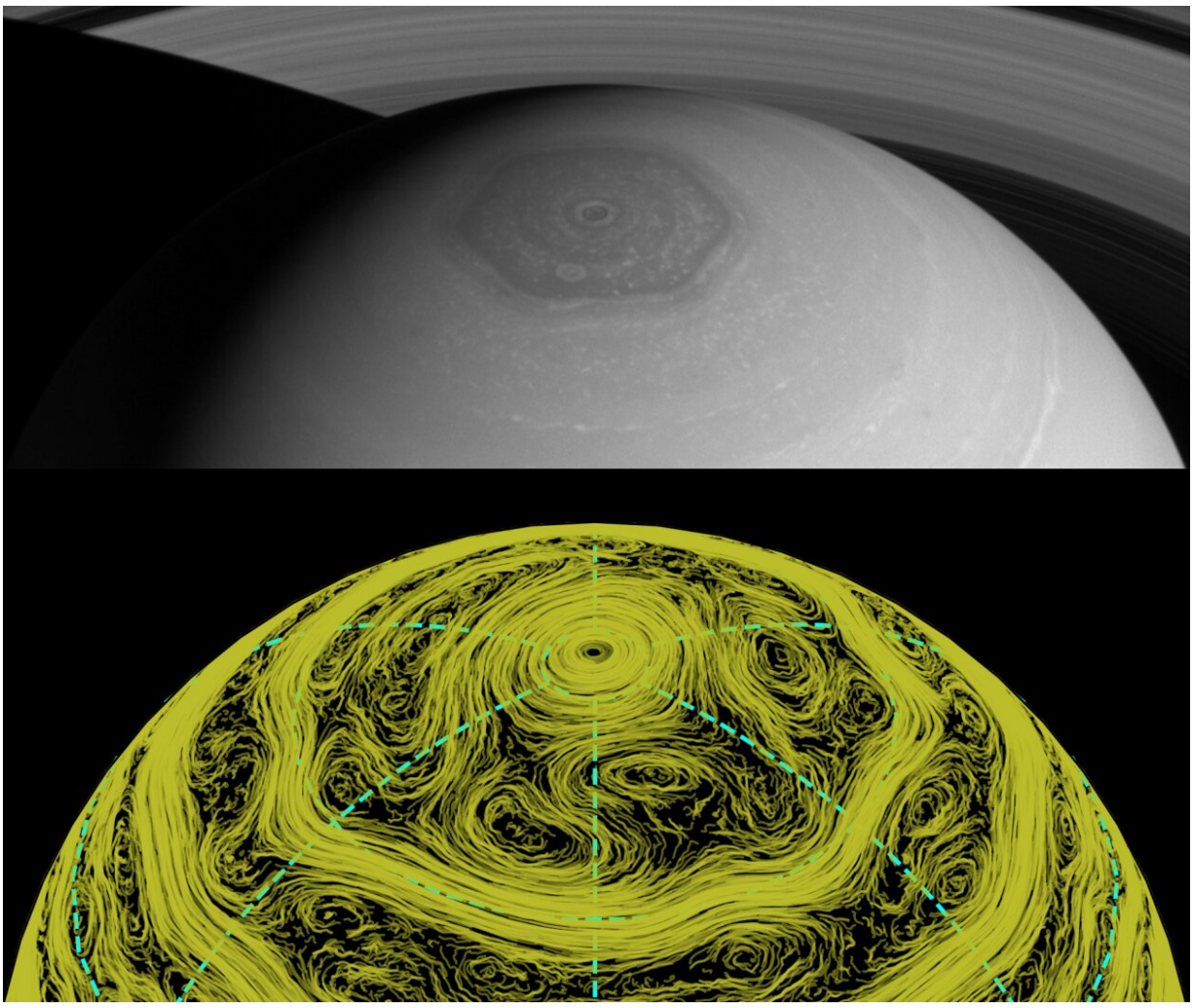

Saturn's hexagonal storm as seen in 2014 (top) and a similar but larger storm with multiple edges produced in the simulation (bottom). Credit: NASA/JPL-

Caltech/Space Science Institute (Top) and Rakesh K. Yadav (Bottom)

A pair of researchers at Harvard University has developed a computer simulation that may explain Saturn's mysterious polar hexagon. In their paper published in *Proceedings of the National Academy of Sciences*, Rakesh Yadav and Jeremy Bloxham describe the factors that went into developing their simulation and what it showed.

Back in 1981, the Voyager 2 space probe passed by Saturn and captured images. One of the things that stood out was a very large hexagon-shaped entity (approximately 30 thousand kilometers across) near the planet's North Pole. Further study suggested the hexagon was an atmospheric phenomenon that was likely similar in nature to a hurricane on Earth—but its hexagonal shape was a mystery. Subsequent research showed that the hexagon shape persisted to this day, almost 40 years later—but the reason for its shape and persistence remains mystery. Space scientists have debated the nature of the hexagon, and over the past several years have divided into two camps: those who believe it is a shallow phenomenon, and those who think it is very deep. In this new effort, the researchers sought to solve the mystery of the hexagon by building a 3-D computer simulation to emulate its behavior.

To build their simulation, the researchers studied and used data regarding the planet from multiple resources, most specifically from the Cassini spacecraft, which generated massive amounts of data over its 13-year mission.

The simulation showed deep thermal convection moving in the outer layers of the planet's atmosphere, which led to the formation of three large cyclones near the poles—and an eastward moving jet that moved in a polygonal pattern. The simulation also showed one of the giant vortices

pinching the jet. In the simulation, the forces of the cyclones and the eastward-moving jet combined to create the hexagonal shape of the central vortex, which spins in an opposite direction of the smaller vortices. The simulation also showed the hexagon as very deep, perhaps thousands of kilometers.

The researchers suggest that the reason the smaller adjacent cyclones are not visible in photographs of the planet is because they are covered by turbulent gasses.

More information: Rakesh K. Yadav et al. Deep rotating convection generates the polar hexagon on Saturn, *Proceedings of the National Academy of Sciences* (2020). DOI: 10.1073/pnas.2000317117