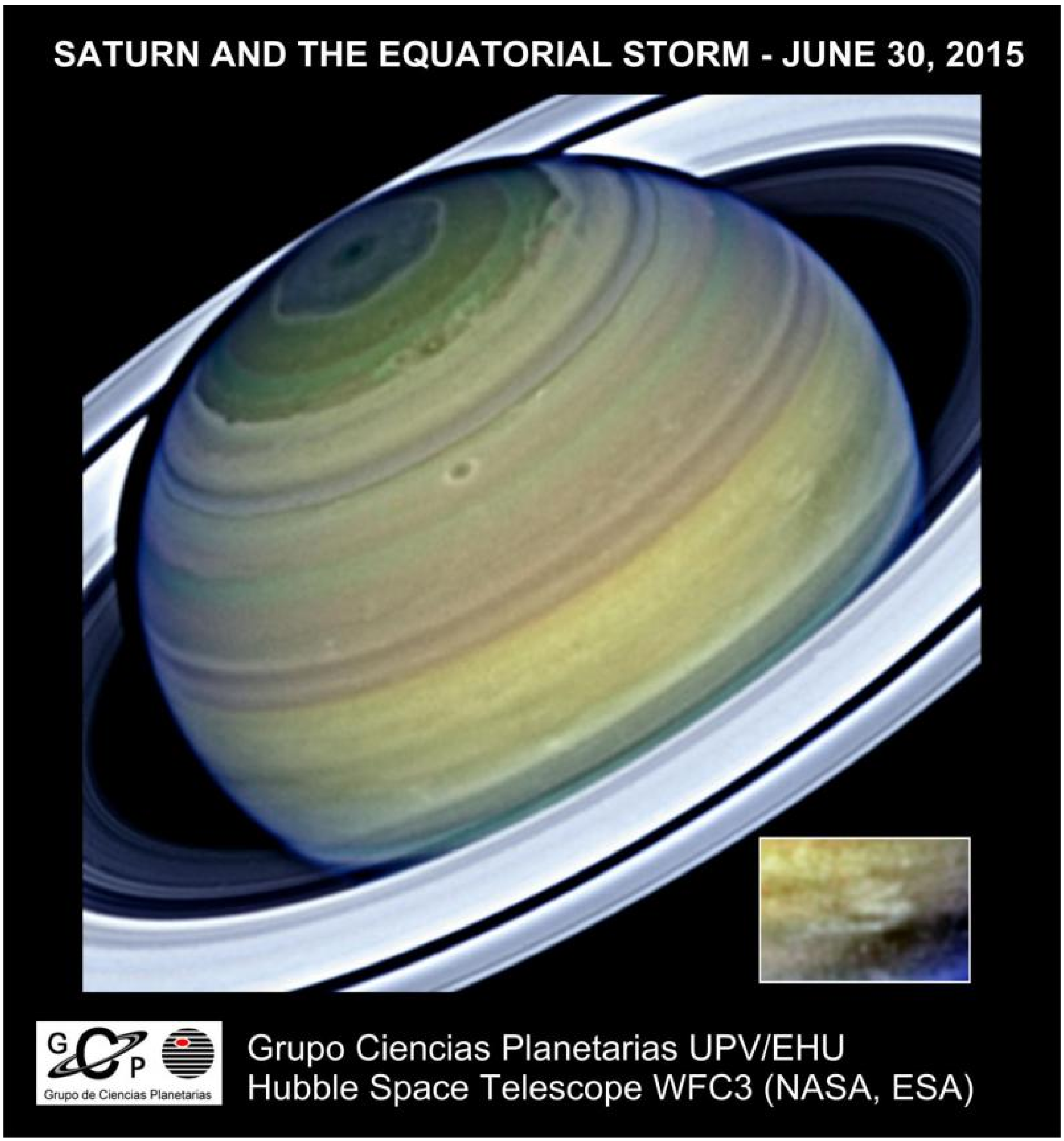
The peculiarities of the huge equatorial jet stream in Saturn's atmosphere revealed

November 10 2016



The atmosphere of the planet Saturn, a gas giant 10 times bigger than the Earth consisting mostly of hydrogen, has a wider, more intense jet stream than all the planets in the solar system. Winds gusting at speeds of up to 1,650 km/h blow from West to East in the equatorial atmosphere, thirteen times the strength of the most destructive hurricane force winds that form on the Earth's equator.

This huge jet stream also extends about 70,000 km from north to south, more than five times the size of our planet. There is as yet no theory capable of explaining the nature of this stream nor the sources of energy feeding it. Back in 2003 the same team warned in an article, published in *Nature*, of the drastic reduction in winds on the cloud level with respect to what had been observed when the Voyager space probes visited the planet.

In June last year, using a simple 28-cm telescope belonging to the Aula EspaZio Gela (Space Lecture Room), we discovered the presence of a white spot on Saturn's equator that was moving at speeds of 1,600 km/h, a speed that had not been observed on Saturn since 1980, said Agustín Sánchez-Lavega, lead author of the work and also director of the Aula EspaZio Gela and Planetary Sciences Group of the UPV/EHU-University of the Basque Country. Observations obtained a month later by members of the Planetary Sciences Group using the PlanetCam camera developed by this team and fitted to the 2.2-m telescope at the Calar Alto Observatory in Almería (Spain) enabled the speed of this atmospheric structure to be confirmed. Images obtained by observers in other countries using small telescopes were also used in the study.

The researchers were able to study the phenomenon in detail after obtaining observation time of the Hubble Space Telescope granted by its director in order to capture images of Saturn at a time when the Cassini probe in orbit around it had poor vision of the planet. "�It is very difficult to obtain observation time in Hubble because it is highly competitive, but its high quality images have been decisive in the research,"� explained Sánchez-Lavega.

1,650 km/h winds

By studying the movement of the clouds that formed the white spot (an enormous storm of about 7,000 km) and of those present in its surrounding areas, the researchers were able to obtain new, valuable information about the structure of the planet�s huge equatorial jet stream. Furthermore, the researchers established the heights reached by the different atmospheric structures and determined that the winds increase dramatically the lower they go. They reach speeds of 1,100 km/h in the upper atmosphere but achieve up to 1,650 km/h at a depth of about 150 km. Furthermore, while the deep wind is stable, in the upper atmosphere the speed and width of the equatorial stream are highly changeable, perhaps due to the seasonal insolation cycle on Saturn, and their intensity is increased by the changing shadowing of the rings above the equator.

There is another significant meteorological phenomenon above the planet�s equator and which could affect the winds: the Semi-annual Oscillation (SAO), which occurs about 50 km above the cloud deck and which causes the temperatures to oscillate and the winds to change direction and strength from East to West. And if the complexity of Saturn's equatorial meteorology were not enough, it is at these latitudes where the so-called Great White Spot developed three times, in 1876, 1933 and 1990; this is a gigantic storm that manages to go all the way round the planet and which has only been seen on six occasions during the last one hundred and fifty years. The study by the Planetary Sciences Group reports that this gigantic storm is another of the agents of change in the equatorial jet stream.

All these phenomena occur on a different scale to a certain extent on our own planet. So by studying them in this way in other worlds in totally different conditions we can make progress in understanding and modelling them, he concluded.

More information: A. Sánchez-Lavega et al. An enduring rapidly moving storm as a guide to Saturn's Equatorial jet's complex structure, *Nature Communications* (2016). DOI: 10.1038/NCOMMS13262

Provided by University of the Basque Country