

# **The Mask of Venus—the thick sulfuric acid cloud layer on our neighbor planet**

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## **Abstract**

Venus was a popular target in the beginning of Space Age. A number of orbiters, descending probes, and landers had been sent by USSR and USA in 60-80s. People then discovered hostile environment near the surface of Venus, for example, 92 times thicker atmosphere than the Earth and 735 K temperature [1], and the extremely dry condition with about 20 ppm water (0.002%) [2]. All of these were completely unknown from the ground-based observations due to the thick clouds that cover the planet completely at the 50-70 km altitudes.

The exploration to Venus has been continued with European Venus orbiter, Venus Express (polar orbiter, 2006-2014) and Japanese Venus Orbiter, Akatsuki (equatorial orbiter, Dec. 2015-current). Data from these recent orbiters revealed a number of discoveries, and I can introduce some of them; such as that Venus may be experiencing ongoing climate changes due to the clouds [3], and that a surface-atmosphere interaction, which was discovered through waves at the cloud top level from small size to global scale [4,5]. In addition, theoretical numerical global circulation model calculations showed exciting results that Venus could have been habitable in the past, because of the subsolar area cloud coverage on this slow rotating planet [6,7].

Overall recent findings on Venus remind us the fact that we still do not have enough knowledge on Venus. This limitation would be mainly caused by the clouds, which effectively restrict our observations below 70 km altitudes, except limited narrow atmospheric windows in short near infrared wavelength. This means, however, Venus can be an excellent target to understand the role of 100% coverage clouds in the atmosphere, and can be investigated as a case study for a possible cloudy Earth-like exoplanets. In coming decades, Venus studies will be continued; Akatsuki is still active, Mercury orbiters (BepiColombo/ESA and JAXA) will make Venus flybys in 2020 and 2021, and new Venus missions are planned in India (2023), Russia-USA (Venera-D), and Europe (EnVision, 2032?).

**Keywords:** *Planetary science, Venus atmosphere, Remote sensing, Space missions, Clouds*

## **References**

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## **Biography**

YJL is a MSCA-IF 2018 beneficiary, working at TU Berlin for Venus and exoplanet research. YJL has a decade experience in Venus atmospheric research in the German and Japanese Venus research teams (ESA's Venus Express and JAXA's Akatsuki). Currently, YJL is a co-I of the UV camera on board Akatsuki, participating future Venus mission projects in USA and Europe, and leading the coordinated Venus observations between Akatsuki and BepiColombo.