Saturn joins Venus in the vortex club

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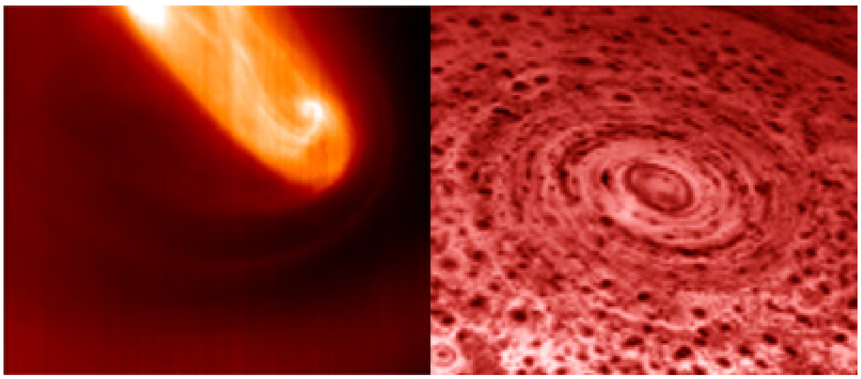

This composite image shows the South polar vortices at Venus (left) and Saturn (right). The left image was taken by the Ultraviolet/Visible/Near-Infrared spectrometer (VIRTIS) on board ESA's Venus Express on 29 May 2006, from a distance of about 64 000 kilometres from the planet. The vortex is imaged at a 5.05-micron wavelength, corresponding to an atmospheric altitude of about 59 kilometres, just about the Venusian cloud deck. The right image was taken in October 2006 by the Visual Infrared Mapping Spectrometer (VIMS) on board NASA's Cassini, at a 5-micron wavelength. The large number of dark, circular leopard spots indicates that convective activity extending over dozens of kilometres in altitude is surprisingly rampant in the south polar region. Literally hundreds of storm clouds encircle the pole, appearing as dark spots in this image. Each of these spots represents a storm. Credits: NASA/JPL/Space Science Institute/University of Arizona

Cassini's spectacular image of Saturn's polar vortex, published this month by NASA, may provide astronomers with a missing piece in the puzzle of how that planet's atmosphere works. For planetary scientists studying Venus, the image was strangely familiar.

Ever since the late 1970s, scientists have known of a similar polar vortex on Earth's nearest neighbour. For six months now, ESA’s Venus Express has been studying this enigmatic atmospheric structure.

NASA's Pioneer Venus spacecraft discovered the north polar vortex over 25 years ago. It is perhaps the most puzzling vortex to be found in the Solar System because it has two 'eyes'.

When Venus Express arrived in orbit around Venus in April 2006, one of the top priorities was to discover whether the South pole possessed a similar double-vortex. It did.

Polar vortices represent a key element in the planet's atmospheric dynamics but they are not hurricanes. "Hurricanes are caused by moist air rising into the atmosphere," says Pierre Drossart, Observatoire de Paris, France. In addition, they require the Coriolis force – the interplay between the circulation of the atmosphere and the rotation of the planet – to whip them up. But the Coriolis force is inefficient for driving vortices at the poles and on Venus it is virtually non-existent anyway because of the planet’s slow rotation: the planet rotates just once every 243 Earth days.

Instead, a polar vortex is created by an area of low air pressure that sits at the rotation pole of a planet. This causes air to spiral down from higher in the atmosphere. Polar vortices are common structures and can be found at the poles of any planet with an atmosphere, even Earth.

What sets Venus apart is the double-lobed structure of the vortices. "This double structure is not well understood at present," says Drossart, who is the co-Principal Investigator on Venus Express’s Visible and Infrared Thermal Imaging Spectrometer (VIRTIS).

To help understand the vortex, every time Venus Express draws within range, its instruments target a polar region. Collecting as much information as possible is vital because of the rapid variability of the vortices. By watching them change, scientists can see how they behave, and this can give them vital clues as to the way the whole atmosphere circulates.

At the same time, data on the Saturn polar vortex will continue to be collected by Cassini. In addition to his work with Venus Express, Drossart is also part of the team that controls the Visual Infrared Mapping Spectrometer (VIMS) on Cassini.

The VIMS team will use their instrument to peer down into the heart of Saturn's polar vortex. By using infrared wavelengths, they can see through the clouds that normally block the view. "We will see down to more than 100 kilometres below the visible cloud tops," says Drossart.

Such observations will allow the scientists to build a picture of the three-dimensional structure of each polar vortex. With these in hand, they can make detailed comparisons of the vortices on Venus with those on Saturn and other worlds. The similarities and differences between the polar vortices should then give vital clues to the differences between the various planetary atmospheres that planetary scientists see throughout our Solar System.

Such studies are called comparative planetology. By studying Earth-like phenomena on other planets, we can better understand the Earth.

Source: ESA