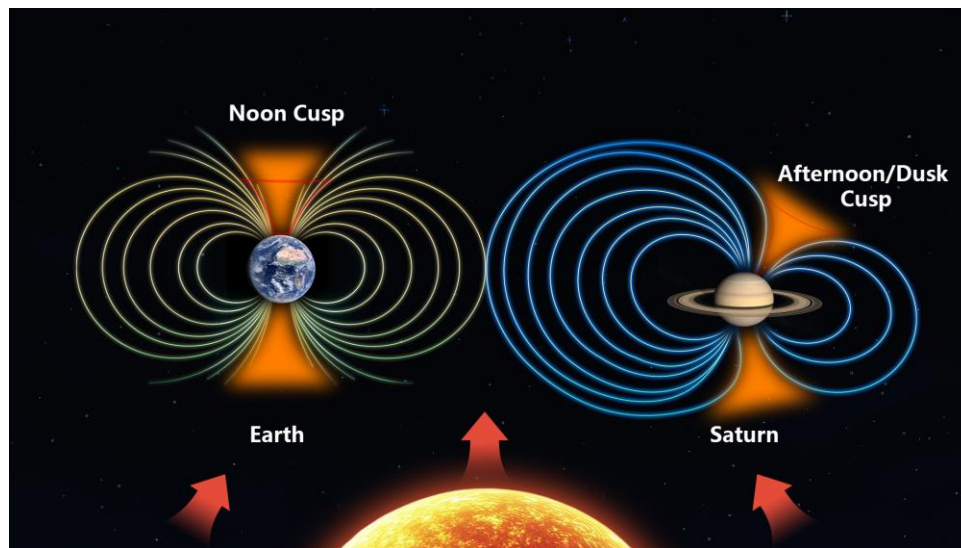


Press release

For immediate release

## HKU Astrophysicists Find Saturn's Magnetic Bubble Differ from Earth-Based Models, Appearing to be Less Symmetrical and Off-Centre

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*Image 1: This diagram compares how charged particles enter the magnetic fields of Earth (left) and Saturn (right). On Earth, the entry region is centred and balanced, while on Saturn it is shifted to one side due to the planet's rapid rotation. Image credit: Yan Xu.*

Latest research led by Professor Zhonghua YAO of the Department of Earth and Planetary Sciences (DEPS) at The University of Hong Kong (HKU) has found that auroras on Saturn behave markedly differently from those on Earth, appearing uneven and shifted to one side rather than forming the familiar symmetrical rings around the poles. Analysing archival data from NASA's Cassini mission, the team shows that Saturn's rapid rotation fundamentally reshapes its magnetic environment, driving this off-centre magnetic bubble pattern.

### A Shield with a Systematic Shift

Like Earth, Saturn is surrounded by a magnetosphere, a magnetic "shield" that protects it from the solar wind. However, near the poles, funnel-shaped openings called "cusps" allow charged particles to leak into the atmosphere along magnetic field lines and produce auroras. On Earth, these entry regions, similar to a magnetic bubble, are usually centred around noon—the part of the planet facing the Sun—so the magnetic bubble tends to form fairly symmetrical rings around the poles.

At Saturn, the dynamics change dramatically. These regions are shifted towards the afternoon side, most commonly between about 1 pm and 3 pm, and sometimes extending towards evening. As a result, the auroras are not centred, but displaced to one side, appearing uneven rather than forming a balanced ring.

This difference is linked to Saturn's rapid rotation. A full rotation takes only about 10 hours, and this fast spin reshapes the planet's magnetic field, pushing the particle entry regions away from the Sun-facing direction. The

findings suggest that, for giant planets like Saturn, rotation and charged particles released by its moons may play a larger role than the solar wind in shaping the magnetic environment.

By identifying where charged particles enter a planet's magnetic field, scientists can better understand how energy is transferred into its atmosphere. This helps improve models of planetary magnetic fields and space weather, and provides insight into how effectively different planets can protect their atmospheres.

“This discovery of an ‘afternoon-skewed cusp’ confirms that giant planets operate under a different magnetospheric environment than Earth,” said Professor Yao. “It fundamentally alters our models of how high-energy particles gain energy and move faster across our solar system”.

The research, published in *Nature Communications*, draws on data collected by the Cassini spacecraft, which orbited Saturn from 2004 to 2017. By analysing data up to 2010, the team identified 67 instances of particle entry into Saturn's magnetic field, allowing them to map these regions for the first time. The study's first author is Dr Yan Xu, a former postdoctoral fellow of Professor Zhonghua Yao at HKU, now affiliated with the Southern University of Science and Technology in Shenzhen.

For more details, please refer to the journal paper “[Dawn–Dusk Asymmetrical Distribution of Saturn’s Cusp](#)” published in *Nature Communications*.

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